Learning Together
Learning Better

Adolescence Education Programme

In Collaboration With

UNFPA
Adolescence Education Programme

Learning Together
Learning Better

Methodology used: Role Play, Use of Media (Films), Conducting Experiments
# ADVISORY COMMITTEE

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<thead>
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<th>Dr. Sitansu S. Jena</th>
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<tbody>
<tr>
<td>Chairman</td>
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<td>Assistant Representative</td>
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<tr>
<td>NIOS, NOIDA</td>
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<td>UNFP A</td>
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Chairpersons of the Curriculum Committees

<table>
<thead>
<tr>
<th>Dr. Kailash Khanna</th>
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<tbody>
<tr>
<td>(Home Science)</td>
<td>(English)</td>
<td>(Social Science)</td>
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<tr>
<td>Reader (Retd.), Dept of Education</td>
<td>Retd HOD, DESSH</td>
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<tr>
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<tr>
<th>Dr. R. D. Shukla</th>
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<tr>
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# MENTORS

<table>
<thead>
<tr>
<th>College of Home Science</th>
<th>Dr. Anita Devraj</th>
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<tbody>
<tr>
<td>(Home Science)</td>
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<tr>
<th>Prof. J.L. Pandey</th>
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<td>(Political Science)</td>
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<td>Reader in Geography</td>
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<tr>
<th>Learning Links Foundation</th>
<th>Vidya Bhawan Society</th>
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<tr>
<td>(English)</td>
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<tr>
<td>804, Padma Tower-1, 5</td>
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# LIFE SKILLS EXPERT

<table>
<thead>
<tr>
<th>Ms. Asheema Singh</th>
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<tbody>
<tr>
<td>Project Coordinator (AEP)</td>
<td>National Programme Officer</td>
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<tr>
<td>National Institute of Open Schooling</td>
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# ACADEMIC OFFICER

<table>
<thead>
<tr>
<th>Mr. Balkrishna Rai</th>
<th>Mr. Vivek Singh</th>
<th>Ms. Neha Sharma</th>
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<tbody>
<tr>
<td>Academic Officer (Hindi)</td>
<td>Sr. Executive Officer (English)</td>
<td>Sr. Executive Officer (Home Science)</td>
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<td>NIOS, NOIDA (U.P)</td>
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<thead>
<tr>
<th>Ms. Tarun Punia</th>
<th>Dr. Chunnu Prasad</th>
<th>Dr. Azmat Noori</th>
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<tr>
<td>Academic Officer (Geography)</td>
<td>Academic Officer (Political Science)</td>
<td>Academic Officer (History)</td>
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<td>NIOS, NOIDA (U.P)</td>
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<tr>
<th>Ms. Neelam Gupta</th>
<th>Dr. Alok Kumar Gupta</th>
<th>Dr. Rajeev Prasad</th>
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<tbody>
<tr>
<td>SEO, (EVS &amp; Biology)</td>
<td>Academic Officer, (Physics)</td>
<td>Academic Officer, (Chemistry)</td>
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<tr>
<td>NIOS, NOIDA (U.P)</td>
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# COORDINATOR

<table>
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<tr>
<th>Ms. Asheema Singh</th>
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<tr>
<td>Project Coordinator (AEP)</td>
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# COVER DESIGN

<table>
<thead>
<tr>
<th>Sh. Sunder Singh Rawat</th>
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<tr>
<td>Office Assistant (AEP)</td>
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*Developed under MHRD-UNFP A Supported: Adolescence Education Programme*
Greetings from NIOS!

National Institute of Open Schooling (NIOS) is an autonomous organization under Ministry of Human Resource Development (MHRD) Government of India and caters to the educational requirements of out of school children and youth of India. With over two million learners on rolls, NIOS has emerged as the largest open schooling organization in the world.

The NIOS in collaboration with MHRD-UNFPA has been engaged in addressing issues and concerns of adolescent learners and empowering them with life skills through ‘Adolescence Education Programme’. Cognizant of the delivery model, NIOS followed a curricular approach and integrated critical adolescent issues and concerns within the self-learning material.

Integration was carried out with the rationale to equip the learners with skills that would make them better humans and more productive for the society while studying for their secondary course. Through a series of capacity building workshops for the lesson writers and providing them continuous support, NIOS was able to realize the aim that seemed daunting initially.

Life Skills have been seamlessly woven into the course content so that the learners, while studying the main syllabus get empowered to apply the core content in real life situations. This teaching material will help you transact not only the subject specific content but it will also help you empower the learners with important skills such as communication skills, critical and creative thinking etc.

It gives me great pleasure to share with you the this teacher-training package of Life Skills enriched lessons from five subjects- Hindi, English, Science, Home Science and Social Science at secondary level along with a set of CDs Learning Together Learning Better. I hope you will find them useful.

Yours sincerely,
Dr. S.S. Jena
Dear Teachers,

The Academic Department at the National Institute of Open Schooling has revised the curriculum in all the subjects at the secondary level. The National Curriculum Framework 2005 developed by the National Council for Educational Research and Training was kept as a reference point. After making a comprehensive comparative study of various state boards, we developed the curriculum that was functional, related to life situations and simple. Leading educationists of the country were involved in developing this material.

Hindi, English, Science and Technology, Home Science and Social Science at secondary level were enriched with life skills under the MHRD UNFPA supported Adolescence Education Programme. The integration of life skills is aimed at instilling an adaptive and positive thinking, feeling and behaviour in the learners.

I sincerely hope that you will find the selected lessons interesting, exciting and useful. Any suggestions for further improvement are welcome.

Let me wish you all a happy and successful future.

(Dr. Kuldeep Agarwal)
Director (Academic)
diracad@nios.ac.in
Dear Teacher,

Welcome to NIOS!

You have just taken your first step towards realizing your goal of empowering students to become global citizens. Globally, the education system is undergoing a change in terms of approach as well as objective. NIOS has initiated a unique process of developing life skills enriched materials and methodologies for the student’s benefit. We have a vision to guide you to enhance your teaching skills such that the student not only does well academically but also enhances his personal and social competencies. Along with subject knowledge, the student should be able to deal with the stress and strain of life. They should have the ability to discriminate between right and wrong, good and bad, and take the correct decisions regarding their life and career. The methodology adopted by NIOS is to integrate these life skills seamlessly with the content of the subject.

While going through these study materials, you will find a number of activities, including in text questions, in between the lessons. These activities have been carefully designed to provide an opportunity to learn and practice. The in text questions are devices to help assess the extent of learning and enhance it. Life skills are abilities that each of us possesses, and yet conscious efforts need to be made to enhance these abilities. Attempting these exercises will help in developing life skills without an extra effort.

I hope you will find these life skills-enriched study materials and methodologies rewarding and helpful for empowering the students.

Asheema Singh
Project Coordinator
(Adolescence Education Project)
asheemasingh@nios.ac.in
EPISODE-1
Methodology: Role Play, Use of Media (Films), Conducting Experiments
1. Adolescence: Charms and Challenges (Home Science)
2. People's Participation in the Democratic Process (Social Science)
3. Force and Motion (Science and Technology)

EPISODE-2
Methodology: Quiz, Crossword, Recitation and Appreciation, Brainstorming and Group Discussion
1. Carbon and its Compounds (Science and Technology)
2. A Tiger comes to town (English)
3. Nine gold medals (English)
4. Life Processes - Control and Coordination (Science and Technology)
5. Bahadur (Hindi)

EPISODE-3
Methodology: Lecture and Practical Demonstration, Survey, PPT/Flash Card/Quiz, value prioritization
1. Care and Maintenance of Fabrics (Home Science)
2. Light Energy (Science and Technology)
3. Robert Nursing Home Mein (Hindi)
4. Consumer! Beware, Be Aware (Home Science)
5. Classification of Living Organisms (Science and Technology)
6. Constitutional Values and Political System in India (Social Science)

EPISODE-4
Methodology: Maps, Charts, Graphs, Tables, Case Study, Quiz, Street Play, Inferential Learning
1. Periodic Classification of Elements (Science and Technology)
2. Population, Our Greatest Resource (Social Science)
3. Bio-diversity (Social Science)
4. Life Processes - Reproduction (Science and Technology)
5. Religious and Social Awakening in Colonial India (Social Science)
6. Climate (Social Science)
ADOLESCENCE: CHARMS AND CHALLENGES

I am unique! Nothing can happen to me! Will I be tall enough! I can change the world! Nobody understands me! Do these statements sound familiar? At what age do you remember having such thoughts?

Adolescence is a crucial period of life between childhood and adulthood during which an individual experiences a range of emotions, very confident about certain things and unsure about others. It takes some time and efforts to become comfortable with the changes taking place in one’s mind and body. These changes make this phase of life very exciting. In this lesson, you will learn about the charms and challenges of adolescence and the ways to manage many issues related to it.

OBJECTIVES

After completing this lesson, you will be able to:

• explain the physical changes during adolescence and learn to manage them effectively;
• explain the emotional and social changes during adolescence and develop a positive self concept and self esteem;
• explain the social changes during adolescence;
• enhance skills to respond positively and responsibly to various situations;
• examine the characteristics of cognitive development during adolescence deal effectively with different influences from peers, adults, media and social norms;
• recognize the importance of planning for a career
20.1 CHARACTERISTICS OF ADOLESCENCE

So what is adolescence? Adolescence is the transitional stage between childhood and adulthood. It is the age between 10-19 years. Though the timing and pace of changes may vary among individuals, these are marked by physical, emotional, social and cognitive changes. Why do you think these changes take place?

These changes are initiated by hormonal changes in the body and are a natural part process of growing up. You can read more about hormones in lesson No. 22 Control and Coordination from the Science and Technology secondary course of NIOS. These changes prepare adolescents for adult roles and responsibilities, so they should be accepted and celebrated. You shall learn more about these changes. These can be broadly categorized as:

1. Physical development
2. Emotional Development
3. Social Development
4. Cognitive Development

1. Physical development:

Physical development during adolescence begins with puberty which means beginning of sexual maturity. This period is marked by physical growth and change in body shape. During this period almost 75% of adult height and about 50% of adult weight is gained. You must be aware that every individual has unique structure which is influenced by several factors such as heredity, environment and nutrition.

Fig 20.1 (a): Physical Development in Girls
During adolescence, both boys and girls experience physical changes but some are specific to boys and some to girls. These have been listed in Table 20.1

**Table 20.1: Physical Changes during Adolescence**

<table>
<thead>
<tr>
<th>Common to boys and girls</th>
<th>Specific to boys</th>
<th>Specific to girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Increase in height and weight</td>
<td>• Broadening of shoulders</td>
<td>• Growth of breasts</td>
</tr>
<tr>
<td>• Growth of underarm hair</td>
<td>• Deepening of voice</td>
<td>• Broadening of hips</td>
</tr>
<tr>
<td>• Growth of pubic hair</td>
<td>• Development of facial hair</td>
<td>• Menarche</td>
</tr>
<tr>
<td>• Pimples / acne</td>
<td>• Increased muscular development</td>
<td></td>
</tr>
<tr>
<td>• Development of reproductive organs</td>
<td>• Nocturnal emission</td>
<td></td>
</tr>
</tbody>
</table>

**ACTIVITY 20.1**

Recall and Mark Tick (√) the physical changes you experienced around the age of 15-16 years in the table 20.1 given above.

*Fig 20.1 (b): Physical Development in Boys*
Among girls menstruation usually begins (menarche) between 9-16 years and stops around 45-55 years of age (menopause). Menstruation is a cycle of 28 days which may vary from 21-35 days. Now you will learn what menstruation is.

During each menstrual cycle, one ovum matures and is released by the ovary. This is called ovulation that occurs around mid cycle. Before the ovum leaves the ovary, the uterus builds up its inner lining with extra blood and tissue. If the ovum meets with sperm, (in case of sexual intercourse) it is fertilized and conception takes place. In that case, the lining of the uterus supports the growing foetus (baby).

But when the ovum is not fertilized, the uterus no longer needs the extra blood and tissue. The uterus therefore begins shedding its lining and the menstrual flow starts. It consists of blood, mucus and fragments of the lining in the uterus. This blood passes through vagina and is caught by using a clean cotton cloth or a sanitary pad. It is important to know that if the girl does not begin her menstrual cycle (periods) until the age of 16 years, she should consult a qualified doctor. Menstruation signifies the ability of a girl to become pregnant.

**DO YOU KNOW THAT**

- a girl can get pregnant before her menstrual cycle begins as she releases an egg before her first period?
- irregularity in menstrual cycle is common when girls just begin to menstruate?
- a missed period usually indicates pregnancy if a girl is sexually active?
- the menstrual cycle may be irregular due to stress, illness and inadequate nutrition?
- all girls should have an iron rich diet to prevent anemia. Girls who bleed heavily or are malnourished may also need iron supplements? You must have read about this in detail in lesson no. 2 Food and its Nutrients.

Although menstruation is a natural phenomena there are many myths related to it. Some of these have been clarified in Table 20.2

<table>
<thead>
<tr>
<th>Myths</th>
<th>Fact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls should not engage in any work during menstruation</td>
<td>Girls should continue with their daily activities as long as they feel comfortable. Infact, walking and exercising can help them get over cramps and pain.</td>
</tr>
<tr>
<td>Menstruation is an abnormal condition</td>
<td>It is a natural phenomenon although some girls may feel less energetic during this period. They may also get cramps,</td>
</tr>
</tbody>
</table>
Adolescence: Charms and Challenges

<table>
<thead>
<tr>
<th>Backache, headache, stomach ache or experience loss of appetite.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>It is alright to take medicine to delay or hasten menstruation</strong></td>
</tr>
<tr>
<td>One should avoid taking medicines to delay or hasten menstruation as these can be harmful to the body. If required take the advice from a qualified doctor.</td>
</tr>
<tr>
<td><strong>Bathing during menstruation causes cramps</strong></td>
</tr>
<tr>
<td>It is important to bathe daily. A warm bath can soothe and relax muscles, reduce pain. It is important to adopt good genital hygiene especially during menstruation. Clean sanitary napkins should be used during menstruation which should be changed every six hours. If a cloth is used instead of a sanitary napkin, it should be washed with soap and water and dried in the sun.</td>
</tr>
<tr>
<td><strong>Women should not enter kitchen during the period of menstruation</strong></td>
</tr>
<tr>
<td>There is no scientific evidence supporting restriction on working in the kitchen, handling certain food items like pickle or participating in social and religious functions.</td>
</tr>
</tbody>
</table>

These are only some of the myths and you may hear about many others. It is upto you to find the truth about these myths and make informed and responsible choices rather than follow these myths blindly.

Nocturnal emission is the release of excess semen from the penis during sleep. It is also known as ‘wet dreams’ or ‘night fall’. The frequency of nocturnal emissions or nightfall varies from person to person. Nocturnal emission is a natural phenomenon hence there is no need for boys to get worried or feel guilty about it. There are many myths about nocturnal emission, some of which have been clarified below in Table 20.3

**Table 20.3: Nocturnal Emission: Myths and Facts**

<table>
<thead>
<tr>
<th>Myths</th>
<th>Fact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nocturnal emission makes one weak</td>
<td>It does not cause any sexual or physical weakness.</td>
</tr>
<tr>
<td>It is associated with sexual thoughts</td>
<td>It is a natural phenomenon and may not always be associated with sexual thoughts and feelings.</td>
</tr>
</tbody>
</table>
However you should note that genital hygiene is important for both girls and boys. So what steps can they adopt for maintaining hygiene?

- Genitals should be washed with clean water after urination as infection can occur between the folds of the skin.
- Undergarments preferably made of cotton should be used.
- Undergarments should be changed normally at least once a day and dirty undergarments dried in the sunlight.
- In stained undergarments should be changed immediately.
- Excessive sweating and subsequent infection can be avoided by keeping the pubic hair trimmed.

### ACTIVITY 20.2

While growing up, you must have gone through a number of changes in your body. Did you feel prepared for these changes? If yes, how did it help you?

If not, do you think it is important to be prepared for them? Why? Who according to you could have helped in preparing you?

### INTEXT QUESTIONS 20.1

1. Write two signs of physical growth which are common and two which are specific to adolescent boys and girls.

<table>
<thead>
<tr>
<th>Common to boys and girls</th>
<th>Specific to boys and girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>boys</td>
<td>girls</td>
</tr>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
</tbody>
</table>

2. Identify whether the following statements are True/False. Give reasons for your answers.

(i) Children should not be educated about the changes during adolescence as it may distract them.

(True/False)
During adolescence emotions become more pronounced due to the hormonal changes. To help them manage their emotions positively, it is important to understand adolescents’ emotional development.

2. Emotional Development

Emotional development means developing an ability to manage emotions and to express them in positive and responsible ways. Almost all adolescents go through a stage of rebelling against restrictions. Angry outbursts, mood swings are quite common in this stage. Adolescents feel as if they are sitting on an emotional seesaw, feeling up one minute and down the next; feeling mature on some days and child-like on others. Though you must realize that each person is unique and has different responses to stress. Positive and healthy ways of responding to stressful situations help in decreasing the negative emotions. So how can you reduce your anger and cope positively to stressful situations?

➢ First of all you need to recognize your anger signals and accept that you are angry.

➢ Try to divert yourself or do something constructive to calm down.

Choose one or two of the options given in the box and see which one works best for you:
However, it may be some other method works for you. Remember if you feel overwhelmed by a situation and find it difficult to cope with it, do not hesitate to seek help from trusted sources like family or friends. Asking for help is not a symbol of weakness. In fact, it signifies strength and good understanding of your inner resources. Analyzing the situation, understanding its cause and avoiding it in future are steps that help in managing emotions better. Take the case of Ramu and his very close friend Rajinder. They had a misunderstanding which led to a fight. Rajinder insulted Ramu in front of everyone. Ramu felt very hurt. Undoubtedly this is a stressful situation for Ramu. There are several ways of dealing with the situation. Three possible responses are listed below:

**Response 1:** He feels that no friend is worth trusting and breaks contact with all his friends.

**Response 2:** He criticizes Rajinder with his other friends.

**Response 3:** Ramu sits with Rajinder and clears the misunderstanding.

Which do you think is the most sensible option? Give reasons for your answer.

Building of positive self concept is very important for the personality development among adolescents. Do you understand what **self concept** and **self esteem** means.

Identity comprises of distinctive characteristics of an individual. As adolescents develop a strong sense of identity and have strong views about issues. Identity of an individual is made up of ‘Self concept’ and ‘Self esteem’.

**Self concept** means the way in which you see your strengths and weaknesses. Self concept is said to be low when you see only your weaknesses and it is high when you look at your strengths and want to improve yourself.

**Self esteem** is your personal judgment of your abilities. In other words, if you have high self esteem, then you have more belief in your abilities. Positive self concept leads to higher self esteem. When adolescents begin to take pride in the abilities they possess and consider these as their assets, their self esteem goes up. One has to realize that success is the key factor in building positive self concept during adolescence. But how can you develop positive self concept and self esteem? For this let us do the following activity.
ACTIVITY 20.3

To know yourself better and develop positive self esteem, assess yourself on the following criteria. Ask your parents to assess you on the same criteria. Tick mark ☑, Yes or No accordingly.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Do you</th>
<th>According to you</th>
<th>According to your parents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>1.</td>
<td>accept your strong points and appreciate them?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>acknowledge your weaknesses?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>try changing everyone?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>indulge in self pity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>seek advice when needed of a trusted friend or a trained counselor?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>realize that certain physical aspects in you cannot be changed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>appreciate others and be genuine and honest in your appreciation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>eat healthy and exercise?</td>
<td></td>
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</tbody>
</table>

After listing your positive qualities how did you feel about yourself? Which of the above points do you think help in developing a positive self esteem? With or without the help of your parents, develop a plan of action for yourself to overcome your weaknesses. Write your answers in the following columns. One has been done for you.

<table>
<thead>
<tr>
<th>My weakness according to</th>
<th>My parents</th>
<th>Plan of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Me</td>
<td>My parents</td>
<td>1. I don’t share my problems even if they are beyond my control</td>
</tr>
<tr>
<td>1.</td>
<td>Shares only some problems and that too almost at the last minute</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
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</tbody>
</table>
1. Nasreen is the best athlete in her village and has won many awards at both district and state level. For the past two years she has been practicing very hard for the coming district athletes meet. She is very upset and wants to know that she is not shortlisted for the same. Given below are three different ways in which Nasreen can try to find why she has not been shortlisted for district athletes.

**Option 1:** Nasreen argues with the sarpanch of the village and accuses him of being unfair.

**Option 2:** Nasreen locks herself in a room and refuses to eat her meals.

**Option 3:** she goes to sarpanch and asks him the reason for her not being selected for district athletes.

Which do you think is the most sensible option? Give reasons for your answer.

____________________________________________________________________

____________________________________________________________________

2. Neha got very angry when her parents did not allow her to go out with her friends. She threw her books on the floor, shouted at everyone and refused to eat her food.

If you were Neha, what would you have done to convince your parents? Please suggest at least two methods.

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

3. Sudha is very conscious of her dark complexion. She avoids interacting with people around. Give four suggestions to Sudha which can help build a positive self esteem.

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
3) Social Development

Social development refers to the interaction of adolescents with their family, peers and others. As children transform into adolescents and later to adulthood, their social relationships undergo many changes.

“Who am I?” Am I an adult or a child? This is one question to which an adolescent is always seeking an answer. At one minute their parents tell them “You are not a child any more.” and the next minute they are told “Go and play, we adults are discussing something.” Such statements often leave them confused as to the status of their identity i.e. whether they are adults or children.

At this stage adolescents develop a strong sense of selfhood and have their own views and feelings about various issues. In their effort to become independent and develop their own identity they slowly start taking their own decisions. Parents can enable their children form an identity and become independent individuals by treating them as responsible young adults.

During this period the relationship adolescents share with their family and peers go through a major change. Let us study more about these changes.

3.1 Relationship with the family

As adolescents start distancing themselves from their families, they start valuing their peers more than before. They often look to their peer group for approval and may even change their behavior to win their approval.

Adolescents start seeking privacy and like to spend lesser time with their families. They dislike any restrictions imposed upon them. Parents may find it difficult to accept these adults like characteristics of their children where they ask questions, reason and sometimes argue rather than obeying them blindly. Parents may feel that their adolescent children no longer value their opinions. This may not necessarily be true as, the nature of this relationship changes. In fact, adolescents need their parents time and counsel more than ever before. However it may be important to re-establish some of the core guiding principles for parent-adolescent interactions.

You must realize that parenting teenagers is not easy. It angers and frustrates parents to see their child slipping out of their control. They know their child cannot foresee the consequences of his/her actions. In fact, some parents worry that their child is not
Growing into a responsible person and worry about their future. This leads to disagreement and conflict.

Similarly, adolescents also have the responsibility to listen to their parents opinions, think through the suggestions carefully and then put forth their views and feelings clearly and in a respectful manner. They must learn to express their thoughts and feelings in a clear, honest and respectful manner without putting down either themselves or the other person. Effective communication is a two way process in which everyone concerned, has not only the right to express their views but also to be heard respectfully.

Following suggestions would help develop a closer bond between you and your parents.

➢ You must share your feelings with your parents and establish an open channel of communication. Both you and your parents should listen to each others’ opinions, think through each others suggestions carefully and then put forth views and feelings clearly in a mutually respectful manner.

➢ You must be as courteous to your own parents as you are to the parents of your friends.

Gradually as you grow older your parents also start understanding and accepting the changes in you. for a healthy relationship you need to understand your parents.

Following activity would help you to do that.

**ACTIVITY 20.4**

Ask your parents about five things that they liked to do with their friends when they were adolescents. Now compare it with what you like to do with your friends.

<table>
<thead>
<tr>
<th>What your parents did with their friends</th>
<th>What you do with your friends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td>Father</td>
</tr>
</tbody>
</table>

Pick the activities which are similar. Now share the experiences with each other.

Did this activity help you to understand your parents better? If yes, how?

_______________________________________________________________

_______________________________________________________________
Adolescence: Charms and Challenges

What can you as an adolescent do to improve your relationship with your parents? You must remember that your parents love you and have your best interest in mind. They are concerned for your safety and security. However, you do not need to have exactly the same opinion as your parents.

Following suggestions would help develop a closer bond between you and your parents.

- You must share your feelings with your parents and establish an open channel of communication. Both you and your parents should listen to each other’s opinions, think through each other’s suggestions carefully and then put forth views and feelings clearly in a respectful manner.

- You must be as courteous to your own parents as you are to the parents of your friends.

**INTEXT QUESTIONS 20.3**

1. Neha is 13 years old. She feels her mother does not love her anymore. She is not allowed to go out with her friends and has frequent arguments with her mother. Suggest two ways in which Neha can improve her relationship with her mother. Could you also recommend two ways in which Neha’s mother can contribute towards improving the relationship with her daughter?

2. Adolescents are often confused whether they are children or adults. Narrate any incidence from your personal life to justify this statement.

### 3.2 Relationship with peers

Peer is defined as a person of equal age, abilities, qualifications, background or social status. As you must be aware adolescents give a lot of importance to their peers. The opinion of their friends seems more important than that of anyone else. Since all of them are going through similar experiences they feel close to each other.

Peer pressure can be both positive and negative. Positive peer relationship helps in social development as well as formation of self-image and self-esteem. These relations act as a safety net during difficult circumstances. Peers can act as positive role models and can also encourage healthy behaviour.
Teenagers who feel isolated and rejected by their friends and family or those who come under the influence of negative peer pressure are more likely to indulge in anti social activities like thefts, substance abuse, gang involvement, smoking, drinking, etc.

**ACTIVITY 20.5**

Here is the case of Sujit and Manoj. They would often bully Sharad, a fellow NIOS learner to lend them money. When he would refuse, they would hit him. He never shared this with anyone. One day they snatched his purse and ran away.

He had to walk home as he had no money for the bus. Sharad’s neighbour, Abid who had witnessed the whole incident, asked him to bring it to the notice of the village elders. Sharad hesitated but agreed when Abid offered to accompany him.

Q1. Pick one example of positive and one of negative peer influence in this story.

Q2. Why do you think Sharad did not complain against the bullies for so long?

Q3. What difference did Abid’s intervention make to the situation? Discuss these questions with your friends and family and try to find the answers.

Developing healthy relationships and friendship is one of the most charming aspects of adolescence. Positive peer relationships are based on mutual respect and appreciation. Here are some ways to maintain healthy relationships.

- Communicate effectively. Practice how to express your thoughts and emotions in socially acceptable ways. This involves learning to listen, speak clearly, politely and seek others opinion and voice your opinions. Listening to others forms an important part of effective communication.
 ✓ Cultivate social skills like anger management, fairness, and sensitivity.
✓ Develop empathy; treat people as you would like to be treated by others.
✓ Spend time together and keep working on your relationships by practicing the skills to resolve conflict and disagreements effectively.
✓ Offer constructive criticism. Treat each other fairly and forgive one another after clarifying the misunderstanding.
✓ Be generous and supportive. Be prepared to listen/talk to your friends in times of trouble.
✓ Maintain mutually respectful behaviour. Remember, there is no room for bullying in a healthy relationship.

INTEXT QUESTIONS 20.4

Complete the following statements giving appropriate reasons:-

1. Engaging in high risk behaviours is dangerous because ____________________
   ________________________________________________________________

2. Keeping communication channel open with parents is important because ____________________
   ________________________________________________________________

3. During adolescence, friends become very important because ____________________
   ________________________________________________________________

4. Positive peer pressure should be encouraged because ____________________
   ________________________________________________________________

5. A clash between parents and adolescents could occur because ____________________
   ________________________________________________________________

Development of intellectual skills are one of the most important step for adolescents to achieve their potential. This would be dealt in cognitive development.

4) **Cognitive Development**

Cognitive development refers to the development of brain which facilitates adolescents to perform more complex mental functions. It is concerned with the development of a person’s thought processes it deals with the way these thought processes influence how we understand and interact with the world. These have been briefly explained below.
Abstract thinking: at this stage, they can imagine the impossible. For example if they hear idioms like a Leopard Can’t Change His Spots, they can now understand that it means that a person cannot change his/her basic nature. Because of this ability they can also write poetry and understand humour.

Personal fable: At this stage adolescents think that they are unique and nothing bad can happen to them. This is one of the reasons for them to take risks. Adolescents are energetic and spontaneous in nature and try new things without fear. This may include helping peers and family, serving the country which leads in positive self identity. The ability to try new things can be used positively to bring about a positive change in the society. However experimenting with drugs, sex and many more such activities like driving at high speed, pillion riding without helmets; etc can often result in serious negative consequences.

Systematic thinking: they are able to think systematically. If asked to take a decision, they are able to list and examine various alternatives and the consequences of each alternative, before choosing any one. For example, while planning for a family holiday adolescents can list out suitable options available; examine them keeping in mind weather condition, location, best time to go, ways to reach the destination and places to see and accordingly decide and plan a holiday.

Idealism: One of the main characteristic of adolescence is idealism. They have a strong sense of right and wrong. They develop awareness about themselves and their surroundings with a strong sense of pride. Often idealism leads to positive thinking and actions. For example, many youngsters extend a helping hand in difficult situations like disaster, conflict.

Imaginary audience: Adolescents imagine that everyone is watching them. For example; if there is a very small hole in their T shirt, they think everyone can see it. They become more aware of their surroundings.

INTEXT QUESTIONS 20.5

1. Enumerate any two characteristics of cognitive development of adolescence.

2. Adolescents are often reckless and refuse to wear ill fitted clothes. Give reasons for their behaviour.

20.2 EFFECT OF CULTURAL AND SOCIAL NORMS

Social norms are a set of rules and expectations by which a society guides the behaviour of its members. You can see the effect of changing social and cultural norms on all aspects of life. These norms affect the way we behave, talk, dress or conduct personal
relationships. Even our gender roles which were governed by social norms are changing and evolving. For example, what women were expected to be 20 years ago is very different from the current expectations from women. Similarly, the roles men had adopted in the past are very different from their current role. Women are no longer restricted to household chores or men are not the only earning members of the family. Both men and women are gainfully employed and both participate in household chores. Hence, the concept of gender is dynamic and is different during different ages.

Adolescents are influenced by social norms and culture of the world. They copy popular language, clothes, music and dance. In their desire to belong, they adopt whatever is popular among their peers or is fashionable in media. It is alright to confirm to the peer group. Sometimes you may not agree with a particular trend.

Here are some suggestions as to how to be more assertive and say no without feeling guilty. Next time you come across a tricky situation, try any of these.

1. Do not give in to societal peer pressure. Don’t fall under the impression that just because “everyone else is doing it”, that you should do it too.

2. Use the word “no” when declining rather than “I can’t” or “I shouldn’t”.

3. Avoid feeling guilty and avoid saying “I’m sorry”.

4. Stop others from making excessive demand on you.

5. Make sure your body language does not contradict what you are saying.

6. Make direct eye contact with the other person.

7. Not give other people reasons for every action we take

8. Maintain your dignity in relationships

9. Let other people know how you are feeling

Many times you may find yourself in situations where it becomes difficult to say no. In each situation you may use any of the following techniques:

- Ignore the question or statement and walk off.
- Pretend as if you have not understood anything
- Change the topic
20.3 INFLUENCE OF MEDIA ON ADOLESCENCE:

Mass media like television, newspapers, magazines, films, radio and internet have both positive as well as negative influences on adolescents. Media not only creates awareness about various issues but also provides opportunities for them to participate in various programs on television and radio, publish articles in newspapers, magazines, websites; etc. By promoting sports, social work, media can motivate adolescents to take up such activities.

On the other hand media promotes certain stereotype images and views that may have a negative influence on adolescents. Constant exposure to sexual images, violence and commercial advertisements debasing women can lead to negative impact on young minds.

Adolescents often over-identify with famous people and idolize stars, professional athletes, movie actors, and television personalities to the point of apparent loss of their own individuality.

Actors and models influence their idea of a perfect body shape. Most of the adolescent girls watch their diet which leads to increasing number of eating disorders. In boys too there is an alarming increase in obsessive weight training and the use of steroids and dietary supplements that promise bigger muscles and more stamina for lifting. Excessive weight loss can lead to loss of stamina, decreased resistance to diseases, and irregular menstrual cycle (in case of girls). Indiscriminate use of steroids without medical advice has many harmful effects.

So what can be done to control this? Remember it is entirely up to you to decide what to watch or read. Very soon you will be an adult. It is important that you make responsible choices based on correct information.

Parents can reduce the negative effect of media by:

- Helping you distinguish between fantasy and reality
- Discussing the consequences of violence and risk taking behaviour
- Empowering adolescents with critical thinking skills to filter the messages they receive and good decision making skills to watch age appropriate content.
20.4 PREPARING FOR A CAREER

Towards later adolescence comes the time when you need to choose and prepare for a career.

You must be aware that you have to face tough competition to secure a good job. Everyone hopes to do something that they enjoy and also earn a decent livelihood. Very often, you are expected to join your parents in their profession. But if you have other interests, you should explore them. Remember what ever you do, you must try to do your best and excel in the chosen field. For this you may have to put in extra labour and effort. After all hard work always pays in the long run. There are many options available besides the usual professions of doctor, engineer or architect. Do try to explore other avenues available around you, at your place of residence. You can get relevant information from the following resources:

✓ Weekly magazine sections of many newspapers offer guidance on vocational choices, the preparation needed for them, the concerned institutions and how to get there.

✓ A number of career guidance websites are also available. You can refer to http://india.gov.in/citizen/career_guidance.php hosted by Government of India to assist young people in making informed career selection.

✓ Parents and employees from specific fields can give first hand knowledge about their careers.

✓ An internship or on the job training will also equip you with necessary job related skills.

TERMINAL EXERCISES

1. Explain the physical changes that are common to both adolescents boys and girls?

2. Differentiate between emotional and social changes during adolescence

3. Giving an example explain how positive self esteem helps in better performance.

4. How would systematic thinking help in choosing a career.

5. Read the case study of three friends below and answer the given questions,

   Mani and Ronny met Adil at a marriage party. They try to convince Adil to drink He does not want to offend his friends and risk his friendship. However
he does not want to drink and drive. He is in a dilemma, should he have alcohol with them or should he leave the party and go home?

(i) What do you think Adil should do?

(ii) What should Adil do to convince his friends not to drink as they will have to drive back home?

(iii) How else can Adil’s friend celebrate? Please give at least two suggestions.

6. Your 9-year-old brother is watching a violent film. In what ways can you help him select an appropriate program?

7. Cite a situation where you experienced a conflict between what you wanted to do and what was expected of you. How did you resolve the situation?

8. Educate your friends on how to be assertive when being forced to do things against their wishes.

9. List various sources from where you can get information regarding your career.

WHAT YOU HAVE LEARNT
ANSWERS TO INTEXT QUESTIONS

20.1

1. **Common signs**— increase in height and weight, hair in underarm and pubic area, increase in genitals.

   **Boys**— Nocturnal emissions, increased muscular development, facial hair.
   (Any two)

   **Girls**— growth of breasts, menarche, broadening of hips.

2. (i) **FALSE** - they should be prepared beforehand so that they do not get shocked and are prepared / relaxed for the forthcoming changes.

   (ii) **FALSE** - she can continue with all her normal activities.

   (iii) **FALSE** - it can happen otherwise too as excess of semen flows out in sleep.

   (iv) **TRUE** - Girls should eat iron rich foods.

   (v) **FALSE** - she can get pregnant before her first periods as ovum is formed few weeks before the start of menstrual cycle begins.

   (vi) **TRUE** - Genital hygiene is important for both boys and girls.

20.2

1. Option 3 is the best option. **REASON** - one should find out the reason instead of expressing anger as that would not solve the problem. Maybe by mistake her name was not there or she may not fulfill criteria for age bar.

2. Neha should ask them the reason for not allowing her. Understand their point of view. She should have not thrown her books, eaten her food and talk politely with all.

3. (i) **Realize that certain physical aspects in you cannot be changed.**

   (ii) spend time analyzing your strong points and appreciate your strengths

   (iii) **do not indulge in self pity**

   (iv) **eat healthy and exercise.**

   (v) **take advice from a trusted friend or a trained counselor**
20.3
1. Neha’s role
   (i) confide in her parents
   (ii) see their point of view
   (iii) respect them and talk courteously
   (iv) participate in household chores with parents

   Role of her mother-
   (i) involve her in family discussions and household chores
   (ii) share problems
   (iii) understand
   (iv) talk openly about the issues
   (v) counsel her

2. Any incidence where your parents one minute tell you that you are child but very next minute they expect you to behave adult like.

20.4
Complete the following statements giving appropriate reasons:-
   (i) STD, HIV, behind bars, any other
   (ii) prevents misunderstanding between both parents and children
   (iii) they go through the same phase and understand each other.
   (iv) it encourages healthy competition and boosts their ego.
   (v) they do not talk freely / do not respect each other.

20.5
1. (i) personal fable – think they are unique
   (ii) imaginary audience – think everyone watching them
   (iii) abstract thinking – can imagine impossible, which is not true
   (iv) systematic – can take all factors in mind before planning anything.

2. reckless — because of personal fable where they think nothing wrong can happen to them. Refuse to wear a defective dress — as think everyone can see the defect even if it is not noticeable.
people’s participation in the democratic process

Vijaya was going through an editorial in a newspaper and exclaimed, “I am delighted to live in a successful democracy like India”. Rampal, her father says, “I may not be very educated, but I am wondering, whether we really are a successful democracy, I see many people who are still begging on the streets or are malnourished.” Vijaya responds by saying, “That’s true, but at least we can vote to bring another government. While many countries are still struggling to have regular popular governments, democracy in India has taken firm roots.”

Indians have been participating in elections regularly for over six decades. People have been electing their representatives for running governments at national and state levels and also for local governments. Voting in elections is a formal and simple form of political participation. People’s participation becomes effective only when there is a respect for public opinion. Within a country there are people and groups having different points of view, some people have disagreements with certain policies or programmes of the government. A process of debate and discussion is important for a healthy democracy. The essence of democracy is the freedom to voice one’s opinion even if it is critical of the government. In fact, democracy is enriched when different voices and constructive opinions influence the policies of the government. Democratic government is a government that sustains itself through public opinion which is expressed through the medium of elections. In this lesson, you will learn about elections, the electoral system, the electoral process, universal adult franchise, in addition to the importance of public opinion in a democracy.

OBJECTIVES

After completing this lesson, you will be able to:

- understand people’s participation in democratic processes;
- explain the meaning and importance of public opinion;
People’s Participation in the Democratic Process

- list the agencies which help formulate public opinion;
- describe the electoral system that operates in India;
- discuss the meaning of elections and their types;
- assess election malpractices and measures to check them;
- identify various electoral reforms; and
- explain the meaning of universal adult franchise and its importance.

### 22.1 PEOPLE’S PARTICIPATION

You must have observed people voting in elections. Have you voted in any election? We vote to elect our representatives who form and run the government. These representatives implement the government’s policies and programmes. People’s participation in the election is what makes our democracy a representative and participatory democracy. But the meaning of people’s participation does not begin and end with their voting in elections. People’s participation is also expressed through public debates, newspaper editorials, protest demonstrations and their active involvement in governmental programmes. Even in respect of election process, it includes participation in campaign, political discussion, working for political parties and standing as candidates.

![Figure 22.1 People’s Participation in an election rally](image)

People’s participation may be defined as, “behaviour through which people directly express their political opinions”. This conceptualization is broad enough to cover the electoral and non-electoral forms of political participation. In fact, participation comprises all those actions of citizens by which they seek to influence, support or criticize the government and its policies. They do so to ensure that their representatives respond to their needs and aspirations.
ACTIVITY 22.1

Ask the following questions to three people who are 18-years old or above and write their answers in the table given below.

<table>
<thead>
<tr>
<th>Person 1</th>
<th>Person 2</th>
<th>Person 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you vote in last election, why or why not?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you participate in the election process by campaigning for a party/candidate?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If the elected person did not fulfill his/her promise, did you make in any public response eg. write to a newspaper, or participate in a protest rally.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

22.2 PUBLIC OPINION: MEANING, IMPORTANCE AND ITS AGENCIES

The discussion on people’s participation makes it abundantly clear that there are several ways in which citizens participate in the democratic process. Public opinion is one of the most effective ways. You also must have observed that people quite often enter into discussion on political parties, leaders and candidates and express their opinions on various issues. They do so while travelling in a train or a bus, or at other public places. They also discuss policy decisions taken by the government. Many of us write letters to the editor expressing views on different issues or participate in protest rallies and discussions on radio or television. All such views take the form of public opinion and influence various aspects of democratic process, such as voting behaviour, functioning of a government and the working of administration.

22.2.1 Public Opinion: Meaning

But do the terms, ‘voice of the people’ and ‘public opinion’ mean the same? When you study these terms further, you will be able to appreciate that it is not so. In fact, the concept of public opinion has been defined in a variety of ways and definitions appear to be complex. At this stage, let us try to understand the meaning of public opinion in a simple manner. Public opinion is not the unanimous opinion of the people, nor it is the opinion of the majority. Public opinion is an organized and considered opinion of the people on any issues of public concern. Public opinion can also be defined as the complex collection of opinions of different people and the sum of all
their views. To a great extent, various definitions on public opinion include the following characteristics:

(a) Public opinion is an aggregate of views;
(b) views are based on reasons;
(c) these views aim at ensuring the welfare of the whole community; and
(d) public opinion influences the decisions of governments, functioning of political parties and running of administration.

Do you know?

Public opinion as a concept dates back to the eighteenth century. This concept came about through the process of urbanisation and other political and social forces. For the first time, it was Jeremy Bentham, the British Philosopher, who developed theories of public opinion. He said that public opinion had the power to ensure that rulers would rule for the greatest happiness of the greatest number.

22.2.2 Public Opinion: Its Importance in a Democracy

The role of public opinion, in a democracy, can hardly be ignored. You already know that democratic government draws its authority from the people and claims its legitimacy from the consent of the governed. No government can function without the support of the people. The process of development of public opinion generates thinking, promotes awareness and invites people’s views on issues of public concern. Do you realize how a democratic government is formed, sustained and controlled by public opinion? The following roles of public opinion are especially important:

1. An alert and free public opinion is a check on absolute power;
2. it ensures a system in which no organ of the government overrules others;
3. it promotes a process to be responsive to the needs and aspirations of the people;
4. it influences government in making laws in the interest of the people;
5. it strengthens democratic values and norms; and
6. it protects rights, freedoms and liberty: ‘eternal vigilance’ is rightly called the price of liberty, i.e. every citizen needs to be vigilant in order to protect democratic values.

22.2.3 Public Opinion: Agencies for its Formulation

As we have seen above, public opinion is not the simple aggregation of views or opinions expressed by individuals or groups. In fact, public opinion is formed on the basis of such views and opinions, but as you find in the illustration, there are number of agencies that contribute to its formulation. The following are some of the important agencies which help to formulate public opinion:
1. **Print Media**: Newspapers, periodicals, magazines and other print materials have been contributing to the formulation of public opinion since a long time. As you are very well aware, the news items, articles, news stories, letters to editors and several other published items on almost all the critical public issues update the individual views and opinions. These also assimilate and concretise varied views and opinions and help them evolve as public opinion. These media instruments also facilitate communication of public opinion to all concerned.

2. **Electronic Media**: Cinema, radio, T.V. channels and now cell phones have emerged as perhaps the most effective tools that contribute to the formulation of public opinion. Their audio-visual mode helps a great deal in assimilating views and opinions expressed even in the remotest part of the country. They help in converting views into the most representative public opinion and also in communicating it to all concerned.

3. **Political Parties** constitute an important agency for opinion formation. As you also may be experiencing, almost everyday, the political parties and their leaders feed the people with facts and ideas. We hear and see the leaders of political parties undertaking *padyatras*, *rathyatras* and workers of political parties conducting mass awareness activities about their programmes and policies. These contribute a great deal in the formulation of public opinion.

4. **Legislatures**: Legislatures, Parliament and State Legislatures in our country are the most effective institutions that make substantive contribution to the formation of public opinion. The impact of their contribution has increased manifold since the beginning of the live telecast of legislative debates. These are places where most of the discussions and debates on all the critical issues of public policy and
People’s Participation in the Democratic Process

public welfare take place. These are watched and heard by the vast majority of population. Legislature’s platform provides authentic information and ideas on which public opinion is effectively formulated.

5. Educational Institutions: Different educational institutions also help create public opinion. Our schools, colleges, universities and professional institutes leave on our minds permanent impact. These formal educational institutions impart political education and contribute to the formation of public opinion as well.

ACTIVITY 22.2

You may have watched the film, Rang De Basanti. Its story is about 5 young men whose friend gets killed in a fighter aircraft crash. The corruption in government appears to be the root cause of the incident. This event changes them from being carefree to passion-driven individuals who are determined to avenge their friend’s death by using violent means.

In another film, Lage Raho Munnabhai, a Mumbai (Bombay) underworld don begins to see the spirit of Mahatma Gandhi. Through his interactions with the image of Gandhi, Munna Bhai begins to practice what he calls Gandhigiri (focused on satyagraha, non-violence and truth) to help ordinary people solve their problems. In both the films the lead actors were working towards a cause using different methods. Which method do you like more? Give your reasons.

Note: This question can be answered even if students have not seen the film.

INTEXT QUESTIONS 22.1

1. What do you mean by people’s participation in the democratic process?
2. Are ‘public opinion’ and ‘voice of the people’ synonyms? Give reasons to your answer.
3. Explain the importance of Public Opinion in a democracy.
4. List any two agencies which help in the formation of public opinion? Which agency according to you has the most powerful impact on public opinion?

22.3 ELECTIONS IN INDIA

You may have seen a polling booth as shown in the illustration where citizens are lined up to cast their votes. In our country, elections take place for electing Members of the Lok Sabha or the Vidhan Sabha or the representatives of Gram Panchayat.
or Municipal Bodies. You may have even participated in such election. Can you define elections? Well, election is a contest among candidates in order to seek the membership of a legislative body or a representative institution to attain a public position. Elections, to the legislatures and local government bodies are held periodically, usually after a particular period. The whole country or the entire State or the area of the concerned local body is divided into a number of constituencies. Each constituency returns one representative from a number of candidates who contest elections. The candidate who gets the largest number of votes as against the other candidates in the constituency is declared elected.

![Figure 22.3 A polling booth with voters in a queue](image)

**Do you know**

A **Constituency** is a territorial area delimited separately for the Parliament, the State Legislature and the local bodies in India. Each constituency returns a single representative.

A **Candidate** is a prospective person seeking some position through election. He/She is either the incumbent seeking re-election or is a challenger seeking to unseat the incumbent or is simply an aspirant for an open seat.

A **Manifesto** is a document which outlines the proposed programmes and policies of the political parties.

**22.3.1 Importance of Elections**

You also may have experienced that elections provide opportunities to the people to participate actively in the functioning of the democratic government. These are the most important expressions of public opinion, as these enable the people to express their will. In fact, elections widen the scope of political awakening among the masses and educate them by familiarising them with issues of public concern. Elections facilitate peaceful transfer of power from one political party or one group of political parties to another and legitimise the working of the government by justifying the authority of representatives to lead people.
Mukund Das, a politician is a two time MLA from Pratappur. He is associated with one of the prominent regional parties of Uttar Pradesh. He has 100% attendance in the Legislative Assembly. However, in terms of his active participation in the Assembly, he has never raised any question in the Assembly nor participated in debate on any issue. Out of Rs. 6 crore that he had in his MLA Development Fund, he has been able to spend only a small amount on development of roads and sewers in his locality.

Devika Sen became an MLA from Durgapur, West Bengal. She is an independent MLA not belonging to any political party. Her family owns a cloth mill in the area. She has 100% attendance in the Assembly. She has often raised questions in the Assembly relating to rights of women and on policies related to trade unions. Out of the Rs. 6 crore from her MLA Development Fund, an amount of Rs. 4 crores was spent on improving the schools in the area and another two crores on developing infrastructure like roads, community centers etc. around the cloth mills.

1. Based on the above information, write in the table below, whom would you vote for. Give reasons for your choice and suggest two ways in which the two candidates can improve their performance.

<table>
<thead>
<tr>
<th>Candidate</th>
<th>My Vote and reasons</th>
<th>Suggestions for improvement</th>
</tr>
</thead>
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22.3.2 Types of Elections

We all observe that elections do take place in our country quite often. But all the elections are not of the same kind. The kinds of elections that take place in India may be understood in two ways. Firstly, we have direct and indirect elections. In direct elections, people vote directly through their ballot to elect their representatives to legislative bodies (Lok Sabha and State Legislative Assemblies) and local government institutions. We have also indirect elections, in which the elected representatives of the people vote for electing persons to occupy certain positions. The President and the Vice-President of India are indirectly elected. The members of the Rajya Sabha also are elected indirectly. Moreover, certain percentage of
members of the Legislative Councils (that are present in some of the States) are indirectly elected by the members of the concerned Legislative Assemblies.

Observed in a different way we find another three categories of elections. These are: (a) General Elections, (b) Mid-term Elections, (c) Bye-elections. The General Elections are held all over the country, for the Lok Sabha and/or for the State Legislative Assemblies. Such elections are held after the expiry of the full term of the legislature. The Lok Sabha Elections held in 2009, for example, may be described as General Elections. If the elections are held before the completion of the normal term of the legislature owing to the dissolution of legislative bodies, these are called Mid-term Elections. The Lok Sabha elections that took place in 1991, for example, were mid-term elections. Bye-elections are held in a particular constituency owing to a vacancy caused by resignation or death of the elected member, or when the election of a particular member is set aside by the judiciary. In such elections, the member is elected for the remaining period of term of the legislature. P.V. Narasimha Rao was elected to the Lok Sabha from Andhra Pradesh in a bye-election held in November 1991.

Do you know

1. The first general elections (Parliamentary Elections) were held in our country in the year 1952. Since then there have been 15 General Elections (Lok Sabha elections) up to 2009.
2. The Lok Sabha elections of 1980, 1991, 1998 and 1999 were Mid-term Elections, held before the schedule.
3. In the history of Indian Elections, only the 1977 Lok Sabha elections were deferred for about two years on account of the proclamation of National Emergency in the country.

INTEXT QUESTIONS 22.2

1. Examine the importance of elections in India.
2. What do you mean by direct and indirect elections?
3. Fill in the blanks
   1. Elections held after the expiry of the full term of the legislatures are known as .....................
   2. If the elections are held before the completion of the normal term of the legislature owing to the dissolution of legislative bodies, these are called .....................
   3. An election held in a particular constituency owing to a vacancy caused by resignation or death of the elected member, or when the election of a particular member is set aside by the judiciary is known as .....................
22.4 ELECTORAL SYSTEM IN INDIA

India has earned accolades for successfully conducting so many elections. But how do all these happen? Have you ever given thought to certain questions like how are elections conducted in a vast country like India? Who supervises the process of elections? Who delimits the constituencies? Who declares the schedule of elections right from nominations to declaration of results? Who are these officials, called the returning officers, presiding officers, and polling officers? In fact, there is a huge electoral system that has been engaged in managing elections in India. Let us discuss its details.

22.4.1 Election Commission of India

The task of conducting free, fair and impartial elections is entrusted to an impartial constitutional authority which is known as the Election Commission. The Election Commission is not a legal but is a constitutional body. A legal body is one which is created by the law of Parliament or State Legislature, while a constitutional body is one which is provided in the Constitution itself. Our Constitution provides for the Election Commission of India. The Election Commission consists of a Chief Election Commissioner and the number of Election Commissioners as the President may fix in accordance with the law. At present, the Election Commission of India consists of a Chief Election Commissioner and two Election Commissioners.

The Chief Election Commissioner and the Election Commissioners are appointed by the President of India. They have tenure of six years or up to the age of 65, whichever is earlier. They enjoy the same status and service conditions as are enjoyed by the Judges of the Supreme Court of India. The Chief Election Commissioner can be removed only by impeachment, through a procedure as applicable in the case of a Judge of the Supreme Court. The Election Commissioners can be removed by the President on the recommendations of the Chief Election Commissioner.
The main functions of the Election Commission of India are as follows:
1. Ensure free and fair elections in the country;
2. supervise, direct and control the entire election machinery; preparation of electoral roll;
3. provide recognition to political parties and register them as national and state parties;
4. allotment of symbols to political parties and the numerous independent candidates contesting the elections;
5. issuing guidelines and code of conduct for the election officials, candidates, and for the political parties during the elections;
6. redressal of election complaints received from the voters, the candidates and the political parties;
7. appointment of electoral officials; and
8. advising the President on matters relating to elections.

The Election Commission performs its role with the help of a group of officials and by observing an election procedure as discussed below:

1. **Election Officials**

For the conduct of elections, the Election Commission is assisted by a number of officials. At the state level, the election work is supervised, subject to overall superintendence, direction and control of the Commission, by the Chief Electoral Officer of the State. The Chief Electoral Officer of the State is appointed by the Election Commission from amongst senior civil servants proposed by the concerned State government. He/She is, in most of the States, a full time officer and has a team of supporting staff. The Election Commission utilises the State government officers for election work, by designating them as District Election Officers, Electoral Registration Officers, Returning Officers, Assistant Electoral Registration Officers, and Assistant Returning Officers. They all perform their functions relating to elections in addition to their own routine responsibilities. During election time, they are available to the Commission, more or less, on a full time basis. Out of these, there are three main officials who play very important roles in the conduct of free and fair elections. They are the Returning Officer, Presiding Officer and Polling Officer.

**Returning Officer:** In every constituency, one Officer is designated as Returning Officer by the Commission in consultation with the concerned State government. However, an Officer can be nominated as Returning Officer for more than one constituency. He/She is the official who (a) receives and scrutinises the nomination papers of the candidates contesting elections, (b) allots election symbols on behalf of the Election Commission, (c) conducts smooth elections in the constituency(ies), (d) ensures counting of votes, and (e) declares the election results.
People’s Participation in the Democratic Process

**Presiding Officers:** Every constituency has a large number of polling booths. Every booth, for 800-1000 voters, remains under the charge of an Officer who is known as Presiding Officer. He/She supervises the entire process in the polling booth and ensures that every voter gets an opportunity to cast vote freely and that there is no impersonation. After the polling is over, he/she seals all the ballot boxes and delivers them to the Returning Officer.

**Polling Officer:** Every Presiding Officer is assisted by three or four officials who are called the Polling Officers. These officials ensure that the elections take place smoothly at the polling booth. They check the names of the voters in the electoral roll, put indelible ink on the finger of the voter, issue ballot papers and ensure that votes are secretly cast by each voter.

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**Do you know**

1. **Impersonation:** It is ‘bogus’ voting. When somebody takes on a false identity and votes instead of the real person during elections, such an illegal act is called impersonation. It can be curtailed by compulsory identification through use of voters’ cards.

2. **Indelible ink:** This ink cannot be removed easily. It is put on the index finger of the right hand of the voter, so that a person does not come again to cast vote for the second time. This is done to avoid impersonation.

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**2. The Electoral Process in India**

The election process is a considerably long process having numerous stages. It is important for you to recognize various stages of the electoral process, which are as follows:

1. Delimitation of constituencies is the first step which is undertaken by the Delimitation Commission.

2. Preparation and revision of the electoral roll constitute the next step done under the supervision of the Election Commission periodically.

3. Consequent upon the President’s and Governor’s notifications, the Election Commission undertakes the task of conducting elections in the country.

4. The election schedule is announced indicating the dates for filling the nomination papers, their scrutiny, withdrawals, polling, counting of the votes, and declaration of the election results.

5. Allotment of election symbols to the candidates, and the political parties is done by the Election Commission.

6. The candidates and the political parties are given time for election campaigns by the Election Commission.
7. Re-poll, if necessary, in a constituency or in a part of the constituency, is done only on the orders of the Election Commission.

8. Countermanding of election is done when a duly nominated candidate belonging to a recognized political party dies any time after the last date of withdrawals of the nomination papers and the commencement of the polling. The countermanding orders are issued by the Election Commission.

9. The election disputes such as improper rejection of nomination papers of the candidate(s), use of unfair or corrupt means during the elections, bribing and intimidating of voters, or the use of official machinery are probed by the judiciary, i.e. the High Court, and through appeals by the Supreme Court.

22.4.2 Polling and After
You must have noticed that the polling day, at every polling booth is a day full of activities. On the day of the polling, the voters go to their respective polling booths, and wait in a queue, for their turn. On entering the polling room, the voter discloses his/her identity to the first polling officer, and then to the second one. After that, another polling officer puts indelible ink on the first finger of left hand in the case of a male voter, and on the right hand in case of the female voter. This is done to avoid bogus or false voting or impersonation. Impersonation, you must be aware is an offence, punishable by law. After the identification of the voter is done by the officials, the voter is given a ballot paper or is shown the electronic voting machine (EVM) containing the names of the candidates along with their respective election symbols. Does not the EVM look like the one shown in the illustration?

Figure 22.5 Voting in a Polling Booth

Figure 22.6 Electronic Voting Machine
If a ballot paper is given, the elector casts his/her vote by marking the ballot paper with a rubber stamp on or near the symbol of the candidate of his/her choice, inside a screened compartment in the polling station. The voter then folds the ballot paper and inserts it in a common ballot box which is kept in full view of the Presiding Officer and polling agents of the candidates.

But if the electronic voting machine is used, the voter uses the machine to indicate his/her choice of candidate. Secrecy is maintained so that nobody gets to know for whom the voter has voted. After the polling, boxes or EVMs are sealed and sent to the counting centres. The votes are counted and the candidate who obtains the largest number of votes is declared elected. The candidate who fails to poll even one-sixth of the total votes cast in the constituency, forfeits his/her security deposits. If any candidate suspects corrupt practices used by the other candidates, he/she can file an election petition in the High Court. If the court is satisfied that corrupt means were used, the election is set aside. An appeal can be made in the Supreme Court against the decision of the High Court.

**Do you know**

**Ballot paper** is a piece of paper which indicates the names of the candidates together with their election symbols. It is used to record the choices made by voters.

The **Secret Ballot** is a voting method in which the voters’ choices are made confidential, in an election or in a referendum. The method is a means of achieving the objective of secrecy.

**Electronic Voting Machine (EVM)** is a simple electronic device used in place of ballot papers and boxes which were used earlier in conventional voting system. It was first used in 1982 in the bye-election to Parur Assembly Constituency of Kerala for a limited number of polling stations (50 polling stations). During the General Elections of 2004 in India, elections were conducted using a total of 10.75 lacs EVMs.

**INTEXT QUESTIONS 22.3**

1. How is the Election Commission constituted?
2. What according to you are the two most critical functions of the Election Commission?
3. Who are the main election officials from state level to the level of polling booth?
4. If you are assigned the task of acting as a Returning Officer, what main functions will you perform and how will you ensure free, fair, and peaceful poll in the constituency?

5. What are the five major stages of electoral process in India?

22.5 PEOPLE’S PARTICIPATION IN ELECTIONS AND ELECTORAL REFORMS

The discussion so far has enabled us to appreciate the significance of elections ensuring people’s participation in the democratic process. But over the years, it has been found that the election system in India needs improvement to make India a truly participatory democracy. We shall now discuss the most notable factor that has contributed to ensure people’s participation in elections. The discussion will also focus on those issues that are considered concerns of Indian elections as well as on suggested electoral reforms.

22.5.1 Universal Adult Franchise

Elections play an important role primarily because of the system of universal adult franchise adopted in India just after its independence. It is interesting to observe that in Great Britain, the universal adult franchise was granted in 1928, nearly 300 years after the process of democratization began. In Switzerland, the Home of Democracy, it was also granted as late as in 1972. In India, however, universal adult franchise became a part of the electoral process right from the beginning of our establishment as a democracy, that is, after Independence. What does Universal Adult Franchise mean?

Let us begin with the literal meaning of the concept of universal adult franchise in this context. ‘Universal’ means commonly applicable to all persons, without any discrimination; ‘adult’ means a person who is a major and not a minor; ‘franchise’ means individual’s right to cast his/her vote. Universal adult franchise thus means, a system in which all adults, men and women, without any discrimination, have a right to vote in the elections. But all adults do not include those who are legally barred from voting.

Do you know

1. New Zealand was the first country to grant universal franchise in 1893, and Finland was the first European Country to do so, in 1906.

2. Universal Adult Franchise was introduced in Germany in 1919, Sweden in 1920, and France in 1945.

The concept of universal adult franchise is based on the principle of political equality: one person, one vote; none has more than one vote. It helps ensure liberty of the people and helps secure protection of rights. It is educative in so far as it widens the scope of people’s participation.
The right to vote is linked with age of the person. The minimum age required for voting differs from country to country. In most countries of our times, the voting age is 18 years, as in India, China, United States of America, Great Britain and Russia. In countries like Iran, the minimum age for a voter is 15, while in Brazil, Cuba, Nicaragua, it is 16 years, and in Indonesia, North Korea and Sudan, it is 17 years. In Japan and Tunisia, it is 20 years, while in South Korea, it is 19 years. In countries such as Kuwait, Lebanon, Malaysia, Maldives, Singapore, the voting age is 21 years, but in Uzbekistan, a voter has to have a minimum age of 25 years.

### 22.5.2 Electoral Reforms

As we have seen, the electoral system in India based on universal adult franchise has helped our voters not only in choosing their representatives, but also in facilitating smooth and peaceful change of governments, replacing one political party or a set of political parties by another. We have also observed that our elections, held so far, have largely been free and fair. People have participated in the election processes actively. Accordingly, elections have become an important part of our democratic life. And yet, there are certain critical problems that have been adversely affecting not only the quality of electoral process but also the functioning of democratic system. These definitely call for electoral reforms.

In fact, the electoral reforms have been engaging the attention of the Parliament, the Government, the Election Commission, the Press and the people for a long time. Some measures were implemented in the past to remove glaring lacunae in the law. Based on the experiences in the recent past, the need has been felt for some steps to be taken quickly for amendment of certain provisions of law. There are issues like (a) rigging of the elections - fake and bogus voting, impersonation, (b) violence during elections, (c) adverse role of money and muscle power, (d) intimidation of voters especially the people of weaker sections, (e) misuse of governmental machinery, (f) booth capturing and criminalization in both elections and politics, that demand immediate attention.

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**Figure 22.7** Criminalization of Politics
These negative developments have been discussed at different levels and actions are on for electoral reforms. Indeed, a lot of electoral reforms have already been introduced. But no system of election can ever be perfect. In actual practice, there always come up flaws and limitations in the electoral practices. We have to keep searching some mechanism to make elections truly free, fair and impartial. Numerous suggestions for electoral reforms have come from scholars, political parties, government sponsored committees, and various independent sources.

A tentative list of suggested electoral reforms is as follows:

1. Democratization of electoral system be made from time to time so as to keep the electoral system in pace with changing times;
2. change from the on-going system (plurality system) to some form of proportional representation system to be introduced to reduce the votes-seats imbalance (see box below);
3. the functioning of political parties to be regulated in order to ensure that they function in a transparent and democratic manner. There is a need to audit their expenditure incurred during the elections;
4. electoral laws to be made more stringent and there must be provisions for harsher punishment;
5. state funding of elections to be introduced so as to reduce and curb election expenses;
6. special provision to be made to ensure at least one third representation of women in Parliament and State legislatures;
7. the role of money and muscle power to be curbed during the elections;
8. criminalization of politics to be stopped in the elections;
9. candidates with any criminal record to be barred from contesting elections; and
10. complete ban to be imposed on the use of caste and religious appeal in election campaigns.

Do you know

1. The Plurality System refers to an election won by the candidate having maximum votes. This voting system is used at present to elect members of the legislative assembly in single-member and multi-member constituencies.
2. The Proportional Representation is an electoral device to ensure representation of all sections of the people more or less in proportion to their voting strength. Under this system any group, whether it is a political party or interest group will secure representation in proportion to the popular votes it obtains.
The Election Commission has taken several new initiatives in the recent past, a reference to some of which has already been made above. Notable among these are: (i) a scheme for use of State owned Electronic Media for broadcast/telecast by political parties, (ii) restrictions on Opinion and Exit Polls (because these polls might influence voters), (iii) checking criminalisation of politics, (iv) computerisation of electoral rolls, (v) providing electors with Identity Cards, (vi) simplifying the procedure for maintenance of accounts and filing of the same by candidates and (vii) a variety of measures for strict compliance of Model Code of Conduct for providing a level playing field to contestants during the elections. As our electoral system has worked well even under certain adverse conditions, hopes are ripe that democracy in our country is going to stay and continue to be better. Our people are committed to democratic values and there are chances that the governments would come up to people’s expectations.

**ACTIVITY 22.4**

Given below is a short interview sheet. Conduct this interview with the adults in your family or neighborhood to find out what they feel about voting.

1. Name : Age :
2. When did you vote for the first time?
3. How did you decide on the candidate you voted for?
4. Have you ever seen the manifesto of a political party? Did it help you to take your decision?

**INTEXT QUESTIONS 22.4**

1. Universal adult franchise ensures that the vote of every Indian citizen is equally valuable. Do you think that this has been able to reduce inequalities related to class, caste, gender and religion. Justify your view point.
2. Mention any three problems that are confronted by the electoral system in India.
3. Mention any two electoral reforms you think are important to improve our electoral system.

**WHAT YOU HAVE LEARNT?**

- In a large country like ours, representative democracy is desirable. Representative government works through representation and representation through elections. Elections, therefore, are the basis of democracy.
Elections require electorate and electoral processes. Electorate means citizens exercising franchise. In modern democracy, universal adult franchise (all adult citizens without any discrimination, have the right to vote) is essential.

- Single member constituency system is more common than multi-member constituency. Voting is through secret ballot.
- Usually the elections are direct for popular legislative assemblies, though indirect election system is used for certain offices such as the President and the Vice-President of India.
- The electoral process moves through various stages: filling up the nomination papers for election by the candidates, scrutiny of the nomination papers, withdrawals from elections, election campaign, results, etc.
- In India, there is a provision for independent and impartial Election Commission to conduct and supervise elections.
- In the context of a number of lacunae in the on-going electoral process, there is a need for electoral reforms.

**TERMINAL EXERCISES**

1. What do you mean by people’s participation in the democratic process? Do you think, casting votes in elections is the be-all and end-all of people’s participation? Give reasons.

2. Define Public Opinion and discuss its importance in a democracy.

3. Give any four agencies which help to formulate public opinion. Which agency according to you has the most powerful impact on public opinion?

4. Examine the role of elections in Indian democratic system. Discuss the types of elections that are held in the country.

5. What are the major functions of the Election Commission of India? What are the major stages of election process?

6. What is meant by Universal Adult Franchise? Explain its significance.

7. In India where we see many inequalities related to class, caste, gender, religion, how successful do you think is universal adult franchise?

8. Discuss any four major problems confronted by the electoral system in India.

9. Do you think there is an urgent need to effect electoral reforms in India? What are the major recommendations for bringing about election reforms?

10. Make an Action Plan for the Election Commission, for bringing about reforms in the process of electoral campaigning. The Plan should help promote effective dissemination of information among the general public, about political parties and candidates.
People’s Participation in the Democratic Process

22.1

1. People’s participation includes voting in elections, it is also expressed through public debates, newspaper editorials, protest demonstrations and their active involvement in governmental programmes. Even in respect of election process, it includes participation in campaign, political discussion, working for political parties and standing as candidates.

2. ‘Voice of the people’ and ‘public opinion’ do not mean the same. Public opinion is not the unanimous opinion of the people, nor is it the opinion of the majority. Public opinion is an organized and considered opinion of the people on any issue of public concern. Public opinion can also be defined as the complex collection of opinions of many different people and the sum of all their views.

3. Public opinion plays an important role in a democracy. A democratic government draws its authority from the people and claims its legitimacy from the consent of the governed. No government can function without the support of the people. The process of development of public opinion generates thinking, promotes awareness and invites people’s views on issues of public concern. An alert and free public opinion is a check on absolute power and it promotes a process to be responsive to the needs and aspirations of the people. It also influences government in making laws in the interest of the people.

4. Two agencies which help in the formation of public opinion are Print media and electronic media.

Write the answer to the second part based on your understanding and experience.

22.2

1. Elections provide opportunities to the people to participate actively in the functioning of the democratic government. These are the most important expression of public opinion, as these enable the people to express their will. Elections also widen the scope of political awakening among the masses and educate them by familiarizing them with issues of public concern. They facilitate peaceful transfer of power from one political party or one group of political parties to another and legitimise the working of the government by justifying the authority of representatives lead people.

2. In direct elections, people vote directly through their ballot to elect their representatives to legislative bodies (Lok Sabha and State Legislative Assemblies) and local government institutions. In indirect elections, the elected representatives of the people vote for electing persons to occupy certain positions. The President
and the Vice-President of India are indirectly elected. The members of the Rajya Sabha also are elected indirectly.

3. (a) General Elections, (b) Mid-term Elections, (c) Bye Election

22.3

1. The Election Commission consists of a Chief Election Commissioner and such number of Election Commissioners as the President may fix in accordance with the law. At present, the Election Commission of India consists of a Chief Election Commissioner and two Election Commissioners.

2. The two important functions of the election commission are
   (i) Ensuring free and fair elections in the country;
   (ii) supervision, direction and control of the entire election machinery.

3. For the conduct of elections, the Election Commission is assisted by a number of officials. The main election officers are the Chief Electoral Officer of the State, District Election Officers, Electoral Registration Officers, Returning Officers, Assistant Electoral Registration Officers, Assistant Returning Officers, and Polling officers.

4. The following are the main functions performed by a returning officer:
   (a) receives and scrutinizes the nomination papers of the candidates contesting elections,
   (b) allots election symbols on behalf of the Election Commission,
   (c) conducts smooth elections in the constituency(ies),
   (d) ensures counting of votes, and
   (e) declares the election results.

5. The five major stages of electoral process in India are:
   (i) Delimitation of constituencies is the first step which is undertaken by the Delimitation Commission;
   (ii) preparation and revision of the electoral roll constitute the next step done under the supervision of the Election Commission periodically;
   (iii) consequent upon the President’s and Governor’s notifications, the Election Commission undertakes the task of conducting elections in the country;
   (iv) the election schedule is announced indicating the dates for filling the nomination papers, their scrutiny, withdrawals, polling, counting of the votes, and declaration of the election results;
   (v) allotment of election symbols to the candidates and the political parties is done by the Election Commission.

22.4

1. Universal adult franchise means a system in which all adults, men and women, without any discrimination, have a right to vote in the elections. In many ways
People’s Participation in the Democratic Process

Universal Adult Franchise has provided opportunities to people to participate in election processes despite differences of class, caste, gender and religion. It has enriched our democracy by giving equal opportunity to all persons. Today, people of all castes and classes have an opportunity to vote. However, we cannot say that the inequalities in our society have completely gone, persons belonging to different castes, classes and gender is still discriminated. Real equality can only be brought in once there is a change in the attitude and behavior of ordinary citizens and they stop discrimination at all levels in their personal lives as well at the societal level.

2. Three problems confronting the electoral system in India are:
   (a) rigging of the elections - fake and bogus voting, impersonation;
   (b) violence during elections; and
   (c) adverse role of money and muscle power.

3. (i) The functioning of political parties to be regulated in order to ensure that they function in a transparent and democratic manner. There is a need to audit their expenditure incurred during the elections;
   (ii) electoral laws to be made more stringent and there must be provisions for harsher punishment.
FORCE AND MOTION

In the previous lesson you have learnt about the motion of a body along a straight line. You also know that motion can be uniform or non-uniform. You might have seen that a body at rest can be brought to motion and a moving body can be brought to rest. Do you know what makes bodies at rest to move or stop if they are in motion? What changes the speed or direction of a moving object? Why do the dust particles get detached from a carpet when it is beaten with a stick? Why does a ball rolling along the ground stops after moving through some distance? Why cutting tools always have sharp edges?

In this lesson we shall try to find the answer of all such questions.

OBJECTIVES

After completing this lesson, you will be able to:

- explain the cause of motion - concept of force;
- distinguish between balanced and unbalanced forces;
- define the terms inertia, mass and momentum;
- state and explain the three laws of motion and explain their significance in daily life and nature;
- derive a relationship between force, mass and acceleration;
- explain the force of friction and analyze the factors on which it depends;
- illustrate and appreciate that rolling friction is less than sliding friction;
- cite examples from everyday life where importance of friction can be appreciated and
- explain the terms thrust and pressure, citing example from daily life situations.
10.1 FORCE AND MOTION

If we place a ball on a flat surface, it will remain there until unless we disturb it. It will move only when either we push it or pull it. This push or pull acting on an object is known as a force. What else happens when we apply force on an object? Think! Let us do an activity to understand it.

ACTIVITY 10.1

Hold an inflated balloon between your palms. Now, apply a force on it by pressing your palms (Fig. 10.1). What do you observe?

You will observe that on pressing the balloon, its shape changes. Thus, we can say that on applying force, the shape of a body can be changed. Can you now think of some other effect of force?

While playing football if you want to change the direction of the moving ball you will have to kick the ball in a particular direction. When you kick the ball, you apply certain force to change the direction of the moving ball. Similarly, you can also change the speed of a moving object by applying force on it. For example the speed of a moving bicycle can be changed by applying brakes on it.

Thus, on the basis of above examples and activities we can say that the force applied on an object can

- make the object move from rest.
- change the speed of a moving object.
- change the direction of motion of the object
- change the shape of the object.

Now, it is time to assess how much have you learnt?

INTEXT QUESTIONS 10.1

1. Is there any force applied when a cricket player changes the direction of ball by using his/her bat?
2. Give an example from your daily life in which the shape of an object changes by applying a force.

### 10.2 BALANCED AND UNBALANCED FORCES

Have you even seen a game of tug-of-war (Fig. 10.2)? In this game when the two teams pull with equal force they apply balanced forces on the rope. The rope thus remains stationary. When one of the teams applies greater force, it is able to pull the other team and the rope towards their side. In this case forces are unbalanced.

![Fig. 10.2 Tug of war](image)

For understanding the concepts of balanced and unbalanced forces, let us perform the following activity.

#### ACTIVITY 10.2

Place a brick on a table. Push the brick towards left with your right hand. What do you observe? The brick begins to move to the left direction [Fig. 10.3 (a)]. Now push the brick towards right with your left hand. In which direction the brick moves this time [Fig. 10.3 (b)]?

![Fig. 10.3 Unbalanced and balanced forces](image)
Now push the brick from both the sides with equal forces [Fig. 10.2 (c)]. What do you observe? In this case you will observe that the brick does not move in any direction. Can you think why the brick does not move this time? In fact, in this case the two forces balance each other. Such forces are called balanced forces.

What type of changes can be produced by balanced forces? As seen above, balanced forces do not change the state of rest or motion of the object on which they are applied. Now recall the activity 10.1 and think whether it was balanced or unbalanced force on the balloon? Yes, you are right, it was the balanced force applied by your palms that changed the shape of balloon.

What happens when the two opposite forces acting on the brick are of different magnitudes? In this case the brick would begin to move in the direction of greater force. Such forces are called unbalanced forces. Unbalanced forces acting on an object may change its state of rest or motion.

Try to find out some more examples of balanced and unbalanced forces.

INTEXT QUESTIONS 10.2

1. What are balanced forces?
2. Can a balanced force produce any acceleration in a body?
3. What type of change can be produced by an unbalanced force in a body?

10.3 NEWTON’S LAWS OF MOTION

10.3.1 Inertia

You would have seen that whenever we shake the branches of a tree vigorously, the leaves and fruits get detached. Similarly, when you beat a carpet with a stick, you will see that the dust particles get detached from the carpet. Do you know why?

The answer to all such questions is inertia. What is inertia? We can understand the property of inertia by doing a simple activity.

ACTIVITY 10.3

Take a smooth sheet of paper (30 cm × 8 cm) and place it on a table with some part of it coming out of the edge of the table. Now place a glass half filled with water on the paper. Remove the paper with a jerk (Fig. 10.4). What do you observe? You will find that the glass remains in its position. The inertia of the glass prevents it from moving with the paper.
Thus we can say that the inertia is the tendency of objects to stay at rest or to keep moving with the same velocity. You can find out some more examples of inertia from your daily life. In fact it is the inertia due to which a sprinter keeps running for some time even after crossing the finish line. Similarly, you would have noticed that it is difficult to take out the tomato sauce from a bottle by just inverting it. However, it is easy to take out the sauce from the bottle by giving a sudden jerk to it. By moving the bottle in the downward direction the sauce comes in motion. When the bottle stops suddenly, the sauce remains in motion due to inertia of motion and comes out of the bottle.

10.3.2 Inertia and Mass

By now you have learnt that due to inertia an object offer resistance to change its state of motion. Do all objects have the same inertia? Let us find out.

Push an empty box on a smooth surface. Now try to push a similar box full of books on the same surface. What do you find? Why is it easier to push an empty box than a box full of books?

Now suppose you are asked to stop a table tennis ball and a cricket ball moving with the same velocity. On which ball you are supposed to apply more force to stop it. You will find that cricket ball require more force to stop as compared to table tennis ball.

Thus all objects do not resist a change in their state of rest or motion equally. Massive objects resist more than lighter ones. What do you conclude from these observations? We can say that mass is a measure of inertia.

10.3.3 Newton’s First Law of Motion

You have learnt that an object offer resistance to change in its state of motion. This was studied by Newton in detail and he presented his findings in the form of three
fundamental laws that govern the motion of objects. Newton’s first law of motion is stated as follows:

“Every body continues in its state of rest or of uniform motion in a straight line until unless it is compelled by some unbalanced force to change that state.”

Newton’s first law of motion tells us that all bodies resist a change in their state of motion. We know that this property of bodies is called inertia. That is why, Newton’s first law of motion is also known as the law of inertia.

First law of motion has many applications in our daily life. Why do the passengers standing in a bus fall in the backward direction when the stationary bus begins to move suddenly (Fig. 10.5)?

![Passengers falling backward](image1.png)

**Fig. 10.5** *Passengers falling in the backward direction when the bus starts suddenly*

This observation can be explained on the basis of first law of motion. The feet of passengers are in contact with the bus. When the bus starts suddenly, the feet start moving with the bus. But the upper part of the passengers tries to remain at rest due to inertia and tends to fall in the backward direction.

What happen when the moving bus stops suddenly? In this case the passengers standing in the bus fall in the forward direction. Can you think the reason of it on the basis of the explanation of the above example?

![Passengers falling forward](image2.png)

**Fig. 10.6** *Passengers falling forward as the moving bus stops suddenly*
Now you should be able to explain why do the dust particles get detached from a carpet when it is beaten with a stick? Try to explain it on the basis of first law of motion.

10.3.4 Momentum

You have learnt in the earlier section that the force required to stop a moving body depends upon its mass. Now suppose two balls of same mass are moving with different velocities. Which ball will need more force to stop? You will find that the faster moving ball require more force to stop it. Thus, the force required to stop a body also depends upon its velocity.

You must have noticed that a small bullet when fired from a gun can kill a person. But the same bullet if thrown with hand can hardly do any harm. Similarly a truck parked along a road side does not require any attention. But a moving truck may kill a person standing in its path. Is it only the velocity of the truck which makes us frightened? If it is so, then a toy car moving with the same velocity as the truck would have equally frightened to us.

From these observations it appears that the impact produced by the objects depends on their mass and velocity. These two quantities help us to define a new quantity called momentum.

The momentum, \( p \) of a moving body is defined as the product of its mass, \( m \) and velocity, \( v \). That is

\[
p = mv
\]

SI unit of momentum is kilogram-metre per second (kg m s\(^{-1}\)). Momentum has both magnitude and direction. Its direction is same as that of velocity.

10.3.5 Newton’s second law of motion

According to Newton’s first law of motion the application of an unbalanced force brings a change in the velocity of an object. Thus, the force can produce a change of momentum. Newton’s second law of motion establishes a relationship between force and change in momentum.

Second law of motion states that the rate of change of momentum of a body is directly proportional to the force acting on it and takes place in the same direction as the force.

Newton’s second law of motion also gives a relation between force and acceleration. Let us derive this relationship.

Suppose the velocity of an object of mass \( m \) changes from \( u \) to \( v \) in time \( t \) by the application of a constant force \( F \).
The magnitude of initial and final momentum of the object will be $p_1 = mu$ and $p_2 = mv$ respectively. The change in momentum in time $t = p_2 - p_1$.

The rate of change of momentum $= \frac{(p_2 - p_1)}{t}$

According to second law of motion, the magnitude of the force $F$, is

$$F \propto \frac{p_2 - p_1}{t}$$

or

$$F = \frac{k(p_2 - p_1)}{t}$$

...(10.2)

where $k$ is constant of proportionality.

Substituting the value of $p_1 = mu$ and $p_2 = mv$, we get

$$F = \frac{k(mv - mu)}{t}$$

$$= \frac{km(v - u)}{t}$$

Now, $\frac{v - u}{t}$ is the rate of change of velocity, which is the acceleration ‘a’. Therefore, we have

$$F = kma$$

(10.3)

We choose the unit of force in such a manner that the value of $k$ becomes one. For this we can define one unit of force as that amount which produces an acceleration of 1 m/s$^2$ in an object of 1 kg mass. So that:

1 unit of force $= k \times (1 \text{ kg}) \times (1 \text{ ms}^{-2})$

Thus, the value of constant $k$ becomes 1. Therefore, from equation (10.3)

$$F = ma$$

(10.4)

The unit of force is called newton and its symbol is N.

So a force of 1 newton will produce an acceleration of 1 m/s$^2$ on an object of mass 1 kg.

Can you estimate, how much is 1 N force?

For this, let us experience it. Keep a mass of 100 g on your palm. How much force you feel on your palm? Calculate this force.
From equation 10.4,

\[ F = ma \]

Here,

\[ m = \frac{1}{10} \text{ kg} \text{ and } a = 10 \text{ ms}^{-2} \text{ (approximately)} \]

Therefore,

\[ F = \frac{1}{10} \times 10 = 1 \text{ N} \]

Thus the force exerted by a mass of 100 g on your palm is approximately equal to 1 newton.

**10.3.6 Some Example of Second Law of Motion from Daily Life**

In our everyday life we see many applications of second law of motion. In many situations we try to decrease or increase the rate of change of momentum by changing the time in which the change of momentum takes place. Let us consider some examples.

(a) While catching a fast moving cricket ball, why does a fielder moves his hands backward?

By doing so the fielder increases the time duration in which the momentum of the ball becomes zero (Fig. 10.7). As the rate of change of momentum decreases, a small force is required for holding the catch. So the hands of the fielder do not get hurt.

(b) Why does a person get hurt when he falls on a cemented floor?

Just before touching the floor, the person has some initial velocity, say \( u \), which becomes zero when he comes to rest. Thus the momentum of the person becomes zero within a very short time. As the rate of change of momentum is very high, so very large force is exerted on the person, thereby hurting him. On the other hand,
if he falls on sand or husk or on a foam mattress, he does not get hurt due to longer period of time in making momentum zero and hence reduction of force.

(c) How does a karate player breaks a pile of tiles or a slab of ice with a single blow?

The karate player hits the pile of tiles or a slab of ice as fast as possible with her hand. In doing so the entire momentum of the hand is reduced to zero in a very short time. As a result, the force delivered on the tiles or slab of ice is large enough to break it.

(d) You would have noticed that when a bundle tied with a string is lifted quickly by holding it, the string breaks (Fig. 10.8). Can you now explain why the string breaks in this case?

Example 10.1: What is the acceleration produced by a force of 15 N exerted on an object of mass 3 kg?

Solution: According to second law of motion

\[ F = ma \]

Here \( m = 3 \text{ kg} \) and \( F = 15 \text{ N} \)

Therefore, \( 15 \text{ N} = 3 \text{ kg} \times a \)

or \( a = \frac{15 \text{ N}}{3 \text{ kg}} = 5 \text{ ms}^{-2} \)
Example 10.2: What force accelerates a 50 kg mass at 5 ms\(^{-2}\)?

**Solution:** Newton’s second law gives

\[ F = ma \]

Here, \( m = 50 \text{ kg} \) and \( a = 5 \text{ ms}^{-2} \)

Therefore, \( F = 50 \text{ kg} \times 5 \text{ ms}^{-2} \)

\[ = 250 \text{ N} \]

10.3.7 Newton’s Third Law of Motion

You must have noticed that when a rubber balloon filled with air is released, the balloon moves opposite to the direction of the air coming out of it (Fig. 10.9). Why does the balloon move in a direction opposite to the direction in which the air escapes? Let us find out.

You must have also noticed that when you jump from a boat to the river bank, the boat moves in the backward direction (Fig. 10.10). Why does this happen?

While jumping out of the boat, your foot exerts a backward force on the boat. This force is called action. At the same time a force is exerted by the boat on your foot, which makes you move forward. This force is known as reaction. Remember that two bodies and two forces are involved in this problem. You pushed the boat backward and the boat pushes you forward. These two forces are equal in magnitude but opposite in direction.
Let us consider the balloon problem again. In this case the air coming out of the balloon (action) exerts a force of reaction on the balloon and this force pushes the balloon backwards (reaction).

Newton in his third law of motion stated a relation between action and reaction. According to this law, **to every action there is an equal and opposite reaction.** The action and reaction act on two different bodies if action and reaction are on same body they will constitute a balanced force and body will not move.

Look at the Fig. 10.11 and find out the action and reaction forces and try to analyse whether the truck will move or not.

There are three significant features of third law of motion:

(i) We cannot say which force out of the two forces is the force of action and which one is the force of reaction. They are interchangeable.

(ii) Action and reaction always act on two different bodies.

(iii) The force of reaction appears so long as the force of action acts. Therefore, these two forces are simultaneous.

Remember, it is not necessary that the two bodies, amongst which the forces of action and reaction act are in contact. They may be quite far from each other. For example, attraction or repulsion between two magnets can take place even without being in contact (Fig. 10.12).
Do you know that action and reaction forces enable us to walk on the surface of the earth? Let us see how? While walking on the ground we push the ground with our foot in the backward direction. This is the force of action.

In return the ground exerts an equal force of reaction on our foot in the forward direction. The force that actually makes us walk in the forward direction is this reaction force.

Similarly, during swimming we push the water in the backward direction, with our hands and feet, to move in forward direction. It is the reaction to this force that pushes us forward (Fig. 10.13).

**Fig. 10.13** A swimmer pushes the water backwards with hands to move in forward direction.

It may be interesting for you to know that rockets and jet-planes also work on the principle of action and reaction. In each of these, when the fuel burns, hot burning gases are ejected from the tail. The hot gases come out in the backward direction and the rocket or the jet plane moves in the forward direction (Fig. 10.14).

Now think, why a rifle kicks backward when we fire a bullet?

**10.3.8 Conservation of Momentum**

Law of conservation of momentum is a very important law of science. According to this law, if two or more objects collide with each other, their total momentum remains conserved before and after the collision provided there is no external force acting on them.
From the Newton’s laws of motion, we know that the rate of change of momentum is equal to the force.

If \( p_1 \) = initial momentum and \( p_2 \) = final momentum after time \( t \), then

\[
F = \frac{p_2 - p_1}{t}
\]

Now, if \( F = 0 \), then we have \( p_1 = p_2 \). Which shows that the momentum of a system remains unchanged (or conserved) if no force is acting on it?

You can verify the law of conservation of momentum with the help of a simple activity.

**ACTIVITY 10.4**

Take a plastic channel of about 40 cm length and seven marbles of same size. Place the channel on a horizontal table and put the marbles on the channel touching each other as shown in figure 10.15. Remove one marble and keep it at a distance of about 15 cm from the rest. Hit this marble with your fore finger gently so that it collides with other marbles. What do you observed?

![Fig. 10.15 Arrangement to show the law of conservation of momentum](image)

You will find that after the collision, the moving marble comes to rest and the last marble out of the rest moves ahead. Try to guess the speed of this marble after the collision and compare it with the speed of marble you had thrown before the collision. Do the two speeds appear to be equal? What does it indicate? If the speeds are equal then the total momentum of the marble is same before and after the collision.

Repeat this activity by removing two marbles and striking them with the five marbles at rest. What do you observe this time? What conclusion do you derive from this activity? You will find that in each case, total momentum of marbles before collision is same as after collision.

**Do you know**

Have you ever seen a toy as shown here? If not, try to find this toy in a toy shop or a science museum. Can you tell the principle on which this toy works?
Example 10.3: A bullet of mass 0.03 kg is fired with a velocity of 100 ms\(^{-1}\) from a rifle of mass 3 kg. Calculate the recoil velocity of the rifle.

Solution:

Here, mass of the rifle \(m_1 = 3\) kg
mass of the bullet \(m_2 = 0.03\) kg
Initial velocity of the rifle \(u_1 = 0\)
Initial velocity of the bullet \(u_2 = 0\)
Final velocity of the rifle = \(v_1\) (say)
Final velocity of the bullet \(v_2 = 100\) ms\(^{-1}\)

According to the law of conservation of momentum,
\[
m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2
\]
On substituting the given values,
\[
0 + 0 = 3 \times v_1 + (0.03) \times 100
\]
\[
v_1 = \frac{-100 \times 0.03}{3} = -1.0\text{ ms}^{-1}
\]

\[\therefore\] Recoil velocity of the rifle = \(-1.0\) ms\(^{-1}\)

Negative sign indicates that the rifle would move in the direction opposite to that of bullet.

Example 10.4: A rifle having a mass of 5 kg fires a bullet at a speed of 250 ms\(^{-1}\). If the rifle recoil with a velocity of 1 ms\(^{-1}\) then find the mass of the bullet.

Solution:

Here,
\(M = 5\) kg; \(m = ?\)
\(V = -1\) ms\(^{-1}\); \(v = 250\) ms\(^{-1}\)
\(U = 0\); \(u = 0\)

According to the law of conservation of momentum
\[
MU + mu = MV + mv
\]
\[
0 = MV + mv
\]
\[
m = \frac{-MV}{v} = \frac{-5 \times (-1)}{250} = \frac{1}{50} = 0.02\text{ kg}
\]

So, Mass of the bullet = 0.02 kg or 20 g
INTEXT QUESTIONS 10.3

1. Why does water come out from a wet piece of cloth when you shake it?
2. Why do we fall forward when a moving bus stops suddenly?
3. Two similar trucks are moving on a road with the same velocity. One of them is empty while the other one is loaded. Which of the two has more momentum?
4. If a body of mass 5 kg moves with a velocity of 10 ms\(^{-1}\), then what is the momentum of the body?
5. Why does a boxer move his head backward while taking an oncoming punch?

10.4 FRICTION

You might have noticed that a ball rolling along the ground stops after moving through some distance. Similarly a moving car begins to slow down the instant its engine is switched off and finally it stops. Why does it happen? Let us find out.

10.4.1 Force of Friction

According to Newton’s first law of motion, a moving body continues to move along a straight line until unless an external force is applied on it. Is this external force slows down the motion of the ball or the car? Think! Infact the ball or car is slowed down by a force called friction. Friction exists between the surfaces of all materials which are in contact with each other. The direction of the frictional force is always in a direction opposite to the motion.

Now, try to analyze the forces acting on an object moving with a constant velocity. If an object is to move with a constant velocity, a force equal to the opposing force of friction must be applied. In that condition the two forces are balanced forces. They exactly cancel one another and the net force on the body is zero. Hence the acceleration produced in the body is zero and the body maintains its velocity. It neither speeds up nor slows down.

The resistive force, before the body starts moving on a surface is called static friction. Once a body starts moving on a surface the friction between them is called sliding or kinetic friction. You should remember that the sliding friction is slightly less than the static friction.

10.4.2 Factors affecting friction

You must have seen that it is easier to move a bicycle on a concrete road than on a rough road. Why is it so? Does friction depend upon the smoothen or the roughness of the surfaces? Let us find out.
ACTIVITY 10.5

Set up an inclined plane on a table as shown in Fig. 10.16. Mark a line near the top edge of the inclined plane. Now hold a pencil cell on this line. Release the pencil cell. What do you observe? The cell moves down the inclined plane and continues to move for some distance on the table. Note down the distance up to which the cell moves on the table.

![Image of inclined plane](image_url)

**Fig. 10.16** Pencil cell covers different distances on different type of surfaces

Now place a glass sheet on the table. Again release the pencil cell from the line on the inclined plane and note the distance up to which the cell moves on the glass plate. Repeat this activity by spreading a uniform layer of sand on the table.

In which case the distance covered by the pencil cell is maximum? In which case it is minimum? What do you conclude from this activity?

You will find that the distance moved by the cell is maximum on the glass surface and minimum over the sand. This difference is due to the friction offered by different types of surfaces. Smooth glass surface offers less friction compared to a rough sand bed. Thus **smoothness of the surfaces is one of the factor on which friction depends**.

You might have observed that more force is needed to move a heavy box than to move a lighter box on the same surface. It is so because the heavy box has greater normal reaction (reaction of the surface on the box against the action of its weight) and hence greater frictional force. Thus **friction also depends upon the normal reaction**.
10.4.3 Advantages and disadvantages of friction

The friction plays a very important role in our day to day life. It has several advantages as well as disadvantages.

(a) Advantages of friction

Have you ever walked on ice or a wet marble floor? You might have found that it difficult to balance your body. The force of friction developed between the soles of your shoes and the ground helps us to move. Had there been no friction, walking or running would have been impossible.

You can write with a pen on page or with a chalk on the blackboard due to friction. Buildings may be constructed only due to force of friction between different building materials. Without friction, you could not fix a nail on the wall.

Tyres of automobiles are treaded to increase the friction between tyres and surface of the road. Thus the tyres get better grip with the ground. The breaks applied in automobiles also work only due to friction.

Can you think of some more examples from your daily life where friction is useful?

(b) Disadvantages of friction

Due to friction, a lot of energy is wasted in the form of heat that causes wear and tear of the moving parts of a machine. Friction also reduces efficiency of the machines as considerable amount of energy is wasted in overcoming friction. However, the efficiency of a machine can be increased by putting a suitable lubricant between its moving parts.

In most of the machines, to reduce friction ball bearings are used between the moving parts. By using the ball bearing the sliding friction is replaced by rolling friction. As the rolling friction is less than the sliding friction, therefore, the friction between the moving parts is reduced.

Friction also wears out the soles of shoes. You would have seen that the steps of foot over-bridge at railway stations also wear out due to friction.

Vandana and Navneet are racing on rock ice with the specially designed shoes shown in the Fig. A and B respectively. Who will win?

(A) Shoes for Vandana

(B) Shoes for Navneet

Cite some more example from you daily life where friction is undesirable.
INTEXT QUESTIONS 10.4

1. Why does a fast moving car slow down when its engine is switched off?
2. Why do we slip when we step on a banana peel?
3. Why are tyres of automobiles treaded?

10.5 THRUST AND PRESSURE

Observe some bodies around you like table, desk, bucket full of water, etc. They press the floor with a force equal to their own weight. You know that weight is the force acting vertically downwards. As the surface of the floor can be taken as horizontal, therefore, the force with which each of the above mentioned bodies presses the floor is directed perpendicular to the surface of the floor. The force acting upon the surface of a body perpendicular to it is called thrust.

Let us find out the effect of thrust acting on a surface.

ACTIVITY 10.6

Take a small wooden board (10 cm × 10 cm × 1.0 cm) with four nail fixed at each corner as shown in Fig. 10.17 (a). Fill a tray with sand to a depth of about 6 cm. Place the wooden board on sand with the nail-heads downwards [Fig. 10.17 (b)] Also put about 500 g weight on the board. Observe the depth of the nails upto which they penetrate into the sand.

Now place the wooden board on the sand with pointed side of the nails facing downwards and put the same weight on the board as in the previous case [Fig. 10.17 (c)]. Again observe the depth of the nails upto which they penetrate upto the sand.

In which of the above two cases the penetration is more? You will find that the penetration is more in the second case.

Thus the action of the given thrust depends on the area of the surface it acts upon. The smaller the area on which the thrust acts, the more evident is the result of its action. The thrust on unit area is called pressure. Thus
Pressure = \frac{\text{thrust}}{\text{area}} \quad \text{...(10.5)}

The SI unit of pressure is Nm\(^{-2}\). This unit has also been given a specific name pascal (Pa) in honour of the scientist named Blaise Pascal.

**Do you know**

Pascal was a French philosopher and mathematician. He formulated the famous Pascal's law of hydraulics regarding transmission of pressure through fluids. He also invented one of the earliest calculating machines. The unit of pressure pascal (Pa) was named in his honour.

Equation (10.5) shows that the same force acting on a smaller area exerts a larger pressure and a smaller pressure on a larger area. This is the reason why cutting tools like knives and axes always have sharp edges.

In many cases it is desirable to decrease pressure. In such cases the area on which the thrust is acting should be increased. For example, foundation of buildings and dams are made on larger area. Similarly trucks and vehicles used to carry heavy loads have much wider tyres. Also army tank weighing more than a thousand tonne rests upon a continuous chain.

**INTEXT QUESTIONS 10.5**

1. Why does a porter carrying a heavy load place a round piece of cloth on his head?
2. Why a nail has a pointed tip?
3. Why shoulder bags are provided with broad straps?
4. State the SI unit of pressure.

**WHAT YOU HAVE LEARNT**

- Unbalanced forces acting on an object may change its state of rest or motion.
- Balanced forces do not change the state of rest or motion of an object. Balanced forces can change the shape of the object on which they are applied.
- Inertia is the tendency of objects to stay at rest or to resist a change in their state of motion.
The mass of an object is a measure of its inertia. Newton’s first law of motion states that, everybody continues in its state of rest or of uniform motion in a straight line until unless it is compelled by some unbalanced force to change that state.

The momentum of a body is the product of its mass and velocity. The SI unit of momentum is kg ms\(^{-1}\).

Second law of motion states that the rate of change of momentum of a body is directly proportional to the force acting on it and takes place in the same direction as the force.

The unit of force is newton and its symbol is N. A force of 1 newton will proceed on acceleration of 1 ms\(^{-2}\) on an object of mass 1 kg.

Newton’s third law of motion states that, to every action there is always an equal and opposite reaction. Action and reaction always act on two different bodies.

According to the law of conservation of momentum, in an isolated system the total momentum remains conserved.

Force of friction always opposes motion of bodies. Friction depends on the smoothness of surfaces in contact. It also depends upon the normal reaction.

Rolling friction is less than the sliding friction.

Force acting perpendicular to the surface of a body is called thrust.

Thrust per unit area is called pressure. The SI unit of pressure is Nm\(^{-2}\). This unit is known as pascal (Pa).

**TERMINAL EXERCISE**

1. Why does a sprinter keep running for sometime even after crossing the finish line?
2. Why is it advised to tie the luggage with a rope on the roof of busses?
3. Why do the dust particles from the hanging blanket fall off when it is beaten with a stick?
4. State Newton’s first law of motion. Why do the passengers standing in a stationary bus fall in the backward direction when the bus begins to move suddenly.
5. Define momentum. How the rate of change of momentum is related to force?
6. If a body of mass 10 kg moves with a velocity of 7 ms\(^{-1}\), then what is the momentum of the body?
7. If a force of 50 N acts on a body of mass 10 kg then what is the acceleration produced in the body?
8. State Newton’s third law of motion. Why it is difficult for a fireman to hold a hose pipe which ejects larger amount of water at a high speed?

9. “Action and reaction forces are equal in magnitude and opposite in direction”. Then, why do they not balance each other?

10. A motorcycle is moving with a velocity of 72 km/h and it takes 6 s to stop after the breaks are applied. Calculate the force exerted by the breaks on the motorcycle, if its mass along with the rider is 175 kg.

11. An object of mass 2 kg travelling in a straight line with a velocity of 10 ms\(^{-1}\) collides with and sticks to a stationary object of mass 6 kg. Then they both move off together in the same straight line. Calculate the total momentum just before the impact and just after the impact.

12. What is the force of friction? State two methods to reduce friction.

13. What is the relation between thrust and pressure? State the SI units of thrust and pressure. Why a camel can run in a desert easily?

14. A block of wood kept on a table applies a thrust of 49 N on the table top. The dimensions of the wooden block are 40 cm \(\times\) 20 cm \(\times\) 10 cm. Calculate the pressure exerted by the wooden block if it is made to lie on the table top with its sides of dimensions (a) 20 cm \(\times\) 10 cm and (b) 40 cm \(\times\) 20 cm.

**ANSWER TO INTEXT QUESTIONS**

**10.1**

1. Yes
2. Pressing a lump of dough with your hands.

**10.2**

1. When two or more forces acting on an object in opposite direction balances each other then the forces are known as balanced forces.
2. No. Balanced forces do not change the state of motion of an object.
3. Unbalanced forces acting on an object may change its state of rest or motion.

**10.3**

1. Due to inertia of rest. When we shake the cloth, the water remains in its position and comes out.
2. Lower part of our body come to rest but due to inertia of motion our upper part tends to move in the forward direction and we fall in the forward direction.
Notes

3. As momentum is equal to mass × velocity. So the momentum of loaded truck (more mass) has more momentum.
4. Momentum = \( \text{mass} \times \text{velocity} = 5 \text{ kg} \times 10 \text{ ms}^{-1} = 50 \text{ kg ms}^{-1} \).
5. To decrease the rate of change of momentum boxer moves his head backward so that the impact of punch is reduced.

10.4

1. Due to force of friction acting between wheel of car and ground.
2. Because the friction between banana peel and ground is very small.
3. Treaded tyres provide better grip with the ground because in such tyres the friction between the tyres and ground is very large.

10.5

1. Round piece of cloth increases the area of contact between load and head of porter, thereby decreasing the pressure on his head.
2. To increase the pressure.
3. To decrease the pressure.
4. Nm\(^{-2}\) or pascal (Pa)
Learning Together
Learning Better

Episode 2
Methodology used: Quiz, Crossword, Recitation and Appreciation, Brainstorming and Group Discussion
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<tr>
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<td>(Social Science)</td>
<td>Jawaharlal Nehru University</td>
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## MENTORS

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<td>Reader in Geography</td>
<td>Deptt. of Science &amp; Technology, GOI</td>
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<td>Vidya Bhawan Society</td>
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## LIFE SKILLS EXPERT

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<td>Project Coordinator (AEP)</td>
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<td>National Institute of Open Schooling</td>
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<tr>
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<td>A-24-25, Institutional Area Sector-62, NOIDA, U.P.</td>
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## ACADEMIC OFFICER

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## COORDINATOR

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## COVER DESIGN

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<tbody>
<tr>
<td>Sh. Sunder Singh Rawat</td>
<td>Office Assistant (AEP)</td>
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*Developed under MHRD-UNFPA Supported: Adolescence Education Programme*
Greetings from NIOS!

National Institute of Open Schooling (NIOS) is an autonomous organization under Ministry of Human Resource Development (MHRD) Government of India and caters to the educational requirements of out of school children and youth of India. With over two million learners on rolls, NIOS has emerged as the largest open schooling organization in the world.

The NIOS in collaboration with MHRD-UNFPA has been engaged in addressing issues and concerns of adolescent learners and empowering them with life skills through ‘Adolescence Education Programme’. Cognizant of the delivery model, NIOS followed a curricular approach and integrated critical adolescent issues and concerns within the self-learning material.

Integration was carried out with the rationale to equip the learners with skills that would make them better humans and more productive for the society while studying for their secondary course. Through a series of capacity building workshops for the lesson writers and providing them continuous support, NIOS was able to realize the aim that seemed daunting initially.

Life Skills have been seamlessly woven into the course content so that the learners, while studying the main syllabus get empowered to apply the core content in real life situations. This teaching material will help you transact not only the subject specific content but it will also help you empower the learners with important skills such as communication skills, critical and creative thinking etc.

It gives me great pleasure to share with you the this teacher-training package of Life Skills enriched lessons from five subjects- Hindi, English, Science, Home Science and Social Science at secondary level along with a set of CDs Learning Together Learning Better. I hope you will find them useful.

Yours sincerely,

Dr. S.S. Jena
Dear Teachers,

The Academic Department at the National Institute of Open Schooling has revised the curriculum in all the subjects at the secondary level. The National Curriculum Framework 2005 developed by the National Council for Educational Research and Training was kept as a reference point. After making a comprehensive comparative study of various state boards, we developed the curriculum that was functional, related to life situations and simple. Leading educationists of the country were involved in developing this material.

Hindi, English, Science and Technology, Home Science and Social Science at secondary level were enriched with life skills under the MHRD UNFPA supported Adolescence Education Programme. The integration of life skills is aimed at instilling an adaptive and positive thinking, feeling and behaviour in the learners.

I sincerely hope that you will find the selected lessons interesting, exciting and useful. Any suggestions for further improvement are welcome.

Let me wish you all a happy and successful future.

(Dr. Kuldeep Agarwal)
Director (Academic)
diracad@nios.ac.in
Dear Teacher,

Welcome to NIOS!

You have just taken your first step towards realizing your goal of empowering students to become global citizens. Globally, the education system is undergoing a change in terms of approach as well as objective. NIOS has initiated a unique process of developing life skills enriched materials and methodologies for the student’s benefit. We have a vision to guide you to enhance your teaching skills such that the student not only does well academically but also enhances his personal and social competencies. Along with subject knowledge, the student should be able to deal with the stress and strain of life. They should have the ability to discriminate between right and wrong, good and bad, and take the correct decisions regarding their life and career. The methodology adopted by NIOS is to integrate these life skills seamlessly with the content of the subject.

While going through these study materials, you will find a number of activities, including intext questions, in between the lessons. These activities have been carefully designed to provide an opportunity to learn and practice. The intext questions are devices to help assess the extent of learning and enhance it. Life skills are abilities that each of us possesses, and yet conscious efforts need to be made to enhance these abilities. Attempting these exercises will help in developing life skills without an extra effort.

I hope you will find these life skills-enriched study materials and methodologies rewarding and helpful for empowering the students.

Asheema Singh
Project Coordinator
(Adolescence Education Project)
asheemasingh@nios.ac.in
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5. Religious and Social Awakening in Colonial India (Social Science)
6. Climate (Social Science)
CARBON AND ITS COMPOUNDS

In lesson 27, you have studied about the metals and non-metals. Carbon is an important non-metallic element. The chemistry of carbon and its compounds is an equally important field about which you will learn in this lesson. Carbon is the sixth most abundant element in the universe. It can exist in the free state or in the form of its compounds. It is the major chemical constituent of most organic matter. Carbon is the second most common element in the human body after oxygen. Carbon is present in coal, oil and natural gas. Main natural sources of carbon and its compound which are industrially important are coal, petroleum and natural gas which contribute to our national economy in a big way. Carbon also occurs in a number of minerals. You might have seen that when kerosene oil lamp burns it produces black soot which contains carbon particles. You might have also seen that when any some materials like wood, paper are burnt, a black residue is left which contains carbon.

Carbon atoms can form compounds by combining with other carbon atoms as well as atoms of other elements. Carbon has the unique property of forming long chains of carbon atoms. These long chains serve as a backbone on which various groups can attach to give a large variety of compounds. These compounds have a variety of structures, properties and uses in our life. You will study about some such compounds like alcohol, acetic acid, acetone etc. in this lesson.

We will begin this lesson with the discussion on the properties of carbon. Then, various allotropic forms of carbon-viz. diamond, graphite and fullerenes will be explained. We will also study about hydrocarbons which are compounds containing carbon and hydrogen. Here, we will cover various aspects of hydrocarbons such as their classification, homologous series, isomerism etc.

We will also give you a brief idea about some simple functional groups which can attach onto the hydrocarbon backbone to yield a large number of compounds. Further, the rules for naming the hydrocarbons and their derivatives will be explained. Finally, some compounds of daily use will be discussed.
OBJECTIVES

After completing this lesson, you will be able to:

- recognize carbon as a constituent of all living matter and physical world;
- appreciate the existence of large number of carbon compounds;
- identify various sources of carbon compounds;
- explain various allotropes of carbon and compare their properties;
- describe the preparation of oxides of carbon and mention their properties;
- recognize catenation as the unique property of carbon i.e. its ability to form chains, branches and rings leading to the formation of large number of compounds of carbon;
- classify the hydrocarbons as saturated and unsaturated;
- describe various homologous series and identify various homologues;
- recognize different functional groups (alcohol, aldehyde, keto, carboxylic acid, halogen, double bond (alkene) and triple bond (alkyne) present in common organic compounds;
- appreciate that organic compounds have unique names as per IUPAC nomenclature;
- name simple organic compounds; and
- describe the nature, properties and uses of some useful organic compounds of daily uses i.e. ethanol and acetic acid.

28.1 CARBON AND ITS PROPERTIES

You have studied in lesson 6 that carbon belongs to Group 14 of the periodic table.
Carbon and its Compounds

Carbon is abundant in the universe i.e. in Sun, planets, and atmosphere of the Earth. It is present in carbonate rocks i.e. limestone, dolomite, marble etc. It is also a major constituent of fossil fuels such as coal, petroleum and natural gas. It is present in the form of its compounds in all living organisms. Some such compounds are carbohydrates, proteins, fats etc. In combination with oxygen, it occurs as carbon monoxide and carbon dioxide. You are quite familiar with these compounds. Our atmosphere also contains some pollutants arising from these carbon compounds.

In the structure of a carbon atom, there are 4 electrons in the second shell. The electronic configuration of carbon is 2,4. To complete its octet, carbon requires four more electrons. But due to unfavorable energy considerations, it cannot gain four electrons by ion formation and hence attain the electronic configuration of neon. Due to the same reason, it is also not possible for carbon to lose these four electrons and attain the noble gas configuration of helium. However, it can form covalent bonds by sharing these four electrons.

There are three naturally occurring isotopes of carbon – $^{12}\text{C}$, $^{13}\text{C}$, $^{14}\text{C}$. $^{14}\text{C}$ is a radioactive and its half-life is 5730 years. It is used in radio carbon-dating to determine the age of formerly living things.

It can form four covalent bonds, i.e. it is tetravalent in nature. It has a valency of four which is according to the rule you have learnt in lesson 5 i.e. Group No. 14 – 10 = 4. The sharing of four more electrons from other atoms completes the octet of carbon atom and it attains the stability by forming four covalent bonds.

Carbon can form bonds with atoms of other elements such as hydrogen (H), nitrogen (N), oxygen (O), sulphur(S) and halogens etc. It also has the property of self combination i.e. bond formation with the other carbon atoms. Thus, carbon can form long chains of carbon atoms. This unique property of forming long chains is known as catenation.
The carbon-carbon covalent bond is strong in nature. As you will study later in this lesson, the long carbon chains can act as a backbone to which various groups can attach and give a large number of compounds. The total number of compounds formed by carbon exceeds the total number of compounds formed by all other elements of the periodic table. In addition to the single covalent bonds, carbon can also form multiple bonds, i.e. double or triple bonds with other carbon, oxygen or nitrogen atoms to give a large variety of compounds. The number of compounds formed is so large that a separate branch of chemistry, called organic chemistry, is devoted to the study of these compounds.

Before proceeding further, you can check your progress by answering the following questions.

### INTEXT QUESTIONS 28.1

1. What is the valency of carbon?
2. What is the nature of bonds formed by carbon?
3. Why carbon forms a large number of compounds?
4. Name the branch of chemistry which is devoted to the study of carbon compounds.
5. How many electrons are needed by a carbon atom to complete its octet?

### 28.2 ALLOTROPES OF CARBON

Carbon occurs in free state (i.e. not combined with any other element) in three allotropic forms. Allotropes are different forms of the same element in the same physical state, earlier only two allotropic forms i.e. graphite and diamond were known. Another allotropic form – fullerene – has, been discovered few years back. Let us now study about them in detail.

#### 28.2.1 Diamond

Diamonds are formed inside the earth under the conditions of high temperature (about 1500°C) and high pressure (about 70,000 atmospheres).

South Africa is the leading producer of natural diamonds. In India, diamonds are found in Panna in Madhya Pradesh and in Wajrakarur in Andhra Pradesh.

In a diamond crystal, each carbon atom is linked to four other carbon atoms by covalent bonds in a tetrahedral fashion. This results in a three dimensional arrangement as shown in Fig. 28.1
The three-dimensional network of covalently bonded carbon atoms provides a rigid structure to diamonds. This rigidity makes diamond a very hard substance. It is, in fact, the hardest natural substance known. The only other substance harder than diamond is silicon carbide which is also known as carborandum but note that diamond is a natural substance whereas carborandum is a synthetic one.

Diamonds are basically colourless. However, some impurities impart colour to them.

The density of diamond is high. It has a value of 3.51 g cm\(^{-3}\). The melting point of diamond (in vacuum) is also very high, i.e. 3500°C because a large amount of heat energy is required to break the three-dimensional network of covalent bonds.

Since all the four electrons are covalently bonded and there are no free electrons in diamond, hence it does not conduct electricity. But diamond is a good conductor of heat. Its thermal conductivity is five times that of copper. Thus, it can easily dissipate the heat energy released by friction when it is used as an abrasive.

Because of its above-mentioned properties, diamond has the following uses:

(i) It is used in cutting and grinding of other hard materials.

(ii) It is also employed in instruments used for cutting of glass and drilling of rocks.

(iii) It is used in jewellery. Beautiful ornaments are made with diamonds. The high refractive index of diamond (2.5) makes it very brilliant when it is properly cut and polished.

**Synthetic Diamonds**

Because of their importance diamonds worth millions of dollars are synthesized. In 1950’s diamonds were synthesized by the scientist at General Electric in New York. They heated graphite to 1500°C in the presence of a metal such as...
nickel and iron under a pressure of 50000 to 65000 atmospheres. Most of the diamonds so produced are used as abrasives and for making diamond coated cutting tools used for drilling.

Most synthetic diamonds lack the size and clarity of natural diamonds and are generally not used in jewellery. Gem quality diamonds can be produced but they are costly.

28.2.2 Graphite

In contrast to diamond, graphite is soft, black and slippery solid. It has a metallic luster. It is also a good conductor of electricity and heat.

Both graphite and diamond contain only carbon atoms, then why do they exhibit such different properties? We can find an answer to this question if we look at the structure of graphite as given below in Fig.28.2.

You can see that in contrasts to diamond, which has a three-dimensional tetrahedral arrangement of carbon atoms, graphite contains layers of carbon atoms. In each layer, a particular carbon atom is linked to three other carbon atoms in a trigonal planar arrangement with a bond angle of 120°. Thus, three electrons of carbon are covalently bonded to the other three carbon atoms. The fourth electron, which does not participate in bonding, is free. These electrons of various carbon atoms are free to move along between the layers and hence are able to conduct electricity.

The bonding between these layers of carbon atoms is weak. Hence, these layers can slide one over the other. This property makes graphite a good solid lubricant. The density of graphite is less than that of diamond. It has a value of 2.2g cm⁻³. The melting point of graphite (in vacuum) is about 3700°C. Graphite can be converted to diamond by applying very higher atmospheric pressure and temperature.
Because of the above properties, graphite has the following uses:

(i) It is used as a dry lubricant for moving machine parts which operate at a high temperature and where other ordinary oil lubricants cannot be used.

(ii) It is used for making electrodes in dry cells and in electric arcs.

(iii) It is used for making pencil leads. Because of its soft nature and layered structure, it leaves black marks on paper. Hence, it is used for writing as leads in pencils.

(iv) It is used for making containers which are used for melting metals.

28.2.3 Fullerenes

Fullerenes were discovered in 1985 by Robert F. Curl, Harold W. Kroto and Richard E. Smalley. They were awarded the Nobel Prize in Chemistry in 1996 for this discovery. Fullerenes have closed structures like a football. A typical fullerene, named as buckminsterfullerene has 60 carbon atoms. Its structure is shown below in Fig. 28.3.

![Buckminsterfullerene, C_{60}](image)

Fullerenes are formed when vaporized carbon condenses in an atmosphere of an inert gas. The discovery of fullerenes has opened up a new field in Chemistry. Fullerenes of various other sizes are being synthesized and their properties and uses are being studied. New materials, which contain metals enclosed in the fullerenes are being synthesized. It is hoped that these materials would find uses as superconducting materials, new catalysts, polymers etc.

In addition to the above three allotropic forms, carbon also exists in three microcrystalline or amorphous forms of graphite. They are charcoal, coke and carbon black.
Charcoal is formed when wood is heated strongly in the absence of air. It has a large surface area. Activated charcoal is a pulverized form whose surface has been made free from any adsorbed materials by heating with steam. It is widely used for adsorbing coloured impurities and bad odours from water and other substances.

Coke is an impure form of carbon. It is formed when coal is strongly heated in the absence of air. It is used as a reducing agent in metallurgy.

Carbon black is formed by heating hydrocarbons in limited supply of oxygen. For example,

\[
\text{CH}_4 (g) + \text{O}_2 (g) \rightarrow \text{C(s)} + 2 \text{H}_2\text{O (g)}
\]

ACTIVITY 28.1

Take samples of graphite, coal, charcoal and compare their properties.
ACTIVITY 28.2

Find out places in India which have rich resources of coal, petroleum and natural gas.

Mark these places on the map of India.

It is used as a pigment in black inks. It is also used in making rubber tyres for automobiles.

INTEXT QUESTIONS 28.2

1. Which allotropic form of carbon has been discovered few years back?
2. Each carbon atom is linked to how many carbon atoms in
   (i) Diamond
   (ii) Graphite
3. Why diamond has high melting point?
4. Is diamond a conductor of electricity? Give reason for your answer.
5. Why is graphite a good lubricant?
6. Give two uses of graphite.
7. What kind of structure is possessed by fullerenes?
8. Name the three microcrystalline forms of carbon and give their use.

28.3 COMPOUNDS OF CARBON

The compounds of carbon can be classified as organic and inorganic compounds.

Earlier the organic compounds were defined as those compounds which originated from living organisms but it is now possible to synthesize organic compounds in the laboratory, therefore, they are now defined as compounds of carbon.

The compounds of carbon, which are not organic compounds, are called inorganic compounds. Most of the inorganic compounds are obtained from various
minerals. For example, limestone, marble and dolomite contain carbon as carbonates. The other inorganic compounds are carbides of metal (e.g. CaC₂, calcium carbide), HCN, CS₂ and oxides of carbon such as CO₂ and CO.

The organic compounds are obtained from natural sources such as plants and animals, coal and petroleum. You have studied in lesson ** that plants and animals are sources of complex organic compounds such as carbohydrates, starch, oils, proteins, drugs etc. Coal gives us benzene, phenol, naphthalene etc. whereas petroleum is source of petrol, diesel, kerosene, lubricating oils, wax and other compounds. In addition, a large variety of synthetic organic compounds exists and there number is increasing daily. Thus, the number of organic compounds as compared to the inorganic ones is very large.

The properties of organic and inorganic compounds are different from each other. Organic compounds are generally low melting solids or liquids. They dissolve in organic solvents such as benzene, alcohol, chloroform etc. but are generally insoluble in water. The inorganic compounds are generally solids which have high melting and boiling points. They generally dissolve in water but are insoluble in organic solvents.

After having a general idea about the nature of compounds, let us now study the oxides of carbon. But before that why don’t you answer the following questions to check your understanding.

### INTEXT QUESTIONS 28.3

1. Classify the following compounds as organic or inorganic:
   1. Sugar
   2. calcium carbide
   3. kerosene
   4. carbon dioxide
   5. carbon disulphide

2. Give two differences between organic and inorganic compounds.

### 28.4 OXIDES OF CARBON

The two important oxides of carbon are carbon monoxide (CO) and carbon dioxide (CO₂).

**Carbon monoxide** is formed when carbon or hydrocarbons are burned in a limited supply of oxygen.

\[ 2C(s) + O₂(g) \rightarrow 2 \text{ CO}(g) \]
Carbon and its Compounds

It is a colourless and odourless gas. It has a melting point of –199°C and boiling point of –192°C.

It is a major air pollutant and is released in large quantities from automobile engines. Its low level poisoning causes headache and drowsiness whereas its large amounts can cause even death. It is toxic because it reduces the oxygen carrying capacity of blood by binding with haemoglobin, the red pigment of blood.

Carbon monoxide has many uses which are given below:

(i) It is used as a reducing agent in metallurgical processes to reduce metal oxides. For example, in the blast furnace, it used to reduce iron oxide to iron.

\[ \text{Fe}_2\text{O}_3 (s) + 3\text{CO} (g) \rightarrow 2\text{Fe} (s) + 3\text{CO}_2 (g) \]

(ii) In the presence of a catalyst, it can combine with hydrogen to give methanol (\(\text{CH}_3\text{OH}\)).

(iii) It forms carbonyl compounds. The nickel carbonyl \(\text{Ni(CO)}_4\) is used in the refinement of nickel.

(iv) It is used as a fuel.

(v) It is used in the synthesis of several organic compounds.

**Carbon dioxide** is formed when carbon containing substances are burnt in excess of oxygen.

\[ \text{C} (s) + \text{O}_2 (g) \rightarrow \text{CO}_2 (g) \]

\[ \text{CH}_4 (g) + 2 \text{O}_2 (g) \rightarrow \text{CO}_2 (g) + 2 \text{H}_2\text{O} (l) \]

It is also produced by heating of carbonates.

\[ \text{CaCO}_3 (s) \rightarrow \text{CaO} (s) + \text{CO}_2 (g) \]

It is also released as a by product in the fermentation of sugar to produce alcohol (ethanol).

\[ \text{C}_6\text{H}_{12}\text{O}_6 (aq) \rightarrow 2\text{C}_2\text{H}_5\text{OH} (aq) + 2\text{CO}_2 (g) \]

Glucose ethanol

Carbon dioxide is colourless and odourless gas. It is present in very small amount (0.03%) in the atmosphere. It is a major contributor to the greenhouse effect about which you will study in lesson ——.

The main uses of carbon dioxide are as follows:

(i) Solid carbon dioxide also called dry ice is used as a refrigerant because when it is cooled at atmospheric pressure, it condenses into a solid rather than as a liquid. This solid sublime at –78°C.
(ii) It is used in the production of carbonated drinks.
(iii) It is used in the production of washing soda (Na₂CO₃.10H₂O) and baking soda (NaHCO₃).

**INTEXT QUESTIONS 28.4**

1. What is dry ice?
2. Which gas, carbon monoxide or carbon dioxide, is a major air pollutant?
3. Which gas is used in carbonated drinks?
4. Name the gas which is a major contributor to the green house effect.
5. Name the products obtained by the fermentation of sugar.

**28.5 HYDROCARBONS**

As the name suggests, hydrocarbons are compounds which contain only carbon and hydrogen. As you have studied in lesson —— the main source of hydrocarbons is petroleum.

Hydrocarbons can be divided into various classes as show in Fig. 28.4.

![Classification of hydrocarbons](image)

**Fig.28.4 Classification of hydrocarbons**

**ACTIVITY 28.3**

Why are sources of hydrocarbons getting scarce? What should be done to save these resources?
Aliphatic hydrocarbons: The word aliphatic is derived from the Greek word aleiphar meaning fat. Aliphatic hydrocarbons were named so because they were derived from fats and oils.

Hydrocarbons can be acyclic compounds, which are straight chain compounds, or cyclic compounds, which have rings of carbon atoms.

Aromatic hydrocarbons: The word aromatic is derived from the word aroma meaning fragrance. The aromatic compounds have a characteristic smell. Structurally, they include benzene and its derivative.

The aliphatic hydrocarbons can be divided into two categories: saturated hydrocarbons and unsaturated hydrocarbons. In saturated hydrocarbons, carbon atoms are linked to each other by single bonds whereas in unsaturated hydrocarbons, multiple bond (double and triple bonds) are present between carbon atoms.

Let us now study about them in details.

28.5.1 Saturated hydrocarbons (Alkanes)

Methane (CH₄) is the simplest alkane in which four hydrogen atoms are linked to the carbon atom in a tetrahedral fashion as shown in Fig.28.5.

![Fig.28.5 Structure of methane](image)

If instead of a hydrogen atom, the carbon atom is further linked to another carbon atom, we get another alkane, namely ethane (C₂H₆), Fig 28.6.

![Fig.28.6 Structure of Ethane](image)

Similarly, more carbon atoms can link with each other and the carbon chain can further extend to give a variety of hydrocarbons.
The general formula of alkanes is \( C_nH_{2n+2} \) where \( n \) is the number of carbon atoms in the alkane molecule. First ten alkanes corresponding to \( n = 1 \) to \( n = 10 \) are given in Table 28.1.

### Table 28.1 Some alkanes and their physical properties

<table>
<thead>
<tr>
<th>No. of Carbon atoms</th>
<th>Name</th>
<th>Molecular formula</th>
<th>Molecular Mass (u)</th>
<th>Melting point (°C)</th>
<th>Boiling point (°C)</th>
<th>No. of structural isomers</th>
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<td>1</td>
<td>Methane</td>
<td>CH(_4)</td>
<td>16</td>
<td>−183</td>
<td>−162</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Ethane</td>
<td>C(_2)H(_6)</td>
<td>30</td>
<td>−172</td>
<td>−89</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Propane</td>
<td>C(_3)H(_8)</td>
<td>44</td>
<td>−187</td>
<td>−42</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Butane</td>
<td>C(_4)H(_10)</td>
<td>58</td>
<td>−138</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Pentane</td>
<td>C(_5)H(_12)</td>
<td>72</td>
<td>−130</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Hexane</td>
<td>C(_6)H(_14)</td>
<td>86</td>
<td>−95</td>
<td>68</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Heptanes</td>
<td>C(_7)H(_16)</td>
<td>100</td>
<td>−91</td>
<td>98</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>Octane</td>
<td>C(_8)H(_18)</td>
<td>114</td>
<td>−57</td>
<td>126</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>Nonane</td>
<td>C(_9)H(_20)</td>
<td>128</td>
<td>−54</td>
<td>151</td>
<td>35</td>
</tr>
<tr>
<td>10</td>
<td>Decane</td>
<td>C(<em>{10})H(</em>{22})</td>
<td>142</td>
<td>−30</td>
<td>174</td>
<td>75</td>
</tr>
</tbody>
</table>

Alkanes are colourless and odorless compounds. They have very low reactivity. Many of these compounds are gases or liquids as shown in Table 28.1.

You can also see in Table 28.1 that each compound differs from the previous one by a −CH\(_2\) unit. Such a series of compounds is known as a **homologous series**. Each homologous series has a general formula. We have mentioned above the general formula for alkanes as \( C_nH_{2n+2} \) which is the general formula for the homologous series of alkanes, i.e. all the compounds of the homologous series of alkanes can be represented by this general formula.

You will see later that similar homologous series also exist for the unsaturated hydrocarbons and derivatives of hydrocarbons.

### 28.5.1a Isomerism in alkanes

So far we have not mentioned anything about the last column of Table 28.1. It mentions the number of isomers for various alkanes. **Isomers** are compounds which have the same molecular formula but have different structures.

The first three hydrocarbons have only one isomer because there is only one way in which one, two or three carbon atoms can link to each other i.e.

- Methane
- Ethane
- Propane
But when there are four carbon atoms, they can join in two different ways as follows:

- \[ \text{C} - \text{C} - \text{C} - \text{C} \]  
  (straight chain arrangement)

- \[ \text{C} - \text{C} - \text{C} - \text{C} \]  
  (branched chain arrangement)

Corresponding to the above two carbon skeletons, there are two hydrocarbons—
butane and \textit{iso}butane as shown below:

- \[ \text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \]  
  \text{Butane}

- \[ \text{H}_3\text{C} - \text{CH} - \text{CH}_3 \]  
  \text{iso}butane

They are the isomers of butane as they have the same molecular formula (C\textsubscript{4}H\textsubscript{10})
but have different structures.

The number of possible structures in which different carbon atoms can link to
each other increases with the increase in number of carbon atoms in the alkane
molecules. Hence, the number of isomers of alkanes increases with the increase
in the number of carbon atoms as is shown in Table 28.1.

After knowing about the structures of alkanes, let us now study how they are
named.

\textbf{20.5.1b IUPAC Nomenclature of Alkanes}

Earlier organic compounds were known by their popular or common names which
mostly originated from the sources of these compounds. But as the number of these
compounds increased, it became difficult to correlate the structure and name of the
compound. This led to the need of a systematic nomenclature of compounds.

In 1892, ‘International Union of Chemists’ met in Geneva, Switzerland and
framed the rules for nomenclature. Later, this organization was named as
International Union of Pure and Applied Chemistry (IUPAC) and the names
approved by it are called IUPAC names of compounds.

The systematic names are called IUPAC names. For IUPAC naming, we must
have idea about \textbf{word root} of carbon skeleton. The word root for different carbon
skeletons are given below:

<table>
<thead>
<tr>
<th>No. of Carbon atom</th>
<th>Word root</th>
<th>No. of Carbon atom</th>
<th>Word root</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>meth</td>
<td>5</td>
<td>pent</td>
</tr>
<tr>
<td>2</td>
<td>eth</td>
<td>6</td>
<td>hex</td>
</tr>
<tr>
<td>3</td>
<td>prop</td>
<td>7</td>
<td>hept</td>
</tr>
<tr>
<td>4</td>
<td>but</td>
<td>8</td>
<td>oct</td>
</tr>
</tbody>
</table>
The rules for the IUPAC nomenclature of alkanes are as follows:

1. Upto butane, the common names are listed in Table 28.1, have been adopted by IUPAC. For straight chain alkanes higher than butane, the suffix-ane is added to the Greek root for the number of carbon atoms, i.e. pent- for five, hex- for six and so on.

   For example CH₄, word root + ane → Meth + ane → Methane
   C₃H₈, word root + ane → Prop + ane → Propane, and so on.

   The names of alkanes so obtained are listed in Table 28.1.

2. For branch chain alkanes, the longest continuous chain of carbon atoms is selected as the main chain which gives the root name of the hydrocarbon. For example, in the following compounds the longest chain consists of 6 carbon atoms.

   CH₃ — CH₂ — CH₂ — CH — CH₂ — CH₃
   CH₂
   CH₃

   Hence, this compound is a hexane derivative.

3. Then, the substituent alkyl groups are identified and named. The alkyl groups are named by replacing -ane suffix of the alkane with -yl suffix. Some examples of the names of alkyl groups so obtained are given below.

   **Table 28.2 : Naming of alkyl groups**

<table>
<thead>
<tr>
<th>Alkyl group</th>
<th>Derived from Alkane</th>
<th>Name of Alkyl group</th>
</tr>
</thead>
<tbody>
<tr>
<td>— CH₃</td>
<td>methane</td>
<td>methyl</td>
</tr>
<tr>
<td>— C₂H₅</td>
<td>ethane</td>
<td>ethyl</td>
</tr>
<tr>
<td>— C₃H₇</td>
<td>propane</td>
<td>propyl</td>
</tr>
<tr>
<td>and so on</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   You can see that in the above compound, the substituent alkyl group is an ethyl group.

4. The location of the substituent alkyl group on the main chain is specified by counting its number from that end of the carbon chain which gives it the lowest possible number. If we count from the end as shown in point No.2, we see that the ethyl group is attached to the third carbon atom of the main chain. Hence, we write the IUPAC name of the above alkane as 3-ethylhexane.

   Note that the number and alphabets are separated by a hyphen (-) and there is no space between the substituent and the root name.
5. When more than one substituent is present on the carbon chain, then they are listed in alphabetical order.

\[
\text{CH}_3 \quad 6 \quad 5 \quad 4 \quad 3 \mid 2 \quad 1
\]
\[
\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{C} - \text{CH}_2 - \text{CH}_3
\]
\[
\text{CH}_2
\]
\[
\text{CH}_3
\]

3-ethyl-3-methylhexane

6. The identical substituents are indicated by the prefixes \textit{di} (two), \textit{tri} (three), \textit{tetra} (four) etc.

The prefixes \textit{di, tri, tetra} etc. are not considered while arranging the substituent’s in the alphabetical order.

\[
\text{CH}_3
\]
\[
\text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_3
\]
\[
\text{CH}_3
\]

2,2-dimethylbutane

28.5.2 Unsaturated Hydrocarbons

Unsaturated hydrocarbons contain carbon-carbon double or triple bonds. Unsaturated hydrocarbons having carbon-carbon double bonds (\( \text{—— C = C ——} \)) are called alkenes whereas those having carbon-carbon triple bonds (\( \text{—— C \equiv C ——} \)) are known as alkynes.

(a) Alkenes

The simplest alkene, ethene has two carbon atoms joined by a double bond. Its molecular formula is \( \text{C}_2\text{H}_4 \). Its structure is as shown below:

\[
\text{H} \quad \text{C} = \text{C} \quad \text{H}
\]

\[
\text{H} \quad \text{C} \quad \text{H}
\]

Ethene

Similar to alkanes, alkenes also form a homologous series of compounds in which each member differs from the next one by a \(-\text{CH}_2\) unit. The homologous series of alkenes is shown below in Table 28.3.
Table 28.3 Homologous series of alkenes

<table>
<thead>
<tr>
<th>No. of carbon atoms</th>
<th>Name of the Alkene</th>
<th>Molecular formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>ethene</td>
<td>( \text{C}_2\text{H}_4 )</td>
</tr>
<tr>
<td>3</td>
<td>propene</td>
<td>( \text{C}_3\text{H}_6 )</td>
</tr>
<tr>
<td>4</td>
<td>butene</td>
<td>( \text{C}_4\text{H}_8 )</td>
</tr>
<tr>
<td>5</td>
<td>pentene</td>
<td>( \text{C}<em>5\text{H}</em>{10} )</td>
</tr>
<tr>
<td>And so on</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You can see that the homologous series of alkenes can be represented by the general formula \( \text{C}_n\text{H}_{2n} \) where \( n \) represents the number of carbon atoms in the alkene molecule.

IUPAC name of an alkene can be given as
Ex \( \text{C}_2\text{H}_4 \), Word root + ene = eth + ene = Ethene
The names of alkenes are given by replacing the –ane suffix of alkanes by –ene.
The other rules for the nomenclature of alkenes are same as those of alkanes.
However, the position of the double bond is indicated by the smaller number of the two carbon atoms forming the double bond. For example, in the following alkene

\[
\begin{array}{c}
1 \quad 2 \quad 3 \quad 4 \\
\text{H}_2\text{C} = \text{CH} \quad \text{CH}_2 \quad \text{CH}_3 \\
\text{1-butene}
\end{array}
\]

The double bond is between the carbon atoms numbered as 1 and 2 and hence, it is called 1-butene. Similarly, in another alkene shown below,

\[
\begin{array}{c}
1 \quad 2 \quad 3 \quad 4 \\
\text{H}_3\text{C} \quad \text{CH} = \text{CH} \quad \text{CH}_3 \\
\text{2-butene}
\end{array}
\]

The double bond is between the carbon atoms numbered as 2 and 3 and hence it is called 2-butene.

Note that these two butenes \( i.e. \) 1 – butene and 2 – butene are isomeric in nature.

(b) Alkynes

The simplest alkyne is ethyne and it has molecular formula \( \text{C}_2\text{H}_2 \). Its common name is acetylene. It is used to ripen the fruits such as banana, mango etc. It is also used along with oxygen in oxy-acetylene torch which is used for welding purposes. Its structure is as shown below:

\[
\begin{array}{c}
\text{H} \quad \text{C} \equiv \text{C} \quad \text{H}
\end{array}
\]
Carbon and its Compounds

The homologous series of alkynes is shown below in table 28.4

<table>
<thead>
<tr>
<th>No. of carbon atoms</th>
<th>Name of the Alkyne</th>
<th>Molecular formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>ethyne</td>
<td>C₂H₂</td>
</tr>
<tr>
<td>3</td>
<td>propyne</td>
<td>C₃H₄</td>
</tr>
<tr>
<td>4</td>
<td>butyne</td>
<td>C₄H₆</td>
</tr>
<tr>
<td>5</td>
<td>pentyne</td>
<td>C₅H₈</td>
</tr>
</tbody>
</table>

You can see from the above table that the general formula for the homologous series of alkynes is CₙH₂ₙ₋₂ where n is the number of carbon atoms in the alkyne molecule.

IUPAC Name of alkyne = Word root + yne, eg C₂H₂ = eth + yne = Ethyne
Alkynes are named by replacing –ane suffix of alkanes by –yne suffix. The other rules of nomenclature of alkynes are similar to those of alkanes. The names of some simple alkynes are given below:

\[
\begin{align*}
&1  \\&\text{HC} \equiv \text{C} \equiv \text{CH}_3 \\
&\text{propyne} \\
&1  \\&\text{CH}_3 \equiv \text{C} \equiv \text{C} \equiv \text{CH}_3 \\
&2\text{-butyne}
\end{align*}
\]

INTEXT QUESTIONS 28.5

1. What is the difference between saturated and unsaturated compounds?
2. Give two examples each of (i) saturated compounds and (ii) unsaturated compounds.
3. Name the alkane which has three carbon atoms.
4. Define isomers.
5. What is the full form of IUPAC?
6. Name the following alkyl groups:
   (i) \(-\text{CH}_3\) (ii) \(-\text{C}_2\text{H}_5\)
7. Give IUPAC name of these compounds
   (a) \(\text{CH}_3 \equiv \text{CH}_2 \equiv \text{CH} \equiv \text{CH}_3\)
   (b) \(\text{CH}_3 \equiv \text{CH} \equiv \text{CH} \equiv \text{CH}_3\)
      \(\text{CH}_3\) \(\text{CH}_3\) \(\text{CH}_3\)
28.6 FUNCTIONAL DERIVATIVES OF HYDROCARBONS

Functional derivatives of hydrocarbons are those compounds which are derived from hydrocarbons by replacing one or more hydrogen atoms with the functional groups.

A **functional group** is an atom or a group of atoms which is responsible for characteristic properties of a compound. The double and triple bonds which respectively give the alkenes and alkynes their characteristic properties are functional groups. The other examples of functional groups are halogens (— F, — Cl, — Br, — I etc.), — OH (hydroxyl group and > C = O (carbonyl group).

Since each of these functional groups exhibits the characteristic properties and reactions, all the compounds having the same functional group show the same chemical reactions and constitute one class of compounds. For example, **haloalkanes** such as chloromethane, chloroethane, chloropropane which have the halo (chloro) functional group show the characteristic reactions of the halo (chloro) group and hence, constitute the class of compounds known as **haloalkanes**.

\[
\begin{align*}
\text{CH}_3\text{Cl} & \quad \text{Chloromethane} \\
\text{C}_2\text{H}_5\text{Cl} & \quad \text{Chloroethane} \\
\text{C}_3\text{H}_7\text{Cl} & \quad \text{Chloropropane}
\end{align*}
\]

Similarly, the **alcohols** – methanol, ethanol, propanol etc. which have — OH functional group show characteristic properties and reactions due to the — OH group and they constitute another class called alcohols which is different from that of haloalkanes.

\[
\begin{align*}
\text{CH}_3\text{OH} & \quad \text{Methanol} \\
\text{CH}_3\text{CH}_2\text{OH} & \quad \text{Ethanol} \\
\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} & \quad \text{Propanol}
\end{align*}
\]

Table 28.5 shows the common functional groups and their classes.

**Table 28.5 : Some common functional groups**

<table>
<thead>
<tr>
<th>Functional group</th>
<th>Class</th>
<th>General formula</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;C = C&lt;</td>
<td>alkene</td>
<td>CₙH₂n</td>
<td>H₂C = CH₂</td>
</tr>
<tr>
<td>—C ≡ C —</td>
<td>alkyne</td>
<td>CₙH₂n₋₂</td>
<td>HC ≡ CH</td>
</tr>
<tr>
<td>— X (F, Cl, Br, I)</td>
<td>haloalkanes</td>
<td>R — X</td>
<td>CH₃-Cl</td>
</tr>
<tr>
<td>— OH</td>
<td>alcohols</td>
<td>R — OH</td>
<td>CH₃OH</td>
</tr>
<tr>
<td>— O ≡ — C — H</td>
<td>aldehydes</td>
<td>R — O ≡ — C — H</td>
<td>CH₃CHO</td>
</tr>
</tbody>
</table>
ACTIVITY 28.4

Take some simple organic compounds available around you which contain the simple functional groups and study their properties. You can take help of your teacher for this activity.

INTEXT QUESTIONS 28.6

1. Identify the functional groups present in the following compounds:
   (i) CH$_3$CH$_2$OH (ii) CH$_3$Cl (iii) C$_2$H$_2$ (iv) CH$_3$ — COOH
   In the next section, you will study about some simple compounds which contain some of the above mentioned functional groups.

28.7 COMPOUNDS OF DAILY USE

We daily use many organic compounds such as alcohol, vinegar, vanillin, acetone etc. Let us now study about some of them in more details.

28.7.1 Alcohols

You have read earlier that alcohols contain the hydroxyl (— OH) functional group. They are named by replacing final e of the parent alkane by ol. Some examples of alcohols are given below:

- CH$_3$OH  Methanol
- C$_2$H$_5$OH  Ethanol
- CH$_3$ — CH — CH$_3$  2-propanol (rubbing alcohol)
Alcohols are soluble in water because they can form hydrogen bonds with water molecules.

(a) **Methanol (CH₃OH)**

Methanol is also called wood alcohol because it was earlier obtained by heating wood in the absence of air. It is prepared by heating carbon monoxide and hydrogen under pressure and by using a catalyst.

\[
\text{CO(g)} + 2\text{H}_2 (g) \overset{400^\circ C}{\underset{200-300 \text{ atm}}{\rightarrow}} \text{CH}_3\text{OH (g)}
\]

It has many industrial uses. It is used in the synthesis of acetic acid and many adhesives, fibers and plastics. It is also used as an additive to petrol and also as a fuel.

(b) **Ethanol (C₂H₅OH)**

Ethanol is present in beer, wine and medicines. It is produced by the fermentation of carbohydrates such as glucose and starch present in grapes, barley etc. The reaction is catalyzed by the enzymes present in yeast.

\[
\text{C}_6\text{H}_{12}\text{O}_6 (aq) \xrightarrow{\text{Yeast}} 2\text{CH}_3\text{CH}_2\text{OH (aq)} + 2 \text{CO}_2 (g)
\]

It is used as solvent for organic compounds. It is also used as sprit (95% Ethanol)

### 28.7.2 Aldehydes and Ketones

**IUPAC name of aldehyde** - Suffix “al” is added by replacing “e” from the parent alkane. For example

For HCHO, parent alkane → Methane → replace “e” by “al” → Methanal

For CH₃CHO, parent alkane → Ethane → replace “e” by “al” → Ethanal

\[
\text{O} \quad \text{O}
\]

\[
\text{H — C — H} \quad \text{CH}_3 — \text{C — H}
\]

Methanal (Formaldehyde) \hspace{2cm} Ethanal (Acetaldehyde)

**IUPAC naming of ketone** - Suffix “one” is added by replacing “e” from the parent alkane. For example

\[
\text{O}
\]

\[
\text{CH}_3 — \text{C — CH}_3
\]

Parent alkane → Propane → replace “e” by “one” → Propanone
In ketones, the carbonyl group is attached to two carbon atoms as given below:

\[
\text{CH}_3 - \text{C} = \text{CH}_3
\]

(Propanone) Acetone

An aqueous solution of formaldehyde, called *formalin* is used to preserve biological specimens in the laboratories. Vanillin which is used as a flavour, also has the aldehyde functional group.

Acetone is used as a solvent and also in nail polish removers.

### 28.7.3 Carboxylic Acids

Carboxylic acids contain the carboxyl (— C — OH) functional group. Their general formula is \( \text{R} \rightarrow \text{COOH} \). Vinegar which is also called acetic acid has the formula \( \text{CH}_3\text{COOH} \).

It is obtained by the oxidation of ethanol in the presence of conc. \( \text{H}_2\text{SO}_4 \) and \( \text{K}_2\text{Cr}_2\text{O}_7 \)

\[
\text{CH}_3 - \text{CH}_2 - \text{OH} + 2\text{[O]} \xrightarrow{\text{conc.} \text{H}_2\text{SO}_4 + \text{K}_2\text{Cr}_2\text{O}_7} \text{CH}_3 - \text{COOH} + \text{H}_2\text{O}
\]

It is soluble in water as it forms hydrogen bond with water molecule. It is used as preservative.

Some common carboxylic acids are given below:

\[
\begin{align*}
\text{H} &\rightarrow \text{C} \rightarrow \text{OH} & \text{CH}_3\text{CH}_2\text{CH}_2 &\rightarrow \text{C} \rightarrow \text{OH} \\
\text{Formic acid (from ants)} & & \text{Butyric acid} & & \text{In Latin *formica* means ant} \\
\text{OH} & & & & \text{present in rancid butter}
\end{align*}
\]

\[
\text{CH}_3 - \text{CH} - \text{COOH}
\]

Lactic acid

(present in sour milk, also produced in muscles during heavy exercise)

Similarly, citric acid present in citrus fruits and ascorbic acid present in Vitamin C are carboxylic acids.

### INTEXT QUESTIONS 28.7

1. What is wood alcohol?
2. What is glycerin? Which functional group is present in it.
3. How is ethanol produced?
4. Give two examples of compounds having aldehyde functional group.
5. What is the use of acetone?
6. Which acid is present in vinegar?
7. Name the compound which has an aldehyde group and is used as a flavour.
8. Give IUPAC Name of the following compounds
   (a) C₂H₅OH  (b) CH₃COOH  
   (c) HCHO    (d) CH₃ — CO — CH₃
9. Name the functional group present in the following compounds
   (a) C₂H₅OH  (b) CH₃COOH  
   (c) HCHO    (d) CH₃-CO-CH₃

WHAT YOU HAVE LEARNT

- In this lesson, you have learnt that carbon is tetravalent in nature and has the unique property of catenation,
- The number of compounds formed by carbon is very large.
- The allotropic forms of carbon are diamond, graphite and fullerene.
- Diamond has a three-dimensional network of covalently bonded carbon atom. It is hard and colourless. It has high melting and boiling point and is a good conductor of heat but poor conductor of electricity.
- Graphite is soft, black, and slippery in nature and has a layered structure. It is a good conductor of electricity.
- Fullerenes contain carbon atoms arranged in closed structures similar to football.
- Charcoal, coke and carbon black are micro-crystalline forms of carbon.
- The compounds of carbon can be classified as organic and inorganic.
- Carbon monoxide and carbon dioxide are two important inorganic compounds of carbon.
- Organic compounds of carbon are hydrocarbons and their derivatives.
- The hydrocarbons can be classified as saturated and unsaturated. The saturated hydrocarbons contain carbon-carbon single bonds whereas the unsaturated hydrocarbons contain carbon-carbon multiple bonds.
- Isomers have same molecular formula but different structure.
Organic compounds are systematically named according to IUPAC system of nomenclature.

Some simple functional groups include halo-, hydroxyl-, carbonyl, carboxylic acid etc.

Compounds containing the above functional groups exhibit characteristic properties and have important uses in our daily life.

**TERMINAL EXERCISES**

1. Why carbon cannot form ionic bonds?
2. What is catenation?
3. What types of bonds are formed by the carbon atom?
4. Name the three allotrope forms of carbon.
5. How do natural diamonds form?
6. Name two places where diamonds are found.
7. Why is diamond hard?
8. Give two uses of diamond.
9. Compare the physical properties of diamond and graphite.
10. How can graphite be converted into diamond?
11. Create a flow chart as shown below to compare the various allotropes of carbon

<table>
<thead>
<tr>
<th>C</th>
<th>G.....</th>
<th>D.....</th>
<th>F.....</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Names of Allotropes</td>
<td>...........</td>
<td>...........</td>
</tr>
<tr>
<td>2.</td>
<td>Place where found</td>
<td>...........</td>
<td>...........</td>
</tr>
<tr>
<td>3.</td>
<td>One use</td>
<td>...........</td>
<td>...........</td>
</tr>
<tr>
<td>4.</td>
<td>Appearance</td>
<td>...........</td>
<td>...........</td>
</tr>
<tr>
<td>5.</td>
<td>Arrangement of C atoms</td>
<td>...........</td>
<td>...........</td>
</tr>
</tbody>
</table>

12. What is activated charcoal? How is it prepared?
13. Given below are pictures of three microcrystalline or amorphous form of graphite. Name them and write one use of each.
14. Name the products formed when
   (i) Wood is strongly heated in absence of air.
   (ii) Coal is strongly heated in the absence of air.
   (iii) Hydrocarbons are heated in limited supply of oxygen.

15. Why is CO toxic in nature?

16. Give two uses of CO and CO₂.

17. For the following state one point of differences between the following pairs of terms
   (i) Organic compounds and inorganic compounds
   (ii) Carbon Monoxide and carbon dioxide
   (iii) Aliphatic and aromatic compounds

18. What is a homologous series?

19. Name 10 carbon compounds of a homologous series. Write their molecular formula and derive a general formula for the series.

20. What is general formula for the homologous series of
   (i) alkanes  (ii) alkenes  (iii) alkynes?

21. What is the molecular formula for ethane?

22. Give here four prefixes: But-, Eth-, Meth-, Prop-, and Suffix –ane to develop the names of alkanes. How many carbon atoms do each of these alkanes contain?

23. Draw the Chemical Structure of Butane and Isobutane and based on it justify that they are isomers.

24. Give IUPAC name of the following compounds:
   (i) \( \text{CH}_3 — \text{CH} = \text{CH}_2 \)
   (ii) \( \text{CH}_3 — \text{HC} = \text{CH} — \text{CH}_3 \)
   (iii) \( \text{CH}_3 — \text{OH} \)

25. Give an example of a compound which has carboxylic (-COOH) functional group.

26. (a) Of the following which has single bond, double bonds and triple bonds between C, C atoms? Alkynes, alkane, alkene
    (b) Name their simplest compounds and write the molecular formula.
27. Give one use of each of the following:
   (i) Methanol       (ii) ethanol       (iii) glycerin

28. What is the difference between the structure of an aldehyde and a ketone?

29. What is (i) dry ice (ii) wood alcohol (iii) formalin (iv) vinegar

30. To which group of carbon compounds do each of the carbon compounds used for the following belong?
   (i) To ripen fruits
   (ii) In oxy-acetylene torch

31. Name the carboxylic acid present in vitamin C.

32. Which acid is present in citrus fruits?

33. Your teacher has asked you to procure sources of formic acid and butyric acid. Which two sources will you collect and bring?

34. Name the carboxylic acids found in:
   (i) Lemon       (ii) Vitamin C       (iii) Sour milk       (iv) Rancid butter       (v) Ants

ANSWERS TO INTEXT QUESTIONS

28.1
1. 4
2. Covalent
3. Because of catenation, possibility of existence of isomers and presence of various functional groups.
4. Organic chemistry
5. 4

28.2
1. Fullerenes
2. (i) 4       (ii) 3
3. Because a large amount of heat energy is required to break the three-dimensional network of covalent bonds.
4. No. Because there are no free electrons.
5. Because of weak bonding forces between layers of carbon atoms in graphite, they can slide over each other.
6. As electrodes, lubricant, pencil leads, vessels for melting metals (any two).
7. Closed structure similar to foot ball.
8. Charcoal, coke and carbon black

   Uses: Charcoal – absorption of coloured impurities
   Coke – reducing agent in metallurgy
   Carbon black – pigment in inks or in automobile tyres

28.3
1. (i), (iii) – Organic
   (ii), (iv) – inorganic
2. (i) Organic compounds have low melting and boiling points whereas inorganic compounds have high melting and boiling points.
   (ii) Organic compounds dissolve in organic solvents whereas inorganic compounds dissolve in water and not in organic solvents.

28.4
1. Carbon dioxide
2. Carbon monoxide
3. Carbon dioxide
4. Carbon dioxide
5. Carbon dioxide and ethanol

28.5
1. In saturated compounds, single bonds are present between carbon atoms whereas in unsaturated compounds double or triple bonds are present between carbon atoms.
2. Saturated: methane, ethane  Unsaturated: ethene, propyne
3. Propane.
4. Isomers are compounds which have the same molecular formula but have different structures.
6. (i) methyl  (ii) ethyl
7. (a) 2-methylbutane  (b) 2,3-dimethylbutane
28.6
1. (i) hydroxyl (— OH) (ii) — Cl (iii) Alkyne (iv) Carboxylic

28.7
1. Methanol
2. Glycerin is 1,2,3-propanetriol. It contains the hydroxyl functional group
3. It is produced by the fermentation of carbohydrates such as glucose and starch present in grapes, barley etc.
4. Formaldehyde, acetaldehyde
5. It is used as a solvent.
6. Acetic acid
7. Vanillin
8. (a) Ethanol (b) Ethanoic acid (c) Methanal (d) Propanone
9. (a) Alcohol (b) Carboxylic (c) Aldehyde (d) Ketone
The jungle is a natural home for most wild animals. Where else can you see them? Yes, in a zoo or sometimes in a circus. Are you afraid of them when you are at a circus? No, you are not afraid because you know that they have been trained to listen to their master. ‘A Tiger Comes to Town’ is a story about a runaway circus tiger. The story is told by the tiger who is the central character of the story. Read the story to find out what happens.

OBJECTIVES

This lesson is in two parts. After completing Part I of this lesson you will be able to:

• read and enjoy an interesting story told from the viewpoint of a tiger;
• follow the sequence of events as they occur in the story;
• relate to animals with compassion, and
• develop awareness about the fact that animals have feelings.
• infer the meaning of new words from context and use them effectively;
• identify literary expressions and infer their meaning;
• write a paragraph to describe an event using sequence markers;
• convert imperative sentences into indirect speech;
• use the past perfect tense to describe actions completed in the past;
When I entered the Market Road, people ran for their lives at the sight of me. As I passed through, shutters were pulled down, and people hid themselves in drains, on trees, and behind pillars. The population was melting out of sight.

At the circus I had no chance to study human beings. They had sat in their seats peacefully while I cowered before captain’s whip. I got a totally wrong idea of human beings at that angle. I had thought that they were strong and fearless. But now I found them running from me like a herd of deer, although I had no intention of attacking them. When I paused in front of a tailor’s shop, he abandoned his machine and shut himself in a cupboard, wailing, “A las, I am undone, won’t someone shoot that tiger?”

A prisoner, between two constables, got his chance to escape when the constables fled, abandoning him with his handcuffs. I tore a horse from its Jutka and enjoyed the sight of the passengers spilling out of it and running for their lives.

Sheer hopelessness seemed to have seized the townspeople. They withdrew into their homes and even there remained nervous. All doors and windows everywhere were shut, bolted and sealed. Some even thought that I was some extraordinary creature who might pass through the walls and lie in wait on the roof or in the basement. Why should an ordinary, simple tiger have any interest in them, either to destroy or to safeguard?

I rested for a moment at the door of a restaurant, the coffee drinkers and tiffin-eaters sat still at their tables, uttering low moans on seeing me. I wanted to assure them, ‘Don’t fear, I am not out to trouble you. Eat your tiffin in peace, don’t mind me … . You – nearest to me, hugging the cash box – you are a coward, afraid – afraid even to breathe. Go on, count the cash, if that’s what you want. I just want to watch, that’s all … . If my tail trails down to the street, if I am blocking your threshold, it is because I’m eleven feet tip to tail. I can’t help it, I’m not out to kill. I’m too full. I found a green pasture full of food on my way. I won’t need any food for several days to come. I won’t attack until I feel hungry again. Tigers attack only when they feel hungry, unlike human beings who kill one another without purpose or hunger.’

---

**Notes**

- melting out of sight: disappearing
- cowered: felt afraid
- no intention of: no plan of
- paused: stopped
- abandoned: left alone
- wailing: crying in fear
- spilling out: falling out, jumping out
- seized: captured
- sat still: sat without moving
- uttering low moans: crying in a low voice
- assure them: satisfy them by saying something
- trails down: hangs down
- threshold: doorway
- pasture: grazing field for animals
To the great delight of children, schools were being hurriedly closed. Children of all ages and sizes were running helter-skelter, screaming joyously, 'No school, no school. Tiger, Tiger!' They were shouting and laughing and even enjoyed being scared.

I followed them through their school gate while they ran up and shut themselves in the school hall. I climbed up the steps of the school, saw an open door at the far end of a verandah, and walked in. It happened to be the Headmaster’s room. I noticed a very dignified man jumping on his table and heaving himself up into an attic. I walked in and flung myself on the cool floor, having a special liking for cool stone floors, with my head under the large desk.

I was in no mood to bother about anything. All I wanted was a little moment of sleep. While I slept, I had been properly locked up and was being watched.

After I woke up, I heard a teacher saying, 'Now that this brute is safely locked up, we must decide... .... …'

At this moment my Master pushed his way through the crowds and scolded, 'Never use the words ‘beast’ or ‘brute’. They’re ugly words coined by man in his arrogance. The human being thinks all other creatures are ‘beasts’. Awful word!'

‘Is this the time to discuss problems of vocabulary?’

‘Why not?’ retorted my Master, at which they looked extremely upset and angry. Someone said, ‘What a reckless man you are! Who are you?’

‘You are asking a profound question. I’ve no idea who I am! All my life I have been trying to find the answer. Are you sure you know who you are?’

– R.K. Narayan

5.2 LET US UNDERSTAND THE TEXT

5.2.1 PART 1

When I entered ................. or to safeguard?

The tiger in the story has been trained by his master to perform tricks before a large audience at a circus. His audience, comprising both children and adults, enjoys his performance and tricks, and does not appear to be afraid of him. The tiger comes to believe that human beings are brave and are not scared of animals. One day, finding his enclosure unguarded and open, the tiger walks out into the town for a walk. As he walks down the streets, he finds people running around trying to find a hiding place at the sight of a tiger. The tiger is confused to see their reactions because he is used to seeing thousands of people watch his shows every evening from a close distance. He cannot understand why they are so afraid to see him in the town, especially because he does not want to hurt them or attack them.
INTEXT QUESTIONS 5.1

1. ‘At the circus, I did not have any chance to study human beings. They had sat peacefully while I cowered before Captain’s whip. I got a totally wrong idea of human beings at that angle.’ Who does ‘I’ in the above lines refer to?
   a. the people
   b. the tiger
   c. the Captain

2. The tiger says ‘He did not have any chance to study human beings’ because:
   a. he was so engrossed in his act that he did not look up at the audience.
   b. his Captain had always kept him locked up in a cage.
   c. having only seen people at the circus show he did not realize that they were scared of the tiger.

3. ‘at that angle’ refers to:
   a. the tiger’s opinion about people from his performing ring in the circus.
   b. the spectators’ opinion about the tiger at the circus.
   c. the Captain’s opinion of the spectators.

4. ‘They withdrew into their homes and even there remained nervous. All doors and windows everywhere were shut, bolted and sealed.’ Who does ‘they’ refer to in the above line?
   a. the tiger and his Captain
   b. the people at the circus
   c. the general public in the town

5. Why did ‘they’ withdraw into their homes?
   a. they were scared of the tiger.
   b. they were given an alert warning.
   c. they were advised by the Captain to go inside as a precaution.

6. By saying, ‘Some even thought that I was some extraordinary creature who might pass through the walls and lie in wait on the roof or in the basement’,
the author means to convey that:

a. he was unable to pass through the walls.
b. people thought that the tiger could emerge from anywhere and attack them.
c. if he did not wait for his prey he would have to go hungry.

7. At the circus, the people would usually:
   a. sit quietly and watch the tiger’s antics.
   b. run away on seeing a tiger.
   c. throw stones to chase the tiger away.

8. The tiger got a chance to go out into the town because:
   a. his Master wanted him to graze in the pastures to satisfy his hunger.
   b. his Master was cruel and he wanted to run out of his clutches.
   c. he found an unguarded passage and stepped out unnoticed.

II. On the basis of your understanding of the text, complete the table below with details of the tiger’s thoughts and what different people did on seeing the tiger. One example has been done for you.

<table>
<thead>
<tr>
<th>Different people</th>
<th>Public reaction</th>
<th>Reasons for their behaviour</th>
<th>Tiger’s thoughts</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The spectators at the circus</td>
<td>Sat peacefully and watched the circus.</td>
<td>They were sure that the tiger was tamed and he would not harm anyone.</td>
<td>People are strong and fearless</td>
</tr>
<tr>
<td>b. People on the road</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

III. When did the tiger realise that he was totally wrong about the opinion he had formed about human beings?

IV. Give at least three reasons why you think the people at the circus were not scared of the tiger. One has been done for you.

1. The circus ring had an iron railing around it and the tiger could not have come close to the spectators.

2. —————————————————————————————

3. —————————————————————————————
LET US DO 5.1

There are many ways in which each one of us can contribute to the well being of animals in our day-to-day lives. Here are some do’s and don’ts to follow:

<table>
<thead>
<tr>
<th>DO’s</th>
<th>DON'Ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give a starving or suffering animal food or call an Animal Welfare Organisation in your town.</td>
<td>Don’t keep pets (e.g. dogs) leashed all the time. Be careful not to use leashes made of rough or hard materials when they must be used on pets.</td>
</tr>
<tr>
<td>Dogs and cats are in the habit of sleeping under parked vehicles. Always look under your vehicle before starting, or wait for a few seconds after switching on the engine to allow them to move out.</td>
<td>Don’t overwork your animals or abandon them when they are sick or old.</td>
</tr>
<tr>
<td>Donate for a good cause. Animal welfare organisations are not very rich. With your money they will be able to take better care of the animals.</td>
<td>Do not tease animals.</td>
</tr>
<tr>
<td>A very large number of animals are injured due to carelessly thrown sharp objects. Wrap all pieces of broken glass and nails in a cloth, paper or plastic sheet and dispose them off properly, away from places where animals can access them easily.</td>
<td>Do not throw peels, left over or stale food in a plastic bag. Stray animals generally eat the food that is thrown away. If they swallow the plastic bags along with the food, they could suffocate or fall seriously ill and may even die.</td>
</tr>
<tr>
<td>A large number of birds die of thirst. Put up bird baths in your lawn, on the roof of your house, or even on your balcony. Also keep water outside your house for stray animals.</td>
<td>Do not buy products made out of animal skin or parts. Buying these products encourages animal poachers who kill animals for their body parts.</td>
</tr>
</tbody>
</table>

The Society for Prevention of Cruelty to Animals (SPCA) is an organisation which works for the welfare of animals. Find out the names of other such organisations. If possible you may contact them and find out how you can help.

You and your friends have formed a club to protect the environment. Identify three things that you can do to protect the environment. Two ideas have been given. Add three more of your own.

i) We should not use polythene bags.

ii) We should plant more trees.

iii) ———————————————————————————————————

iv) ———————————————————————————————————

v) ———————————————————————————————————

LET US LEARN NEW WORDS 5.1

I. Given below are some expressions which you have read in the story. What do they mean? Choose the right answer from the choices given below each expression.
1. The population was ‘melting out of sight’ means:
   a. It was very hot and people rushed indoors to escape the heat.
   b. Very few people could be seen on the streets as most of them decided to
      hide in ditches or in their homes.
   c. The Government sent out orders for people to remain indoors during certain
      hours.

2. ‘I tore a horse’ from its Jutka means:
   a. the horse became out of control.
   b. the horse ran so fast that the reins by which he was secured to the carriage
      broke.
   c. on seeing the tiger the horse became frightened and jumped with such
      force that the reins broke.

II. Now I found them running like a herd of deer although I had no intention of
    attacking them. The expression ‘like a herd of deer’ compares the timid quality
    of a deer that runs at the sight of danger with the same quality of people on the streets and
    in the shops who tried to run away or hide at the sight of a tiger. Such expressions
    which are used for comparing two different things are called ‘similes’. Read the similes
    given below.

    • as black as coal
    • as beautiful as a rose
    • swift like an eagle
    • strong like a lion

    The words ‘as’ and ‘like’ are used for comparison.

    Complete the following similes by using words from the box given below. You may use
    your own comparisons too.

    lead    star    night    owl    stream    ice

    1. as clear as a ————
    2. as heavy as ————
    3. as dark as the ————
    4. as bright as a ————
    5. as cold as ————
    6. as wise as an ————
III. Complete the following sentences by using words from the box given below. You may also refer to a dictionary to see the meanings of the words before using them.

abandoned  spilled  nervous  cowered  handcuffed  seized

1. The dog ____________ at the sound of crackers on Diwali day.
2. The police _______ the dangerous criminal before taking him to the court for his trial.
3. People living on the banks of the river ____________ their homes and fled to safer places when they realised that the water level in the river was soon going to cross the danger mark.
4. Excitement seemed to have ____________ the soldiers posted on the border when they heard that their favourite film stars were going to visit them.
5. If we have studied well there is no reasons to feel ________ during examinations.
6. The bowl of soup fell from his hands and all the soup ____________________ onto the floor.

DO YOU KNOW

- Gujarat has become the first state in India to ban the dissection of frogs in schools in Biology classes.
- Japan has passed a law according to which person can face one year imprisonment and a fine of up to one million yen for killing or injuring an animal without reason. It is also levies a fine of up to five hundred thousand yen for abandoning an animal.

5.2.2 PART 2

I rested for a moment at the door of a restaurant .............. Are you sure you know who you are?

Do you know how long a fully grown tiger is? A fully grown tiger’s body, if measured from head to tail, may be more than eleven feet long. How do you think people would react if they saw such a big tiger sitting across the door of a house or a shop? Wandering down the lane, the tiger in the story reaches a restaurant. He sits down at the door of the restaurant. He sees that all the people in the restaurant are shocked and frozen in their seats to see him
sitting at the entrance. The tiger wants to tell them that they do not need to be afraid of him because he is not hungry, and that tigers only attack when they are hungry, that they are not like human beings who kill without a good reason. The tiger also wants to tell the people in the restaurant that they are not brave as he had thought them to be, and that he only wants to watch them, not harm them. The tiger notices that the schools in the town are being closed early and that the school children are shouting with a mixture of delight, excitement and fear. He enters the school gate and goes into the Headmaster’s room. The Headmaster climbs up into the attic in fear, and the tiger goes to sleep under the Headmaster’s desk. He wakes up to find that he has been locked up in the Headmaster’s room. The tiger then hears his circus master angrily telling a teacher not to use rude and ugly words such as ‘brute’ to describe him.

Fig. 5.2

INTEXT QUESTIONS 5.2

Answer the following questions.

1. ‘If my tail trails down to the street, if I am blocking your threshold, it is because I’m eleven feet tip to tail. I can’t help it, I’m not out to kill. I’m too full.’
   a. Why does the tiger tell us his measurements?
   b. What does he want to tell them by saying, ‘I’m too full’?
   c. Where and what did he have for his food?

2. ‘Never use the words ‘beast’ or ‘brute’.’
   a. Who said these words and to whom?
   b. Why did he/she say so?
   c. What does this tell us about the speaker?’
A Tiger Comes to Town-I

3. The tiger went off to sleep in the Headmaster’s room because:
   a. he was very tired and needed rest.
   b. he liked cool floors.
   c. he had eaten too much and was feeling lazy.

4. The Master could not answer the question because:
   a. he did not know the answer.
   b. he thought that was a profound question that could not be answered casually.
   c. living in the circus with the tiger all the time, he had forgotten his name.

5. Why were the coffee drinkers at the restaurant uttering low moans?

6. How was the tiger blocking the threshold?

7. Why were the school children so excited?

8. Where did the tiger go finally?

9. What did the Headmaster do on seeing the tiger in his office?

10. Why was the Master angry with the teachers?

11. The word ‘profound’ refers to something which is felt or experienced deeply or intensely, or something with a deep meaning. For example, ‘Gandhi Ji’s non-violent method of protest against Britishers had a profound effect on the people of India.’ The teachers asked the Master a question which sounded simple, but it was not so. The Master thought it was a question with a deep meaning. What was the profound question put to the Master?

Let Us Learn New Words 5.2

I. What do the following words in italics mean. Tick the right answer. You may use your dictionary to help you.

1. I noticed a dignified man jumping on his table and heaving himself into an attic.
   ‘dignified’ means:
   a. respectful and graceful
   b. important person
   c. tall and handsome

   ‘heaving’ means:
   a. making a big sound
   b. pulling and lifting
   c. taking a deep breath
Notes

‘attic’ means:

a. a small store room in a building
b. a room in the basement of a building
c. a room at the top of a building

2. Now that this brute is safely locked up we must decide...

‘brute’ means:

a. a large animal
b. a wild and ferocious animal
c. a dumb creature

3. ‘Why not?’ retorted my master, at which they looked upset and angry.

‘retorted’ means:

a. gave a polite reply
b. gave an angry and quick reply
c. gave a stupid reply

II. Antonyms are words which give opposite meanings. Some examples are given below.

good - bad
up - down
obedient - disobedient
weak - strong
proper - improper

Read the words and phrases given in Column A and Column B. Match the words in Column A with their opposite meanings given in Column B by drawing a line across. One word in Column B is extra.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>in front of</td>
<td>strong</td>
</tr>
<tr>
<td>fearful</td>
<td>cowered</td>
</tr>
<tr>
<td>protect</td>
<td>attack</td>
</tr>
<tr>
<td>weak</td>
<td>behind</td>
</tr>
<tr>
<td>extraordinary</td>
<td>fearless</td>
</tr>
<tr>
<td>ordinary</td>
<td></td>
</tr>
</tbody>
</table>

III. Now complete the following paragraph by filling in the blanks using some of the words in the above list. The words can be picked from any of the two columns above. One blank has been filled for you as an example.

Last week the children of our village decided to celebrate ‘Earth Day’ in an extraordinary way. We decided to put up a street play through which we wanted to educate all our
village elders the need to __________ our environment. We wrote the script, made animal masks and even composed music using tins, plates and brooms.

On the appointed day we all gathered __________ the park. It was decided that our animal characters would emerge from __________ the crowd to add a surprise element. It was fun to see the commotion in the crowds when animal characters jostled their way through them.

Through our play we were able to show how animals could live in peace and harmony if their habitat was not disturbed. The __________ animals protected the _______ so they could move around in a ________ manner. The village elders appreciated our efforts. They understood the importance of preserving natural resources.

IV. Given below is a crossword grid. Below the grid are some words and phrases. Find their antonyms in the text. Write the antonyms next to these words. Then complete the crossword puzzle grid with the antonyms. One word has been filled in as an example.

**Clues:**

<table>
<thead>
<tr>
<th>Across</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. violent</td>
<td>1. ordinary</td>
</tr>
<tr>
<td>2.</td>
<td>2. proceeded</td>
</tr>
<tr>
<td>3. beautiful</td>
<td>3. warm</td>
</tr>
<tr>
<td>4. weak</td>
<td>4. like</td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>7. beautiful</td>
<td></td>
</tr>
<tr>
<td>8. weak</td>
<td></td>
</tr>
<tr>
<td>9. a brave person</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td></td>
</tr>
</tbody>
</table>
The tiger is one of the endangered species of animals. Today only 3200 tigers are left in the whole world.

The total tiger population in India is about 1500.

Let us do 5.2

Slogan Writing

Slogans are generally one line appeals for a cause. They are short appealing and catchy.

Read the following slogans. Can you guess what they are appealing for? Study the first example and then write your answers in the space provided.

• ‘Save a life – donate blood’ — for blood donation
• ‘Blood is precious, do not shed it on roads’
• ‘Save life, save water’
• ‘Save the earth, save our wildlife’

You must have read in the DO YOU KNOW box above that the tiger is one of the endangered species of animals.

Coin at least three slogans of your own as an appeal for the ‘Save the Tiger’ campaign.
5.3 LET US LEARN GRAMMAR

A. Past Perfect Tense

Read the following sentences:

- At the circus I had no chance to study human beings.
- They had sat in their seats peacefully while I cowered before the Captain’s whip.
- I had thought that they were strong and fearless.

The words ‘had’, ‘had sat’ and ‘had thought’ give us an idea that the action took place sometime in the past and that the action was completed.

Something else happened later - ‘while I cowered’ and ‘they were strong and fearless’

Such verbs (action words) which tell us that an action was completed sometime in the past, before another action also in the past, are said to be in the past perfect tense.

Exercise 1

1. Study the table below. Using the words from each column make five sentences.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Past Perfect Tense had + action word</th>
<th>Action that followed</th>
</tr>
</thead>
<tbody>
<tr>
<td>The patient</td>
<td>had died</td>
<td>before the doctor arrived</td>
</tr>
<tr>
<td>The plane</td>
<td>had landed</td>
<td>by the time we reached the airport</td>
</tr>
<tr>
<td>I</td>
<td>had read the book</td>
<td>before we reached the station</td>
</tr>
<tr>
<td>My parents</td>
<td>had decorated the hall</td>
<td>before the visitors arrived</td>
</tr>
<tr>
<td>They</td>
<td>had planted trees</td>
<td>before the monsoon arrived</td>
</tr>
</tbody>
</table>

2. Based on a similar pattern, write two new sentences of your own.
   1. ___________________________________________
   2. ___________________________________________

B. Direct and Indirect (Reported) Speech—Imperatives

Read the following sentences:

1. Meena said to her friend, ‘Work hard so that you succeed’.
   Meena advised her friend to work hard so that she could succeed.

2. The fireman said to the residents ‘Vacate the building immediately’.
   The fireman ordered the residents to vacate the building immediately.

3. Sheel said, ‘Let’s go to watch a movie’.
   Sheel proposed that they go to watch a movie.
• In the first sentence, Meena is giving advice.
• In the second sentence, the fireman ordering the residents.
• In the third sentence, Sheel is proposing or suggesting something.

The sentences given above are all examples of **Imperative Sentences**.

A **Imperative Sentence** is a sentence which expresses a command, request, instruction, advice or suggestion.

When we change a sentence into indirect speech, we report what someone said. That is why indirect speech is also called Reported Speech.

When we change an imperative sentence into indirect speech we report what someone instructed, ordered, advised or suggested.

• To change an imperative sentence into indirect speech, the reporting verb (said, told, said to, etc.) is changed to a verb which conveys the tone of a command or a request.

• Given below are a few examples of the verbs to be used when changing an imperative sentence into indirect speech. Study them carefully.

**Commands:** ordered instructed told
**Requests:** begged requested pleaded asked told
**Advice:** advised recommended urged
**Suggestions:** suggested recommended proposed

Now read this conversation between Mr. Patil and his son Gopi.

**Mr Patil**

- Lock the door after I leave
- Give mother her medicine on time.
- Finish your home work before dinner.
- Come home on time, dad

**Gopi**

- Don’t worry dad, I’ll do that.
- Don’t overwork or you will fall ill
A Tiger Comes to Town-I

Read the following paragraph which describes the conversation in indirect speech.

Mr Patil advised his son to lock the door after he left.
He instructed him to give medicine to his mother on time.
Mr Patil also instructed Gopi to finish his homework before dinner.
Gopi assured his father that he would do as told.
He pleaded with his father not to overwork lest he should fall sick and asked him to come home early.

Exercise 2

1. Read the following sentences and write them in indirect speech.
   
   a. The invigilator said to the students, ‘Stop writing.’

   b. The officer said to the peon, ‘Bring a file cover for me.’

   c. Anil said to his friend, ‘Please take out the car while I lock the room.’

   d. The ticket collector said to Varun, ‘Why didn’t you buy a full ticket for your son?’

   e. ‘May I borrow your English book for the evening?’ said Usha to Rajni.

   f. The parents said to the Principal, ‘Please admit our daughter in your school.’

   g. Father said to his son, ‘Switch off the television. I am getting disturbed.’

   h. Anita said to Nikhil, ‘Help your younger sister in her studies.’

   i. Hitendra said to Shyam, ‘Have a cup of tea with me, please.’

   j. I said to him, ‘Come in.’
5.4 LET US WRITE

Read the following paragraph carefully. The narrator describes what happened one day.

Yesterday evening I got home from work at 6 o’clock. It was going to be a long weekend this time. We had planned many exciting things for the weekend. My wife had cooked a sumptuous dinner which we both ate with relish. After dinner I helped my wife to clean up the kitchen and then sat down to watch TV for about an hour. Then we got ready to go out to the Sarpanch’s house where a cultural evening had been organised. Many folk artists had been invited from the neighbouring villages too. The programme was so entertaining that we all joined in the singing and dancing. The programme finished at 3 o’clock in the morning. By then we were tired and sleepy too. As soon as we reached home we went to bed.

Note that:

• the paragraph is told like a story where one action follows another in a sequence.
• it uses verbs in the simple past tense.
• each sequence is linked with the help of words (called sequence markers) like after, then, later, by then, as soon as, etc.
• to make the story interesting some descriptive words and phrases that tell us something more about a place, experience or feelings are included, eg. sumptuous dinner, ate with relish, a treat to the ears, etc.

Exercise

Imagine you are the tiger in the story. When you went back to the circus, the other animals were waiting to hear what happened. Identify any three memorable experiences and narrate them in your own words.

The opening lines of the paragraph have been written for you. Continue the story in your words keeping in mind the sequence of events, including all the funny things that you saw. Do not forget to describe your thoughts and feelings at each episode. Use the earlier mentioned sequence markers wherever necessary.

When I went back to my enclosure after my performance, I saw that the Master had forgotten to bolt my cage. After years of being in the cage I was longing to go out into the open and enjoy being free aray camp......
A Tiger Comes to Town-I

LET US TALK 5.1

Read the following dialogue:

Ravi: Mother, our teacher took us to the zoo today.
Mother: That’s nice. What did you see there?
Ravi: Lots of animals and birds. The zoo was so big that we got tired walking.
Mother: What did you learn about animals?
Ravi: Frankly speaking, mother, I was rather sad to see the animals caged in their enclosures.
Mother: What’s wrong with that? The zoo authorities have to do so to ensure the safety of visitors.
Ravi: You are right. But do you realise how sad these animals must be when they lose their homes, freedom and their family only to be lodged here as showpieces to amuse people. I was more sad when some of my friends threw stones at them and teased them.
Mother: Yes, we should not do such things. We ought to show love, respect and care for these animals.

The italicised words have to, should not, ought to have been used to convey desirable and undesirable behaviour or duties. Other words which can be used are must, must not, need to, need not, etc.

Exercise

Imagine you are talking to one of your friends about animals in a circus. Practise speaking at least five sentences using the expressions in italics.

WHAT YOU HAVE LEARNT

In this lesson you have learnt that animals too have feelings and are capable of living in harmony with their surroundings. They are harmless. They may attack only when they are deprived of their food and shelter or if they are attacked without any reason. Human beings have formed fixed ideas about certain wild animals which are totally baseless. They fear them because they do not understand them. Despite the fact that man is supposed to have superior intelligence, he has still not understood his own position in this vast universe and has not understand how he can harm himself by disturbing nature’s plans.
TERMINAL QUESTIONS

I. Given below are events that took place in the story. But the order is mixed up.

Read the sentences and put the events in their correct sequence by writing the number of the sentence in the brackets provided.

One answer has been done as an example.

1. A tiger entered the market place (i)
2. The cops escorting the prisoner ran away leaving their prisoner. (___)
3. People fell off the horse driven carriage as the horse tore from its Jutka. (___)
4. The tailor hid in the cupboard. (___)
5. The prisoner got a chance to run away. (___)
6. The townspeople hid in their homes and locked up their rooms. (___)
7. The tiger followed the children through the school gates. (___)
8. The teachers locked him up and kept a watch on him. (___)
9. The tiger walked into the Headmaster’s room. (___)
10. The Headmaster climbed up into the attic. (___)
11. The Master reached the school. (___)
12. The children rushed upstairs and shut themselves in the school hall. (___)
13. The tiger went off to sleep on the cool floor. (___)
14. The teachers used harsh words like ‘brute’ and ‘beast’ for the tiger. (___)
15. The people at the restaurant froze in their seats at the sight of the tiger. (___)
16. The Master was angry with the teachers for using harsh words for the tiger. (___)
17. The Master was called a reckless man. (___)

II. The Master did not like people using harsh words like ‘brute’ or ‘beast’ for the tiger. Why?

III. ‘You are asking a profound question. I’ve no idea who I am! All my life I have been trying to find the answer. Are you sure you know who you are?’

Explain the Master’s response in 60 words?
A Tiger Comes to Town-I

ANSWERS

5.2.1 PART 1

INTEXT QUESTIONS 5.1

1. b.
2. c.
3. a.
4. c.
5. a.
6. b.
7. a.
8. c.

II.

III. The tiger’s opinion about men changed when he came out on the street and saw men running for their lives.

IV. The possible reasons could be any two of the following:

1. The animals at the circus were well trained to face audiences.
2. The animals were well fed so they were never hungry enough to attack.
3. The animals were tamed.
4. Adequate security measures were taken by the authorities to ensure that no untoward event would take place.

<table>
<thead>
<tr>
<th>Different people</th>
<th>Public reaction</th>
<th>Reasons for their behaviour</th>
<th>Tiger’s thoughts</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The spectators at the circus</td>
<td>sat peacefully and watched the circus.</td>
<td>They were sure that the tiger was tamed and he would not harm anyone.</td>
<td>Men are strong and brave</td>
</tr>
<tr>
<td>b. People on the road</td>
<td>fled from the street, some climbed the trees and some hid in drain and behind pillars.</td>
<td>They were terrified of the tiger.</td>
<td>Confused/amused–Why should a simple tiger have any interest in them, either to destroy or to safeguard?</td>
</tr>
</tbody>
</table>
LET US DO 5.1
You can think of different ways in which you could protect your environment. Two ideas have been given. Add three more. Some other ideas could be as follows:

1. Do not buy products made from animal parts. This will help stop unnecessary killing of animals.
2. Do not waste water.
3. Do not bathe your cows and buffaloes in the same pound from which people use water for drinking.
4. Do not burn dried leaves as smoke adds carbon dioxide in air.
5. Any other

LET US LEARN NEW WORDS 5.1

I. 1. b.
   2. c.

II. 1. as clear as a stream
   2. as heavy as lead
   3. as dark as the night
   4. as bright as a star
   5. as cold as ice
   6. as wise as an owl

III. a. cowered
     b. handcuffed
     c. abandoned
     d. seized
     e. nervous
     f. spilled

5.2.2 PART 2
INTEXT QUESTIONS 5.2
1. a. He says this to show how long he is.
   b. He wanted to tell them that they need not fear him for he was not going to attack them.
c. He had found something to eat in the green fields.

2. a. The Master spoke these words to the teachers.
b. He wanted them to understand that using such harsh words was being rude to a harmless and noble creature.
c. These words show that the Master was kind and that he understood his animals well.

3. b.

4. b.

5. The people were frightened of the tiger. Seeing the tiger lying at the entrance of the restaurant, the coffee drinkers were scared because the way to go out was blocked.

6. He sat in such a way that his long body covered the entire door width.

7. The school children were both excited and scared. They were also happy to know that the school was going to be closed early.

8. He walked up to the Headmaster’s room.

9. The Headmaster got on to the table from where he heaved himself up to the attic.

10. He was angry with the teachers because they were using unkind words for the tiger and were rude to him also.

11. ‘What a reckless man you are. Who are you?’

**LET US LEARN NEW WORDS 5.2**

I 1. ‘dignified’ – a.
   ‘heaving’ – b.
   ‘attic’ – c.
2. ‘brute’ – b.
3. ‘retorted’ – b.

II. in front of  behind
    fearful       fearless
    protect       attack
    weak          strong
    extraordinary ordinary
Sports is not only about winning medals. They are also about learning the values of cooperation, sharing, competing and complementing. In this poem ‘Nine Gold Medals’, the poet, David Roth has presented the idea of empathy and how human values are as important as the spirit of competition. The poem presents the situation of a race, where the contestants leave aside their desire to win the medal to help a smaller and weaker contestant. They all go hand-in-hand to the finishing line.

OBJECTIVES

After completing this lesson you will be able to:
• state the central idea of the poem;
• state how the players displayed their sensitivity towards one another;
• pick words relevant to certain ideas presented in the poem;
• sum up the incident described in the poem;
• pick lines from the poem where a sound has been repeated;
• pick words from the poem that often go together in pairs;
• give the meanings of the metaphors used in the poem;
• use words that can be used as verbs and nouns in sentences of your own;
• explain the significance of the title of the poem, and
• enjoy reading poetry and say how it is different from prose.
Have you ever taken part in a sports event? Surely you can recall the excitement during such competitions. Do you remember the effort you had put in the preparations? Didn’t you want to win the medal? This poem describes a very similar scene here. Read the poem aloud and answer the questions that follow.

**NINE GOLD MEDALS**

The athletes had come from all over the country
To run for the gold, for the silver and bronze
Many weeks and months of training
All coming down to these games.

The spectators gathered around the old field
To cheer on all the young women and men
The final event of the day was approaching
Excitement grew high to begin.

The blocks were all lined up for those who would use them
The hundred-yard dash and the race to be run
These were nine resolved athletes in back of the starting line
Poised for the sound of the gun.

The signal was given, the pistol exploded
And so did the runners all charging ahead
But the smallest among them, he stumbled and staggered
And fell to the asphalt instead.

He gave out a cry in frustration and anguish
His dreams and his efforts all dashed in the dirt
But as sure as I’m standing here telling this story
The same goes for what next occurred.

The eight other runners pulled up on their heels
The ones who had trained for so long to compete
One by one they all turned around and went back to help him
And brought the young boy to his feet.
Then all the nine runners joined hands and continued
  The hundred-yard dash now reduced to a walk
  And a banner above that said (Special Olympics)
  Could not have been more on the mark.

That’s how the race ended, with nine gold medals
They came to the finish line holding hands still
And a standing ovation and nine beaming faces
Said more than these words ever will.

- David Roth

**DO YOU KNOW**

Special Olympics is an international organisation created to help people with intellectual disabilities develop self-confidence, social skills and a sense of personal accomplishment. Among their other activities, Special Olympics conducts the Special Olympics World Games every two years, alternating between Summer and Winter Games. Special Olympics offers children and adults with intellectual disabilities year-round training and competition in 30 Olympic-type summer and winter sports. These games are also held as national events in some countries.

Special Olympics International was founded by Mrs Eunice Shriver, sister of (late) President John F Kennedy of USA.

Special Olympics Bharat, the National Programme, based in Delhi, is accredited by Special Olympics International. It is recognised by the Government of India, Ministry of Youth Affairs & Sports as a National Sports Federation for development of sports for the mentally disabled.
9.2 LET US UNDERSTAND THE TEXT

9.2.1 PART 1 (Stanzas 1 and 2)

The athletes had........high to begin
Let us find out what happens in the poem. The brief explanation below would help you understand the poem better.

You must have heard the term ‘Olympics’. Well, Olympics are held once every four years. Athletes from all over the world train hard to participate in this event. Winning a medal in the Olympics is the ultimate goal of every athlete of the world. However, the setting or the scene of this poem is that of ‘Special Olympics’. Have you ever heard of the term ‘Special Olympics’? In these Olympics, differently-abled persons, who have some problem/s in a particular part of the body, participate in various sports events. The contestants put in a lot of preparation and practice. Everyone hopes to win a medal. The spectators are as excited as the contestants. They cheer and encourage the contestants. These two stanzas help to create the setting of the poem.

INTEXT QUESTIONS 9.1

1. Complete the statement using the correct alternative.
   The event which is being described in the poem is the ___________ event of the day.
   a. first       b. last       c. second

2. Find words that are opposite in meaning to each other from stanza 2.

3. Answer the following questions in a sentence each.
   a. What do the words ‘gold’, ‘silver’ and ‘bronze’ stand for in the poem?
   b. Were the contestants well prepared for the event? Pick the line that illustrates this.

4. What efforts, other than training, are required to prepare oneself for a sports event? Hints are given in the picture below.
LET US DO 9.1

When a person does very well in a field of study, sports, art or work, he or she is given a prize. Mention the different kinds of things that are given away as prizes.

Do you think prizes are important? Why? Discuss with your friends. Write a brief report of your discussion (150 words).

9.2.2 PART 2 (Stanza 3, 4 and 5)

The blocks ... ... ... ... what next occurred

Now let us read the above stanzas and find out what happens next.

Of all the events in Olympics, the hundred-metre race is the most prestigious. The athlete, who wins it, is remembered as the fastest man in the world. So, for Special Olympics mentioned in the poem this is the final event, hence the most prestigious. The hundred-yard race is about to begin. The athletes take position at the starting blocks. They begin to run immediately after the starting pistol is fired. However, one of them is unable to run and falls on the track. The action has begun and already one episode has taken place. Notice how eight contestants are strong and run forward, while the ninth, who is the smallest, falls down. He cries out with the pain of disappointment. He has trained hard but does not get the opportunity to show his talent. All his dreams of winning the medal are broken and destroyed. Let us see what happens next.
**Nine Gold Medals**

**INTEXT QUESTIONS 9.2**

1. Read the statements given below and write T for true or F for false.
   a. The hundred-yard dash was a long jump event.
   b. The athletes were a little nervous.
   c. The athletes ran before the signal was given.
   d. One of the athletes could not run.

2. The word ‘exploded’ is used for the firing of the pistol. What does the phrase ‘so did the runners’ in line 2 of stanza 4 mean?

3. How were the dreams of one of the contestants ‘dashed in the dirt’?

4. Notice how the words ‘stumbled and staggered’ in line 3 of stanza 4 go together. Find a similar pair of words in stanza 5.

5. Complete the following statement using the correct option from those given below.
   The line ‘the same goes for what next occurred’ creates …………. ………..
   a. understanding
   b. confusion
   c. suspense

6. Suppose you were the contestant who fell down at the beginning of the race. What would you have done? Discuss with your friends and write in a few sentences.

**LET US DO 9.2**

1. Find out for which positions the bronze, silver and gold medals are awarded in the Olympics.
   Name any two Indians who have participated in the Olympics.

2. Have you or anyone you know faced a major disappointment? How did you/he/she deal with it? Discuss using the following key questions:
   - What was the event?
   - What had happened?
   - How did I/he/she feel?
• What did I/he/she do?
• Was my/his/her behaviour appropriate?
• Could I/he/she have done something better in that situation?

9.2.3 PART 3 (Stanzas 6, 7 and 8)

The eight other………………………………………… words ever will.

Something unexpected happened at the beginning of the race. Now let us see how many contestants finally ran the race. The explanation below might be of help to you.

When the remaining eight contestants saw him fall, they, instead of continuing the race, came to the help of their fellow contestant. All the athletes had dreamt of winning the medal. However, they readily forgot their dream and came forward to help the boy to his feet. Then all the nine contestants walked hand-in-hand to the finish line. The audience was so moved by the exemplary behaviour of the contestants that it stood up and clapped. There were now nine winners, instead of one, and each was given a gold medal. All the contestants displayed empathy turning the Special Olympics into a really ‘special’ one. Have you ever heard the word empathy? Empathy is the capacity to understand another person’s experience from his point of view. Simply stated, empathy is the ability to ‘put oneself in another’s shoes’. That is exactly what the eight contestants had done. One look at the fallen contestant had forced them to think ‘what would I have felt if I had fallen?’ and they knew exactly what they had to do.

By awarding gold medals to all nine contestants, the authorities honoured their display of empathy, helpful nature and human values.
INTEXT QUESTIONS 9.3

1. Explain the following phrases in a sentence or two.
   a. pulled up on their heels
   b. brought the young boy to his feet

2. Explain in your own words the meaning of the line ‘the hundred-yard dash now reduced to a walk’.

3. How would the nine contestants have felt when they all reached the finish line together? Which words indicate this? Do you think they were happy because they had won the gold medal? Why?

4. How did the spectators react to this gesture of the eight contestants?

LET US DO 9.3

Your friend, Muniya has lost her English notes just before the examination. She is afraid that she will now fail the examination. She is not able to concentrate on studying and ends up crying every time she is reminded of her loss. What are the different ways in which you could help her?

Key words: listening, empathising, boosting confidence, counselling, sharing

9.3 APPRECIATION

Alliteration

1. In a line in stanza 4, the consonant sound /s/ has been repeated in order to bring about a musical effect.

   But the smallest among them, he stumbled and staggered.

   This repetition of the same sound is called alliteration.

   Here the sound /s/ has been repeated. Find another such line from stanza 5.

2. No specific rhyme scheme has been followed in the poem. Yet the poem has a rhythm of its own. Read it aloud to feel the rhythm. Here are a few examples.

   a. And a banner above that said ‘Special Olympics’

      Could not have been more on the mark.

      (stanza 7)
b. And a standing ovation and nine beaming faces
   Said more than these words ever will.

(stanza 8)

3. Poetry says a lot in a few words. Here too, the poet has used the technique of not expressing directly and encouraging the readers to infer meanings on their own.

**WHAT YOU HAVE LEARNT**

In order to enhance the quality of our life we need to develop empathy. Empathy is the ability to understand and accept others who are different from us. It helps us to appreciate what the other person is going through and to offer emotional support at the time of need. Empathy works wonders when applied to relationships - our family, our friends or colleagues. It encourages positive behaviour towards people who are in need. Not only does empathy help us to resolve conflicts but it also enables us to find solutions to problems. In the process we end up making decisions to benefit us without hurting others. The poem also shows that empathetic behaviour is applauded by all.

**TERMINAL QUESTIONS**

1. Complete the statements using the correct option from those given.
   (i) The poem describes a
      a. school Sports Day with participants from different schools
      b. national sports event for women
      c. national sports event for the differently-abled
   (ii) The contestants of the race received a standing ovation because
      a. they are challenged in various ways and not used to sports
      b. they thought it more important to help than to get a medal
      c. they don’t like competition and don’t care about winning

2. Who won the race and how? Explain in about 50 words.

3. Do you think the title of the poem is justified? How?

4. What is the central idea of the poem?

5. Have you ever witnessed any event in ‘Special Olympics’ in real life or on television? Describe it briefly.
7. What have you learnt from the poem?
8. Which is the turning point in the poem?

9.2.1 PART 1

INTEXT QUESTIONS 9.1
1. b. The event which is being described in the poem is the last event of the day.
2. Old and young, men and women.
   b. The phrase ‘many weeks and months of training’ tells us that the contestants were well prepared for the event.
4. One must try to eat healthy nutritious food, get enough exercise, have clean living conditions and get adequate rest.

9.2.2 PART 2

INTEXT QUESTIONS 9.2
1. a. False   b. False    c. False    d. True
2. The phrase ‘so did the runners’ means that the runners ran forward immediately.
3. The dreams of one of the contestants were ‘dashed in the dirt’ when he fell on the black tarred road and could not take part in the race. This finished his chances of winning the race—something he had been looking forward to for a long time.
4. The pair of words is ‘frustration and anguish’ in line 1 of stanza 5.
5. The line ‘the same goes for what next occurred’ creates suspense.
6. Possible answers
   — try to stand up and continue the race
   — stand up and put in extra effort to make up for lost time
   — get up and leave the tracks thinking that the race is lost
   — wait for someone to come and help
9.2.3 PART 3

INTEXT QUESTIONS 9.3

1. a. The phrase ‘pulled up on their heels’ means that the other eight contestants stopped running.

b. The phrase ‘brought the young boy to his feet’ means that the other eight contestants helped the boy who had fallen down, to stand up on his feet.

2. The phrase ‘the hundred-yard dash now reduced to a walk’ describes the moment when the other eight contestants help their friend, who had fallen down, to stand up on his feet. Since the boy was unable to run, the others decide not to run either. All nine contestants walk hand-in-hand to the finish line. In other words, the contestants walk the distance of the hundred yards (which was to be run) at the speed of the contestant who had fallen down.

3. The contestants must have felt happy and united when they reached the finish line still ‘holding hands’. The words ‘nine beaming faces’ tell us how happy they were. The contestants get a ‘standing ovation’ which would have made them feel proud of what they had done.

   The contestants were happy not simply because they had won the gold medal. They were proud of being a united group who stood by each other, understood each other’s problems and helped each other even at the cost of winning a gold medal. For this group of contestants it was more important to empathise with and help each other than to win an individual prize.

4. The spectators gave a ‘standing ovation’ to the contestants, which means they stood up and clapped and cheered for them. Each of the contestants was rewarded with a gold medal.

TERMINAL QUESTIONS

1. (i) c. The poem describes a national sports event for the differently-abled.

   (ii) b. The contestants of the race received a standing ovation because they thought it more important to help than to get a medal.

2. All the nine contestants won the race as they all reached the finish line together. One of them had fallen down at the start of the race. Instead of running to get their positions, they turned back and went to his help. Then they completed the race together.

   They were given the gold medal because they showed the true spirit of sportsmanship by helping the smallest among them at the risk of losing the race.

3. Yes, ‘Nine Gold Medals’ is an appropriate title as all the nine contestants deserved the medal. The smallest one, for not giving up, and the others for being helpful and caring.
Nine Gold Medals

4. The poet wants to convey that sharing and caring are as important as winning and achieving.

5. It is a sports programme for those who are differently-abled. Each one aims to participate and win in whatever he/she can do best.

6. Description of any experience of a person helping another without thinking of one’s own interest.

7. There are moments in our life when we keep our own interests aside and help our friends who may be in a difficult situation. The value of cooperation is greater than the spirit of competition.

8. When the pistol was fired, one contestant fell down while the rest ran forward. Normally the race would finish with three of them getting the first, second and the third positions. But something else happened. All of them stopped and turned back to help their fellow-contestant. This was the turning point of the poem.
CONTROL AND COORDINATION

We observe our body regularly, but few of us are able to appreciate what a well-harmonized machine it is! When we eat food, digestive juices are secreted, but these are secreted only when there is some food in the food canal and so long as the food has to be digested. Our muscles move only when stimulated. Our body temperature remains constant even when outside temperature fluctuates. Can you tell how various organs perform their functions together accurately at the right time? How does the right physiological activity occur at the exact moment? Do you know which organs are responsible for our thoughts, feelings, emotions and behaviour? We shall try to get answers to some such questions in this lesson.

OBJECTIVES

After completing this lesson, you will be able to:

• explain the role of nervous system and hormonal system in control and coordination of various activities of the body;

• recognize major components of the nervous system and enlist their functions, emphasizing their role in informed decision making;

• explain the role of nerve cells (neuron) in the transmission of nerve impulses;

• identify the location and explain the functions of spinal cord in evoking a reflex action;

• analyze the role of some of the endocrine glands in regulating our growth and behaviour; and

• appreciate the role and relevance of reflex, voluntary and involuntary actions as well as hormones in efficient functioning of the human body.
23.1 NERVOUS SYSTEM AND ENDOCRINE SYSTEM

Have you ever wondered how the various organs perform their respective functions in harmony and at the appropriate time? The nervous system and the endocrine system ensure that the body works in a controlled and coordinated manner. The nervous system includes the brain, spinal cord, sense organs and nerves while the endocrine system operates through certain chemicals called hormones which are produced by specialized glands and are secreted directly into the blood. The nervous system works with the endocrine system to communicate, integrate and coordinate the functions of various organs and systems in our body.

Some examples from our daily life will help us to appreciate the complexity of processes coordinated by the nervous and endocrine systems to help us execute several simple and difficult tasks. Do you know why we feel hungry? Yes! You are right. We want food when our body needs energy. The eyes see the food; brain registers this information and a series of coordinated activities are initiated. Appropriate activities in the nervous system instruct the relevant muscles in the hands and the fingers to pick up the food and put it into the mouth. When sufficient food has been eaten, signals from the hunger centre in the brain indicate a sense of fullness and the individual stops eating. The food reaches the alimentary canal and several digestive juices (for example, gastric juice, bile and pancreatic juice under the influence of specific endocrine glands) are secreted that help in digestion. After a series of digestive processes, food is absorbed into the blood stream to fulfill the energy requirement. Several other processes involved in digestion are not mentioned here. Many of these processes cannot be directly observed but they play a vital role in the digestion of food and providing energy for our day-to-day functioning. As you would have realized; eating is not as simple as it seems to be!

The above example illustrates that the nervous system and the endocrine system work together as a team to control and coordinate all our activities such as our physical actions, our thinking processes and our emotional behaviour.

It is noteworthy that sometimes we may not even be aware of the role that the nervous and endocrine systems play in our health and well being. For example, we do not have to remember to breathe or to digest food.

There is another set of action, known as the reflex action that are usually executed in response to an urgent or dangerous situation. For example, immediate removal of hand if it comes in contact with a hot object.

Do you now appreciate that the nervous and endocrine systems have a vital role to play in the smooth functioning of our lives on an everyday basis. Let us understand the structure and functioning of these systems in some more detail.
23.1 INTEXT QUESTIONS

1. Can you think of a real-life example, when team work helped you to achieve something that you could not have done by yourself? Please write about this incidence in 3-5 sentences.

2. Give one example of coordination of a process taking place in our body which is brought about by both the nervous system and hormonal system.

23.2 THE NERVOUS SYSTEM

The functioning of the nervous system depends on detecting a stimulus in the internal or external environment and responding to it.

A stimulus is an agent or an environmental change which can initiate a response in the body. The stimuli can be of several types. It could be physical (touch, prick, pressure), auditory, chemical, radiant (light), heat or cold, or electrical.

23.2.1 Neuron (Nerve cell)

Let us find out how neurons (individual cells of the nervous system) communicate with one another and other tissues to receive and transmit information throughout the body. The generalized structure of a neuron is shown in fig. 23.1. It consists of three parts-

(i) Dendrites are branched cytoplasmic projections from the cell body. The dendritic tip of the nerve cells receive impulses and sets off a chemical reaction that creates an electrical impulse which is further transmitted to the cell body.

(ii) The cell body contains a well defined nucleus, surrounded by cytoplasm. It has cell organelles like any other cells. The cell body further transmits the impulse to the axon.

(iii) Axon: One branch arising out of the cell body is very long in comparison to others. This branch is called axon or
nerve fibre. In most neurons, it is covered by an insulating fatty sheath called neurilemma. The fatty sheath is missing at intervals which are called Node of Ranvier. The absence of neurilemma helps Node of Ranvier to generate electrical activity and in transmission of nerve impulse. The end portions of the axon have swollen ends like “bulbs” which store chemicals called neurotransmitter. Axon bulbs are closely placed near the dendrites of another neuron. This junction of two neurons in called synapse and the space at the synapse separating the two neurons called synaptic cleft. (Fig 23.2) There are many synapses between the millions of nerve cells present in our body.

Through the synapse the impulse passes from one neuron to the next neuron. When an impulse reaches the end of first neuron, a neurotransmitter is released in the synaptic cleft of the synapse. These chemicals cross the gap or synapse and start a similar electrical impulse in the next neuron. Finally, the impulse is delivered from neurons to other cells, for example the muscle cells or glands to elicit the desired action.

There are three types of neurons: (Fig 23.3).

1. **Sensory neurons** convey the impulse from receptor (sense organ) to the main nervous system. (brain or spinal cord).
2. **Motor neurons** carry the impulse from the main nervous system to an effector (muscle or gland).
3. **Association (Connecting) neurons** are located in the brain and spinal cord and interconnect the sensory and motor neurons.

![Fig 23.2: A synapse](image)

![Fig 23.3: Three types of neurons (sensory, motor and association), synapse between them and the direction of transmission of nerve impulse](image)
23.2.2 Nerves

Nerves are thread-like structures which emerge from the brain and spinal cord and branch out to almost all parts of the body. A nerve is formed of a bundle of nerve fibres (axons) enclosed in a tubular sheath (figure 23.4). It may be compared to an underground electric cable containing numerous conducting wires, each insulated from the other. The medullary sheath of the axon acts like an insulation preventing mixing of impulses between the adjacent axons.

There are three kinds of nerves:

(i) Sensory nerves that contain sensory fibres. These nerves bring impulse from the receptors (sense organs) to the brain or spinal cord. Example: Optic nerve arising from the eye and ending in the brain.

(ii) Motor nerves which contain motor fibres. These nerves carry impulse from the brain or spinal cord to the effector organ like muscles or glands. Example: a nerve arising from the brain and carrying impulse to the muscles of the eye.

(iii) Mixed nerves are those that contain both sensory and motor fibres and perform a mixed function. Example: a spinal nerve.

Do you know

Spinal nerves are the nerves that emerge from the spinal cord and cranial nerves are the nerves that emerge from the brain.

23.2.3 Sense organs

As shown in figure 23.5 receptor organs like nose, eyes and/or ears receive the stimulus. The stimulus then reaches the spinal cord and the brain through sensory nerves where it is integrated. The message is then sent by the motor nerves to the required organ (muscles or gland) for suitable action. In this way a response is generated.

23.2.4 Major divisions of the nervous system

Before going any further, it may be useful to know the major divisions of the nervous system as summarized in the chart below. It shows that the nervous system has two main divisions: Central Nervous System (CNS) that includes brain and spinal cord and Peripheral Nervous System (PNS) which includes the
nerves arising from the brain and spinal cord. The major division of the nervous system are summarized in the chart given below:

**Nervous System**

- **Central Nervous System (CNS)**
  - Brain
    - Cerebrum: Controls conscious and unconscious mind, intelligence, memory, reason, etc.
    - Cerebellum: Maintains balance of the body.
    - Medulla oblongata: Controls involuntary actions - heart beat, breathing, peristalsis

- **Peripheral Nervous System (PNS)**
  - Carries impulses to and from CNS
  - Brain
    - Spinal Cord: Controls reflex actions, conveys impulses
  - Spinal nerves (31 pairs)
  - Cranial nerves (12 pairs)
  - Autonomic Nervous System (ANS)
    - Sympathetic: Accelerate heart beat, dilates pupil, constricts blood vessels, releases sugar from liver.
    - Parasympathetic: Restores normal body condition

**INTEXT QUESTIONS 23.2**

1. The structural and functional unit of nervous system is (encircle the correct alternative out of the following)
   (a) Nephron (b) Neuron (c) Synapse (d) Axon
2. Consider that you are passing by a garbage disposal area and you immediately cover your nose. Arrange the events below in a logical order by marking them from 1 to 5 to trace the events that happen in the nervous system from detection of foul smell (stimulus generation) to covering your nose (response).

(i) At the end of the axon, electrical impulse releases chemicals
(ii) Stimulus received on the dendritic cells of a neuron sets off chemical reaction that creates an electrical impulse
(iii) Electrical impulse transmitted through cell body and axon
(iv) The chemicals cross the synapse and reach the next neuron. Similarly, the electrical impulse crosses several neurons
(v) Finally, the impulse is delivered from neuron to the gland that helps in recognition of the foul smell and muscle cells that help in covering the nose

3. With the help of a suitable example, explain the term ‘stimulus.’

23.3 THE CENTRAL NERVOUS SYSTEM

Central Nervous System (CNS) is regarded as the “information processor” in the body. It consists of the brain lying under the skull, and the spinal cord contained within the vertebral column.

23.3.1 The Brain

The brain is a very delicate organ. It is well protected within the bony cranium (brain box). As shown in the fig. 23.6(a), it is further protected by three meninges (that is, membranous coverings) which continue backward over the spinal cord. These meninges are: (i) Dura mater, the outermost tough fibrous membrane, (ii) Arachnoid, the thin delicate middle layer giving a web-like cushion, and (iii) Pia mater, the innermost highly vascular membrane, richly supplied with blood. The space between the covering membranes is filled with a watery fluid known as cerebrospinal fluid which acts like a cushion to protect the brain from shocks.
You may have heard about **Meningitis** which is a serious health problem caused by inflammation of meninges. It is commonly caused by microorganisms such as bacteria, virus, fungi and amoeba that infect the meninges and the cerebrospinal fluid surrounding the brain and spinal cord. Meningitis is a contagious disease and can spread through coughing, sneezing, kissing, sharing eating utensils, toothbrush etc. Good hygiene is helpful in preventing the disease. Effective vaccines are also available to protect against meningitis. A person with meningitis suffers with high fever, lethargy, irritability, headache, photophobia (eye sensitivity to light), stiff neck, skin rashes and seizures. (Seizures: Sudden attack of illness, especially a stroke or an epileptic fit)

Patient / care givers should seek prompt medical assistance for correct diagnosis and effective treatment.

The brain consists of three important parts: Cerebrum, Cerebellum and Medulla.

(a) **Cerebrum**: It is the largest portion of the brain, vertically divided into two halves: right and left **cerebral hemispheres**. Their outer surface is highly convoluted with ridges and grooves. The outer portion or the cortex of the cerebrum contains cell bodies of the neurons which is the basic unit of nervous tissue. Being grayish in colour, it is called the **gray matter**. The inner portion of the cerebrum consists of “**white matter**” which mainly contains the axons or nerve fibres of the neurons.

The highly developed cortex or gray matter enables us to think, reason out, invent, plan and memorize. Overall, the cerebrum is the seat of **intelligence**,
consciousness and will-power. It controls all voluntary actions. Cerebrum helps us to make well thought out and informed decisions, for example, decisions related to the career choices you make. Fig. 23.6 (b) shows some major functions associated with the different areas of the brain.

(b) The cerebellum is a much smaller area of the brain located below the cerebrum. It has no convolutions, but has numerous furrows. This also has an outer cortex made-up of gray matter and an inner white matter.

The main function of the cerebellum is to maintain the ‘balance’ of the body and coordinate muscular activity. The cerebrum and cerebellum work in close coordination. For example, if you stand up and walk, the impulse for this activity arises in the cerebrum. The act of walking involves coordinated working of many muscles. Proper coordination and timing of contraction and relaxation of muscles is the responsibility of the cerebellum.

Do you know

An alcoholic, when drunk, generally walks clumsily. It is because under the effect of alcohol, the cerebellum is unable to coordinate muscular movements properly.

(c) The medulla oblongata is the lowest portion of the brain located at the base of the skull. It is roughly triangular and is continued behind as the spinal cord. Its function is to control the activities of our visceral organs like the alimentary canal, movement, breathing, beating of heart and many other involuntary actions. Injury to the medulla generally results in death as the involuntary and vital functions like breathing and heart beat may be stopped.

23.3.2 The Spinal cord

As mentioned above, the spinal cord is an integral part of the central nervous system. It extends from the medulla oblongata and continues downward almost throughout the length of the backbone, and lies within the neural canal of the vertebral column or the backbone. Figure 23.7 shows the internal structure of the spinal cord. In the spinal cord, the arrangement of the gray and white matter is reversed from that in the brain. The gray matter containing the cell bodies of motor neurons lie on the inner side, while the white matter on the outer side. The white matter contains axons running longitudinally to and from the brain and even
crossing from one side to the other. There is a small central canal in the centre which runs through the entire length and continues with the cavities of the brain. It is filled with **cerebrospinal fluid** which acts as a shock proof cushion and forms a medium for the exchange of food materials, waste products, and respiratory gases with neurons.

Externally, the spinal cord is covered by the same three membranes – dura mater, arachnoid and pia mater in continuation with those of the brain.

![Diagram of the internal structure of the spinal cord and nervous pathway in spinal reflex](image)

**Fig 23.7 : Diagrammatic sketch of the internal structure of spinal cord and nervous pathway in spinal reflex**

**Functions of spinal cord**

The spinal cord is concerned with the following three functions:

(i) It controls the reflexes below the neck.
(ii) It conducts sensory impulses from the skin and muscles to the brain, and
(iii) It conducts motor responses from the brain to muscles of the trunk and limbs.

**INTEXT QUESTIONS 23.3**

Fill in the blanks:

(i) The central nervous system consists of _______ and ____________.
(ii) The two functions of the cerebrum are _________ and ____________.
(iii) The major function of cerebellum is to maintain _______ of the body.
(iv) The _______________ part of brain controls the activity of all internal organs of our body.
(v) The outer and inner region of the cerebrum are composed of _______ and ___________ matter respectively.
23.4 REFLEX ACTION

We may be faced with an urgent and dangerous situation that requires immediate response and does not provide us with the time to think and reach a decision. Such responses are achieved through reflex action. The word ‘Reflex’ is used to convey sudden and immediate action in response to something. When there is a sudden dust storm what do you do to your eyes? You immediately close your eyes to prevent the dust particles from entering your eyes. What is your reaction when you touch a hot pan while making food, you remove your hand to avoid the hot pan? In both those cases there is an instant and automatic reaction.

There are certain actions in our body that are spontaneous and do not need any processing by the brain. Such actions or responses are called reflex actions. Reflex actions are involuntary actions that occur without conscious thought processes. For example: (i) When some particles fall into your eye, there is immediate flushing of tears to wash them out (glandular secretion) (ii) When your hand accidentally touches a hot pan, you withdraw it instantaneously (muscular movement) figure 23.8 (iii) You shiver when it is very cold (muscular contractions) or sweat when it is too hot (glandular secretion).

Do you know

A reflex action may be defined as a spontaneous, autonomic and mechanical response to a stimulus controlled by the spinal cord and without the involvement of the brain. All involuntary actions or reflexes are initiated by some kind of sensory stimulations resulting in either a muscular action or a glandular secretion.

23.4.1 Types of reflexes

Reflexes are of two types (1) natural (inborn) reflexes and (2) conditioned (acquired) reflexes.

1. Natural (inborn) reflex: Close your eyes and try to follow the rhythm of your body. What do you feel? You feel that you are breathing gently. You also feel
your heart and pulse beating. All such activities in which no previous experience or learning is required are termed as natural reflexes. These reflexes are inborn, i.e. inherited at the time of birth. Other examples are: swallowing, coughing and blinking of eyelids.

2. Conditioned (acquired) reflex: What happens when you are able to smell your favourite food even without actually eating it? You are right. Your mouth starts watering (salivation) in anticipation! This phenomenon is based on your past experience by which you are able to associate a particular aroma with the specific food that you like. Aroma of the food item would not have initiated salivation if you had never eaten the food before. Such types of actions which develop during the lifetime due to experience or learning are termed as conditioned reflex.

In the above example of conditioned reflex, salivation occurs at the smell of the food as the brain is able to remember the taste of the food and works in an unconscious way. Such reflexes are not inborn and hence conditioned reflexes are acquired.

In order to preserve the conditioned reflex, it is necessary to reinforce it periodically. For example, once the reflex is formed, the mere smell of the food initiates salivation. However, if repeatedly the smell of the favourite food item is not followed by the food itself, you will stop reacting to the smell with salivation after a certain time.

A reflex arc may be represented as follows:

Stimulus → receptor in the sense organ → afferent (sensory) nerve fibre → CNS → efferent (motor) nerve fibre → muscle (to contract)/gland (to secrete)

INTEXT QUESTIONS 23.4

1. Name the two types of reflexes.

2. Given below are the different components of a reflex arc in a haphazard manner. Arrange them in the correct order in the space provided below:
   Sensory neuron, Effector, Stimulus, CNS, Receptor, Response, Motor neuron

3. Now that you are aware of the well-thought out voluntary actions that are co-ordinated by the cerebrum and immediate response actions or reflex actions, co-ordinated by the spinal cord, try to identify whether the following situations
Control and Coordination

may be best managed by well-thought out voluntary actions or quick response reflex actions. Please provide at least one reason for your choice.

<table>
<thead>
<tr>
<th>Situation</th>
<th>Appropriate action (voluntary action or reflex)</th>
<th>Reason for your choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>You need to immediately stop your bicycle as a speeding motorbike comes in front of your bicycle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You have scored good marks in all the subjects in class X and now need to choose between science and commerce stream. Your family feels you should study science while you like numbers and would like to study commerce.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You are cleaning your cupboard, a sharp needle pokes you and you remove your hand immediately.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You have moved to a new neighborhood and are trying to make new friends.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

23.5 PERIPHERAL NERVOUS SYSTEM

It connects the central nervous system with the sense organs, muscles and glands of the body and, includes the sensory and motor nerves. The peripheral nervous system consists of two sub divisions: (i) **Somatic nervous system** that conveys information from brain and spinal cord to skeletal muscles and regulates voluntary action. and (ii) **Autonomic nervous system** which control the involuntary action of many internal organs, smooth muscles, heart muscles and glands. (Fig.23.9)

2.5.1. **Somatic nervous system**

This consists of two sets of nerves – the cranial nerves and the spinal nerves

(a) **12 pairs of cranial nerves** emerge from the brain. For example, optic nerve (for eyes) and auditory nerve (for ears);

(b) **31 pairs of spinal nerves** emerge from the spinal cord.

23.5.2. **Autonomic nervous system**

The autonomic nervous system (ANS) consists of a pair of chain of nerves and ganglia on either side of the backbone. This system controls the involuntary actions of the internal organs. As you may see in figure 23.9, there are two parts of the autonomic nervous system - Sympathetic and Parasympathetic.

The **Sympathetic Nervous System** (SNS) becomes more active during times of stress. It prepares the body for action. Its action during the stress response
comprise the ‘fight-or-flight response’ that is manifested largely under the influence of the hormone, adrenaline. The Parasympathetic Nervous System executes actions that do not require immediate response, for example producing of saliva and tears, digestion etc..

The functions of sympathetic and parasympathetic nervous systems may seem opposite to each other but in reality they are complementary rather than being antagonistic.

**INTEXT QUESTIONS 23.5**

1. How many pairs of cranial nerves are present in our body?

2. Name the two parts of autonomic nervous system.
23.6 ENDOCRINE SYSTEM

All of us observe the changes and development taking place in humans from the age of infancy to adulthood and old age. You may notice more pronounced changes in height and weight in the initial years and also very significant developments of secondary sexual characters during adolescence. In fact, our body undergoes changes as long as we live. These changes are regulated by special glands in our body known as the endocrine glands. The main function of these glands is to produce chemical secretions called hormones. Hormones play an important role in control, coordination and regulation of the functioning of tissues, organs and systems in the body. Well harmonized mechanisms regulate the release of very precise quantities of hormones to achieve optimal functioning of the human body. The endocrine system is responsible for the chemical coordination in our body.

Did you know

The term hormone has been derived from the Greek word hormaein that means to set in motion or to spur on.

A hormone is a chemical secreted by an endocrine gland and carried by blood to a target organ situated elsewhere in the body to stimulate a specific activity.

Did you know that hyperactivity and hypoactivity of these glands can cause diseases? Let us learn about some important endocrine glands, the hormones they secrete and the effect they have in the body. Some of the endocrine glands are as follows:

Pituitary gland: This is a small gland located at the base of the brain. This gland plays an important role in the growth of a child from puberty to the full reproductive maturity. The pituitary gland secretes Gonad Stimulating Hormone, which regulates the activity of gonads (ovary in females and testis in the males). There is an increase in the activity of this gland at the time of puberty which stimulates the ovary and testes to produce the sex hormones progesterone and...
Notes

**oestrogen** in females, and **testosterone** in males. These hormones initiate the development of secondary sexual characters. You will read more about secondary sexual characters in the lesson, “Reproduction”. The disorders caused by the increased or decreased activity of the pituitary gland include:

- **Cushing’s Disease**: It is caused by the hyperactivity of pituitary gland. In the males, this disease may lead to excessive growth of hair. In some cases, it may even cause atrophy of testes leading to impotency. In the females, this disease causes sterility and masculinization, for example, growth of beard and moustaches.

- Deficiency (hypoactivity) of growth hormone (GH) or **Somatotropic Hormone** (STH) secreted by pituitary gland causes **dwarfism** (retarded growth of the long bones) which adversely affects the height of a person. On the other hand, its excessive secretion or hyperactivity causes **gigantism** (excessive growth of long bones) making a person very tall.

**Thyroid gland**: It is responsible for the speed of metabolism in our body. The thyroid gland is therefore essential for life, growth and development.

When the thyroid gland becomes overactive and produces more thyroid hormone than is necessary for optimal functioning, the condition is called **Hyperthyroidism**. When the thyroid gland becomes underactive and produces less thyroid hormone than is necessary, the condition is called **Hypothyroidism**.

**Cretinism** is a condition of severely stunted physical and mental growth due to untreated congenital deficiency of thyroid hormone (hypothyroidism) or from prolonged nutritional deficiency of iodine.

**Goitre** is a disease of the thyroid gland characterized by an enlargement of the gland, visible externally as a swelling on the front of the neck. Simple goitre is caused by a deficiency of iodine in the diet. (Fig. 23.11)

**ACTIVITY 23.1**

Find out what the Government of India recommends for prevention of iodine deficiency and goitre. (Hint: You could get this information from the news papers, radio, television, internet or your kitchen!)

**Pancreas**: This gland secretes two hormones **insulin** and **glucagon** which help in the metabolism of glucose in our body. Hyposcretion of insulin causes **diabetes mellitus** in which glucose is present in excess in the blood.
INTEXT QUESTIONS 23.6

1. Fill in the blanks:
   (i) A hormone is transported by the .......... to the target organ.
   (ii) Hypoactivity of thyroid gland causes .......... leading to cretinism in young children.
   (iii) Pancreas secretes two hormones, which help in the .......... of glucose in our body.

2. Each of the following statements has one correct response. Please choose the correct option and encircle it.
   (i) If a pathologist were to collect a hormone, where would it be collected from?
      (a) Blood           (b) Brain
      (c) Specific endocrine gland  (d) Any part of the body
   (ii) Hyperactivity of the pituitary gland causes:
      (a) Dwarfism        (b) Gigantism
      (c) Cushing’s disease   (d) Cretinism.
   (iii) The neurons that carry impulses from sense organs to the brain or spinal cord are:
      (a) Sensory neuron    (b) Motor neuron
      (c) Association neuron  (d) Connecting neuron
   (iv) The parts of a reflex are connected to:
      (a) Brain           (b) Spinal cord
      (c) Both brain and spinal cord  (d) A synapse
   (v) Two neurons are connected to each other through:
      (a) Their axons    (b) Their dendrons
      (c) The dendrites of the first neuron and the dendrites of the second one
      (d) Synapse
   (vi) An axon is:
      (a) A nerve fibre    (b) A bundle of dendrites
      (c) A bundle of nerve fibres  (d) The sheath of a nerve fibre.
   (vii) An individual reported to the neuro-physician with a body temperature much higher than normal. After several investigations, the neuro-
physician diagnosed that a tumor in a specific area of the brain was causing this symptom. Where do you thing the tumor may have been located?
(a) Cerebrum          (b) Cerebellum
(c) Hypothalamus      (d) Diencephalon

(viii) Where is the subconscious mind located?
(a) Thalamus          (b) Hypothalamus
(c) Cerebellum        (d) Cerebrum

(ix) Hyposecretion of insulin causes:
(a) Diabetes          (b) Goitre
(c) Cretinism         (d) Gigantism

(x) Which part of our brain helps in maintaining the balance of our body?
(a) Cerebrum          (b) Cerebellum
(c) Medulla           (d) Hypothalamus

(xi) Sudha likes to sleep in and someone always has to wake her up in the morning. However, during exams she is able to get up without an alarm or any other help. Which part of the nervous system helps her to deal with this situation?

Sleep in- sleeping beyond waking hours
(a) Parasympathetic nervous system (b) Medulla
(c) Sympathetic nervous system      (d) Cerebrum

WHAT YOU HAVE LEARNT

- Nervous system and endocrine system are the two systems that control and coordinate various functions in the body.
- The human nervous system is studied under two divisions: The central nervous system and the peripheral nervous system.
- The central nervous system consists of brain and the spinal cord while the peripheral nervous system is further divided into somatic nervous system and autonomic nervous system.
- The autonomic nervous system has two parts – sympathetic and parasympathetic, which cause physical reactions opposite to each other.
• The neuron is the basic unit of nervous system. There are three types of neurons – sensory, motor and association or connecting neurons.

• A synapse is the function of the branches of the axon of one neuron with the dendrites of another neuron. It is here that the transfer of nerve impulse from one neuron to another neuron takes place.

• The reflex action is defined as a spontaneous, automatic and the mechanical response to a stimulus controlled by the spinal cord without involvement of the brain.

• The pathway followed by sensory and motor neurons in a reflex action is called reflex arc.

• Our body has a number of endocrine glands which produce chemical secretions called hormones.

• These hormones are carried by blood to the target organ situated elsewhere in the body to stimulate a specific activity.

• Pituitary gland plays an important role in the growth of the child from puberty to the reproductive maturity, i.e. upto the age of adolescence.

• Pituitary glands secrete many hormones which influence the development of secondary sexual characters among boys and girls. These hormones stimulate the production of eggs and sperms from ovaries and testes respectively. These hormones have profound influence on the behaviour as well as body shape, turning the child into an adult.

• Under secretion of thyroid gland cause cretinism and goitre.

• Pancreas secrete two hormones – the insulin and glucagon, which help in the metabolism of glucose in the body.

TERMINAL EXERCISES

A. Tick the correct answer of the followings

1. The three protective coverings over the brain also called:
   (A) Membranes     (B) Layers
   (C) Meninges     (D) Sheaths

2. Which part of the brain controls the body temperature?
   (A) Cerebrum     (B) Cerebellum
   (C) Hypothalamus     (D) Medulla oblongata
3. The spinal cord is extended from the medulla up to the whole length of the vertebral column and lies within the:
   (A) Neural canal  (B) Vertebral canal
   (C) Spinal canal  (D) Eustachian canal

4. Which one of the following hormones is secreted by the pancreas?
   (A) Prolactin  (B) Thyroxin
   (C) Adrenalin  (D) Insulin

B. **Answer briefly:**

1. What is the nature of the membranes covering the brain? What is the name of the fluid that fills the space between these membranes? What is its role?

2. Describe the three regions of the brain.

3. Differentiate between the following pairs of terms:
   (i) Sensory nerve and motor nerve
   (ii) Cerebrum and cerebellum.
   (iii) Sympathetic and parasympathetic nervous system

4. Define the following terms:
   (i) Receptor
   (ii) Synapse
   (iii) Hormone
   (iv) Neuron
   (v) Impulse
   (vi) Stimulus
   (vii) Effector

5. Given below is a table regarding various hormones secreted by the pituitary gland, and functions of these secretions. Fill in the blanks (1 to 4);

<table>
<thead>
<tr>
<th>Hormones secreted</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somatotropic hormone</td>
<td>(1)_____________________________</td>
</tr>
</tbody>
</table>

                                    (2)_____________________________ Helps in the metabolism of glucose in our body

   | Thyroid hormone      |                      (3)_____________________________ |

                                    (4)_____________________________ In males it stimulates the secretion of testosterone.
6. Imagine that you did not score good marks in your science exam. Do you:
   (a) tear the mark sheet and not let your parents know about it?
   (b) decide that you are not a good student and cannot study science any further?
   (c) discuss your mistakes with the teacher and ask for help from the teacher or another student who has done well and is willing to help you?

Please choose one of the three options above and provide two reasons for your choice.

7. Imagine that you have gone out with three friends. One of them starts smoking and offers the cigarette to the rest of you. One of your friends accepts the offer hesitantly and also encourages you to try smoking. One amongst you refuses to smoke and says that he did not know that he was in bad company. This person leaves the group in a huff. You also do not want to smoke but at the same time you have been friends with this group for many years now and would like to continue your friendship.

Please describe in 2-4 sentences how you will communicate with your friends in an attempt to save your friendship without accepting their offer to smoke.

Please note: There is no single correct answer. The learner needs to demonstrate use of assertive communication skills.

8. After a week, you go out again with the two friends who had asked you to try smoking a cigarette. This time they tell you that it is smart or stylish to smoke and in order to be part of the group, you should also smoke. Would you like to continue/not continue being friends with them?

Please state your decision and provide at least two reasons for your decision.

Please note: There is no single correct answer. The purpose of this activity is to enable the learner to appreciate that friends never pressurize to do things that someone is uncomfortable with. The learner also needs to realize that exploitative relationships, including friendships should be terminated.

9. When a barefoot person accidentally steps on a pin, what will be her/his immediate response? Explain how this reaction is processed by the nervous system?

10. Give one function performed by each of the following:
   1. Cerebrum
   2. Cerebellum
   3. Hypothalamus
   4. Medulla oblongata
   5. Cerebrospinal fluid
ANSWERS TO INTEXT QUESTIONS

23.1
1. There is no single correct answer. There may be diverse examples. For instance, in farming, a group of people till the land, another group sows the seeds, someone else takes care of the crops and only then everyone enjoys the bounty of a good harvest.

2. Secretion of digestive juices

23.2
1. (b) Neuron

2. The sequence should be: ii, iii, i, iv, v

3. A stimulus is an agent or an environmental change which can initiate a response in the body. The stimuli can be of several types. It could be physical (touch, prick, pressure), auditory, chemical, radiant (light), heat or cold, or electrical.

23.3
1. (i) Brain and spinal cord
   (ii) Intelligence and consciousness
   (iii) Balance
   (iv) Medulla/medulla oblongata
   (v) Gray matter, white matter

23.4
1. Natural reflex and conditioned reflex.


3. Correct response has been provided in italics for the column on ‘Appropriate Action.’ However, there is no single correct reason for the choice that the learner makes. The evaluator needs to keep in mind that the learner is providing logical reasons for their choice.
Control and Coordination

### Notes

<table>
<thead>
<tr>
<th>Situation</th>
<th>Appropriate action voluntary action or reflex</th>
<th>Reason for your choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>You need to immediately stop your bicycle as a speeding motorbike comes in front of your bicycle.</td>
<td><em>Reflex Action</em></td>
<td>It is an emergency and there is no time to process information through the central nervous system.</td>
</tr>
<tr>
<td>You have scored good marks in all the subjects in class X and now need to choose between science and commerce stream. Your family feels you should study science while you like numbers and would like to study commerce.</td>
<td><em>Well thought out voluntary action</em></td>
<td>As the learner will have to live with the subject/ career choice that she/he makes, it is important to give priority to their individual choice. This decision should not be made impulsively.</td>
</tr>
<tr>
<td>You are cleaning your cupboard, a sharp needle pokes you and you remove your hand immediately.</td>
<td><em>Reflex Action</em></td>
<td>It is an emergency and there is no time to process information through the central nervous system.</td>
</tr>
<tr>
<td>You have moved to a new neighborhood and are trying to make new friends.</td>
<td><em>Well thought out voluntary action</em></td>
<td>It is important to choose friends who care for you and wish you well. Hence, it has to be a well thought out action.</td>
</tr>
</tbody>
</table>

23.5

1. 12 pairs

2. Sympathetic and parasympathetic

23.6

Answers to Question I

1. Blood

2. Goitre

3. Metabolism

Answers to Question II

i-(a); ii-(c); iii-(a); iv-(c); v-(d); vi-(d);

vii-(c); viii-(d); ix-(a); x-(b); xi (c)
बहादुर

आपने कम उम्र के अनेक लड़के-लड़कियों को कारखानों, चाय की दुकानों या फिर घरों में काम करते देखा होगा। आपकी इच्छा होती होगी कि उनके विषय में कुछ जानें, जैसे- वे कहाँ से आए हैं? क्यों आए हैं? कैसे रहते हैं? उनके साथ कौन सा व्यवहार किया जाता है? विभिन्न परिस्थितियों का सामना वे कैसे करते हैं? समय है कि इस विषय में आपके भी कुछ अनुभव हों।

बहादुर एक ऐसे किशोर की कहानी है, जो अपने घर से भागकर शहर आता है। वह कई घर में नौकरी करने लगता है। वह अपना काम पूरी इमानदारी और लगाने से करता है, लेकिन एक दिन अंखानक वह इस घर से भी भाग जाता है। वह ऐसा क्यों करता है – आइए, जानें।

उद्देश्य

इस पाठ को पढ़ने के बाद आप
- बहादुर के घर से भागने के मनोवैज्ञानिक कारण स्पष्ट कर सकेंगे;
- व्यक्तिगत, विशेषता: किशोरों पर सामाजिक परिवेश के दबाव को समझ सकेंगे;
- विभिन्न परिस्थितियों वाले दो किशोरों के व्यवहार में अंतर स्पष्ट कर सकेंगे;
- बहादुर के निर्देश परिवार के प्रतिकृत व्यक्ति के व्यवहार पर कारण स्पष्ट टिप्पणी कर सकेंगे;
- बहादुर के नौकरी छोड़कर भाग जाने के बाद समी के पछतावे का कारण बता सकेंगे;
# 1.1 मूल पाठ

आइए, इस कहानी को एक बार ध्यान से पढ़ लें। आपकी सहायता के लिए कहानी में आए कथित शब्दों के अर्थ ध्यान से पढ़ जा रहे हैं।

**बहादुर**

सहसा में काफी गंभीर हो गया था, जैसा कि उस व्यक्ति को हो जाना चाहिए, जिस पर एक भारी दायित्व आ गया हो। वह सामने खड़ा था और आँखों को बुरी तरह मलका रहा था। बार-बार दर्शन की उम्र। दिग्न चकित शरीर, गोरा रंग और चपता मुँह। वह सफ़ेद नेकर, आँखें बूढ़ी सफ़ेद कमीज़ और भूरे रंग का पुराना जुता पहनते थे। उसके गले में एकसातों की तरह एक समान बंध़ था। उसको बंधकर परिचाल के अन्य लोग खड़े थे। निमला बचपनी दृष्टि से कमी लड़के को देखती और कभी मुसको और अपने भाई को। निश्चय ही वह पुंछ बराबर हो गई थी।

उसको लेकर मेरे साले साहब आए थे। नौकर रखना कई कारणों से बहुत जरूरी हो गया था। मेरे सभी भाई और रिश्तेदार अच्छे ओहदें पर थे और उन सभी के यहाँ नौकर थे। मैं जब बहान की शादी में घर गया, तो वहाँ नौकरों का सुख देखा। मेरी दोनों भाभियों रानी की तरह बैठकर चर्चापत्रों तोड़ती थी, जबकि निमला को सबसे से लेकर रात तक खटना पड़ता था। मैं ईंडी में जल गया। इसके बाद नौकरी पर वापस आया, तो निमला दोनों जून ‘नौकर-चाकर’ की माला जपने लगी। उसकी तरह अभावित और दुखिया रही और वो कोई इस दुनिया में होगी? वे लोग दूसरे होते हैं, जिनके भाषा में नौकर का सुख होता है।

पहले साले साहब से उसका किस्सा सुनना पड़ा। वह एक नेपाली था, जिसका गाँव नेपाल और दिल्ली की सीमा पर था। उसका बाप युद्ध में मारा गया था और उसकी माँ सारे परिवार का भरण-पोषण करती थी। माँ उसकी बड़ी गुरुसल थी और उसको बहुत मारती थी। माँ चाहती थी कि लड़का घर के काम-धाम में हाथ बटाए, जबकि वह पहड़ या लंगलों में निकल जाता और पेड़ों पर बढ़कर चिढ़ों के घोंसलों में हाथ डालकर उसके बच्चे पकड़ता या फल तोड़-तोड़कर खाता। कमी-कमी वह पशुओं को चाहने के लिए ले जाता था। उसने एक बार उस मैस को बहुत मारा, जिसको उसकी माँ बहुत प्यार करती थी, और इसीलिए उससे वह बहुत चिड़ता था। मार खाकर उसकी माँ-भाई-भाई उसकी माँ के पास चली गई, जो कुछ दूरी पर एक खेत में काम कर रही थी। माँ का माथा उठना। बेचारा बेजबान जानवर चरना छोड़कर यहाँ वो आएगा?

**बहादुर**

- बहादुर जैसे किसी अन्य किशोर के रहन-सहन पर टिपणी कर सके, थे;
- कहानी के मुख्य पात्रों का चरित्र-विचारण कर सके, थे;
- कहानी की भाषा-शैली पर टिपणी कर सके, थे।
बहादुर

जब उसने उसको काफी मारा है। वह गुस्से से पागल हो गई। जब लड़का आया, तो माँ ने बैठी का काल्पनिक अनुमान करके एक झंडे से उसकी दुःखी पिटाई के और उसको वहीं कराहना हुआ छोड़कर घर लौट आई। लड़कों का मन माँ से फट गया और वह रात भर जंगल में छिपा रहा। जब सबसे होने का आया, तो वह घर पहुँचा और किसी तरह अंदर चोरी-चुरीपुर कुपा गया। फिर उसने घर की हैंडिया में हाथ डालकर माँ के रखे रूपयों में से दो रुपए निकाल लिए। अंत में नी-दो ग्यारह हो गया। वहाँ से छह मील की दूरी पर बस स्टेशन था, जहाँ गोरखपुर जाने वाली बस मिलती थी।

तुम्हारा नाम क्या है, जी?—मैंने पूछा।

दिल बहादुर, साबू।

उसके स्वार में एक भीती ज्ञानजनाहर थी। मुझे ठीक-ठीक याद नहीं कि मैंने उसको क्या हिदायते दी। शायद यह कि वह शारार की भोजन कर और इस घर को अपना घर समझे। इस घर में नौकर-चाकर को भहुत प्यार और इज़जत से रखा जाता है। जो सब खाते-पहनते हैं, वही नौकर-चाकर खाते-पहनते हैं। अगर वह यहाँ रह गया तो ठंग-शहर सीख जाएगा, घर के और लड़कों की तरह पढ़-लिख जाएगा और उसकी जिंदगी सुधार जाएगी। निर्मला ने उसी समय कुछ व्यवहारिक उपदेश दे दाले थे। इस मुहल्ले में भहुत तुछु लोग रहते हैं, वह न किसी के यहाँ जाए और न किसी का काम करे। कोई बाबाजी से कुछ लाने को कहे, तो वह 'अभी आता हूँ' कहकर अंदर खिसक जाए। उसको घर के सभी लोगों से समभाव और तमीज से बोलना चाहिए। और भी भहुत सी बातें। अंत में निर्मला ने भहुत ही उदारतापूर्वक लड़कों के नाम में से 'दिल' शब्द उड़ा दिया।

परंतु, बहादुर भहुत ही हूँसमुख और मेहनती निकला। उसकी बजह से कुछ दिनों तक हमारे घर में वैसा ही उल्लासपूर्वक वालाकरण छाया रहा, जैसा कि प्रथम बार तोता-भना
भारत

या पिल्ला पालने पर होता है। सबसे - सबसे ही मुहल्ले के छोटे-छोटे लड़के घर के अंदर आकर खड़े हो जाते और उसको देखकर हँसते या तरह-तरह के प्रसन करते। “ऐ, तुम लोग छिपकली को क्या कहते हो?” – “ऐ, तुमने क्या देखा है?” – ऐसी ही बातें। उससे पहाड़ी गाने की फरमाइशों की जातीं। घर के लोग भी उससे इसी प्रकार की छेड़छाड़ करते थे। वह सितारा उत्तर देता, उससे अविक हँसता था। सबक उसके खाने और नाश की बड़ी फिक्र रहती।

निम्नलिखित आंगन में खड़े होकर पड़ोसियों को सुनाते हुए कहती थी – भारत, आकर नाश क्यों नहीं कर लेते? मैं दूसरी औरतों की तरह नहीं हूँ, जो नौकर-वाकर को तल्ली-भूती हैं। मैं तो नौकर-वाकर को अपने बच्चों की तरह रखती हूँ। उन्होंने तो साफ-सफाई कह दिया है कि सौ-डेढ़ सो महानवारी उस पर भरे ही ख़ाब हो जाए, पर तल्लीफ उसको जरा भी नहीं होनी चाहिए। एक नौकर-कमीज़ तो उसी रोज़ लाए थे…और भी कपड़े बन रहे हैं…

धीरे-धीरे वह घर के सारे काम करने लगा। सबसे ही उठकर वह बाहर नीम के पेड़ से दाँते तोड़ लाता था। वह हाथ का सहारा लिए बिना कुछ दूर तक तांगे पर दोहों हुए चढ़ जाता। मिनट भर में वह पेड़ की तलीनौकर-वाकर कहार थी – अंरे रोश-रोश की जाता, कहीं गिर गया तो बड़ा बुरा होगा। वह घर की सफाई करता, कभी में पौंछ लगाता, अंगीठी जलाता, चाय बनाता और पिलाता। दोपहर में कपड़े धोता और बर्तन मलता। वह रसोई बनवाने की भी फिक्र करता, पर निम्नलिखित सच्ची और रोटी बनाती। निम्नलिखित की उसको बहुत फिक्र रहती थी। उसकी उन दिनों की बीयत ठीक नहीं रहती थी, इसलिए वह कुछ दवा ले रही थी। भारत उसको कोई काम करते-देखकर कहता था – माता जी, मेहनत न करो, तल्लीफ बढ़ जाएगा। वह कोई भी काम करता होता, समय होने पर हाथ धोकर मातू की तरह दौड़ता हुआ करते थे जाता और दवाई का ढिब्बा निम्नलिखित के सामने लाकर रख देता।

जब मैं शाम को दफ्तर से आता, तो घर के समी लोग मेरे पास आकर दिन भर के अपने अनुभव सुनाते थे। बाद में वह भी आता था। वह एक बार मेरी ओर देखकर झर बूका लेता और धीरे-धीरे मुस्किलने लगता। वह किसी बहुत ही मामूली घटना की रिपोर्ट देता। बाबू जी, बहिन जी का एक सहीली आया था या बाबू जी, मैया सिनेमा गया था। उसके बाद वह इस तरह हँसते हुए लगता, निराश होते ही मजेदार बात कर दी हो। मैं उससे बातचीत करना चाहता था, पर ऐसी इच्छा रहते हुए भी मैं जान-बूझकर बहुत गंभीर हो जाता था और दूसरी ओर देखने लगता था।

निम्नलिखित कभी-कभी उससे पूछती थी – भारत, तुमको अपनी माँ की याद आती है?
- नहीं।
- क्यों?
- वह मारता क्यों था?—इतना कहकर वह खूब हँसता था, जैसे मार खाना खुशी की बात हो।
- तब तुम अपना पैसा माँ के पास कैसे मेंजने को कहते हो?
- माँ-बाप का कर्ज़ा तो जन्म भर भरा जाता है — वह और भी हँसता था।

निर्मला ने उसको एक फटी-पुरानी दरी दे दी थी। घर से वह एक चादर भी ले आया था। रात को काम-धाम करने के बाद वह भीतर के बरामदे में एक दूधी हुई बंसखट पर अपना बिस्तर बिछाता था। वह बिस्तर पर बैठ जाता और जब में से कपड़े का एक गोल-शी नेपाली टोपी निकलकर पहन लेता, जो बाई और काफी झुकी रहती थी। फिर वह एक छोटा-सा आईना निकलकर बंदर की तरह उसमें अपना मूंह देखता था। वह बहुत ही प्रसन्न नज़र आता था। इसके बाद कुछ और भी चीज़ें उसकी जेब से निकलकर उसके दादारे पर सज जाती थीं — कुछ गोलियों, पुराने ताश की एक गड्ड़ी, कुछ खूबसूरत पत्ती के टुकड़े, ब्लैंड, कागज की नापें। वह कुछ देर तक उनसे खेलता था। उसके बाद वह धीमे-धीमे स्वर में गुस्सागुस्सा लगता था। उन पहाड़ी गाँवों का अर्थ हम समझ नहीं पाते थे, पर उनकी मौली उदासी सारे घर में फैल जाती, जैसे कोई पहाड़ की निर्मितियाँ में अपने किसी बिछुड़े हुए साथी को बुला रहा हो।

दिन में में बीतते लगे। बससत आ गई थी। पानी रुकता था और बससत था। मैं अपने को बहुत ठीचा महसूस करते लगा था। अपने परिवार और संबंधियों के बड़ा पता तथा शान-बान भी मुझे सदा गर्व रहा है। अब मैं मुहल्ले के लोगों को पहले से भी लुब्ध समझते लगा। मैं किसी से लीखे मूंह बात न करता। किसी की ओर ठीक से देखता भी नहीं था। दूसरे के बच्चों को मामूली-सी शारारत पर डॉट-डॉट देता था। कई बार पड़ोसियों को भूला चुका था — जिसके पास कलेजा है, वहीं आजकल नौकर रख
सकता है। घर के सवाग की तरह रहता है। निर्मला भी आमे गहरे में शिम सूचना दे आई थी – आगे नहा तो नीकर पर ही खड़ी हो रही है, पर सपाट-पेसा कमाया किसलाइ हाल है? ये तो कई बार कह ही चुके थे कि तुझ्ये लिए नूनिया के किसी कोने से नीकर जल्द लांगांवा... वही हुआ।

निरसंदेह, बहादुर की बजह से सबको बहुत आराम मिल रहा था। घर खाब सफ़े और चिंतक करता। कपड़े चमायम सफंदे। निर्मला का तब्बिया भी काफी सुन्दर गई थी। अब कोई एक खर भी न तकसाता था। किसी को मामूली काम करना होता, तो तो बहादुर को आवश्यकता – “बहादुर, एक गिलास पानी...”, “बहादुर पैंसिल नीचे गिरी है, उठाओ।” इसी तरह की फरमाइशों! बहादुर घर में फिरकी की तरह नावता रहता। सभी रात में पहले ही सो जाते थे और सबसे अंद से कह जाते न उठते थे।

मेंरा बड़ा लड़का किशोर काफी शान-शोकत कुछ और 'रीढ़-दाब' से रहने का कायल था और उसके ही पल्ले के अनुसार उसने बहादुर को अपने कड़े एक नजर में रखने की आवश्यकता महसूस कर ली थी। कहता: उसने अपने सभी काम बहादुर को सीप दिए। सबेरे उसके जुते में पालिश लगानी चाहिए। कोलेज जाने के थिंक पहले साइकिल की सफाई जरूरी थी। जोर ही उसके कपड़े की थुलाई और इतनी होनी चाहिए। और रात में सोंत हम जाने तलाय बहादुर से अपने शरीर की मालिका करता और मुक्की भी लगाता। इसी सारी फरमाइशों की पूर्ती में कभी-कभी कोई गड़बड़ी भी हो जाती। जब ऐसा होता, किशोर गर्जन-तर्जन करने लगता, उसको बुरी-बुरी गालियों देता और उस पर हाथ छोड़ देता। मार खाकर बहादुर एक कोने में खड़ा हो जाता – चुपचाप।

'देख बें – किशोर बेतावनी देवी – मेंरा काम सबसे पहले होना चाहिए। अगर कभी भी छूटा, तो मारते-मारते हुलिया टाइट कर दूंगा। साला, कामचोर, कार्य क्या है तव? बैठ-बैठा खाता है।

रोज ही कोई-न-कोई ऐसी बात होने लगी, जिसकी रिपोर्ट पत्नी मुझे देती थी। मेंरे किशोर को मना किया, पर वह नही माना, तो मेंरे यह साॅकर छोड़ दिया कि थोड़ा बहुत तो यह चलता ही रहता है। किसे एक हाथ से ताली कहीं बजती है? बहादुर भी बदमाशी करता होगा। पर, एक दिन जब मैं दफ्तर से आया, तो मेंरे किशोर को एक दंडे से बहादुर की पिटाई करते हुए देखा। निर्मला कुछ दूरी पर खड़ी 'हाँ-हाँ' कहती हुई मना कर रही थी।

मेंरे किशोर को डॉक्टर अलग किया। करण यह था कि शाम को साइकिल की सफाई करना बहादुर भूल गया था। किशोर ने उसको मारा तथा गालियों दी तो उसने उसका काम करने से इन्कार कर दिया।

तम साइकिल सफ़ा कहीं नहीं करते? – मेंरे भी काम कर खड़ा किया? – वह रोते हुए बोला।
भदरुर

मैं जानता था कि किशोर उसको और भी भदरी गालियाँ देता था, लेकिन आज उसने 'सुमुख का बवचा' कहा था, जो उसे बदरादाट न हुआ। निस्संदेह वह गालियाँ उसके बाप पर पड़ी थी। मुझे कुछ ही से आ गई। खैर, किशोर के व्यवहार को अच्छा नहीं कहा जा सकता, पर गृहस्वामी होने के कारण मुझे पर कुछ और गंभीर दायित्व भी थे।

मैंने उसे समझाया – भदरुर, ये आदंते ठीक नहीं। तुम ठीक से काम करोगे, तो तुमको कोई कुछ भी नहीं कहेगा। मेहनत बहुत अच्छी चीज है, जो उससे बचने की कोशिश करता है, वह कुछ भी नहीं कर सकता। रत्नान-फूलना मुझे सख्त नापसंद है। तुम तो घर के लड़के की तरह हो। घर के लड़के मार नहीं खाते? हम तुमको जिस सुख-आराम से रखते हैं, वह कोई क्या रखेगा? जाकर दूसरे घरों में देखो, तो पता लगे। नौकर-बाकर भर्पेट मोजन के लिए तरसते रहते हैं। बल्कि, सब खुश हुआ, अब काम-धाम करो...

वह युगाप सुनता रहा। फिर हाथ-मुंह धोकर काम करने लगा। जल्दी ही वह प्रसन्न भी हो गया। रात में सोते समय वह अपनी टोपी पहनकर देख तक गता रहा।

लेकिन कुछ दिनों बाद एक और गडबड़ी शुरू हुई। निर्मला बहुत पतली-पतली रोटियाँ सेकती थी, इसलिए वह रोटी बनाने का काम कभी भदरुर से नहीं लेती थी, लेकिन मुहल्ले की किसी औरत ने उसे यह सिखा दिया जिसे परीक्षा के लिए रोटियाँ बनतीं। बाद वह भदरुर से कहा कि वह अपनी रोटी खुद बना लिया करे, नहीं तो नौकर-बाकर की आदत खराब हो जाती है, महिला खाने से उनकी आदत बिगड़ जाती है।

यह बात निर्मला को जज मान गई थी और रात में उसने ऐसा ही प्रयोग किया। वह अपनी रोटियों बनाकर चौंकिये में से उठ गई। भदरुर का मुंह उतट गया। वह चूले के पास सिर झुककर युगाप खड़ा रहा।

- क्या हो गया रे? – निर्मला ने पूछा।

- चल, युगाप बना अपनी रोटियाँ। तू सोचता है कि मैं तुझे पतली-पतली, नरम-नरम रोटियाँ सेककर खिलाऊँगी? तु कोई घर का लड़का हैं? नौकर-बाकर तो अपना बनाकर खाते ही रहते हैं। तू तो इसको इसलिए लग रहा है कि तु सारे घर के लिए मैंने रोटियाँ बनाई, इसको अलग करके इसके साथ में बनो रखा किया? वह रे, इसके पैट में ही लंबी दाढ़ी है! समझ जा, रोटियाँ नहीं सेकेंगा, तो भूखा रहेगा।

पर, भदरुर उसी तरह खड़ा रहा, तो निर्मला का गुस्से से बुरा हाल हो गया। उसने लपककर उसके माथ पर दो-तीन थप-थप उड़ दिए – सूफ़ कहीं के! इसीलिए किशोर तुझे मारता है। इसी वजह से तेरी माँ भी मारती होगी। चल, बना रोटी...

भदरी – गांव वरदास्त – सहन
गुहारमी – घर का मालिक महिला खाना – अच्छा खाना;
रफून लोगों का भोजन
चुप उतरना – उदास हो जाना
चौका – रोसाउँ
शरीफ़ दिखना, लेकिन
वास्तव में चालाक होना

हिंदी
बहादुर

- मैं नहीं बनाऊँगा... मेरी माँ भी सारे घर की रोटियाँ बनाकर मुझसे रोटी सेवकता थी—वह रोने लगा था।

- तो क्या मैं तेरी माँ हूँ कि तू मुझसे जिज्ञासा कर रहा है? घर के लोगों के बराबर बन रहा है? मारते-मारते मुझे डंपर डूंगी।

पर, उसने अपने लिए रोटी नहीं बनाई। मुझे भी बड़ा गुस्सा आया। मैंने उसको ठींटा और समझाया। पर वह नहीं माना। रात भर वह भूखा ही रहा।

पर, सबसे उत्कार वह पहले की तरह ही हंसने लगा। उसने अंगैटी जलाकर अपने लिए रोटियाँ सेकी। अपनी बनाई मोटी और भद्री रोटी को देखकर वह खिलखिलाने लगा। फिर रात की बांची तुलिय मे सब्जी से उसने खाना खा लिया।

लेकिन निर्मला का भी हाथ खुल गया था। वह उससे कुछ चिप्स भी गई थी। अब बहादुर से कोई भी गलती होती, तो वह उस पर हाथ चला देती। उसको मारने वाले अब घर में दो व्यक्ति हो गए थे और कमी-कमी एक गलती के लिए उसको दोनों मारते।

बरसात बीत गई थी। आकाश दरण की तरह सब्च दिखाई देता। मैंने बहादुर की माँ के पास बिठायी लिखी थी कि उसका लड़का मेरे पास मजे में है और मैं उसकी तनखाब के पैसे उसके पास मैज दिया करूँगा, लेकिन कई महीने के बाद भी उसके साथ नहीं जाया था। मैंने बहादुर से कह दिया था कि उसका पैसा यहाँ जमा रहेगा, जब घर जाएगा, तो लेता जाएगा।

पर, अब बहादुर से भूल-गलतियाँ अधिक होने लगी थीं। शायद इसका कारण मार-पीट और गलती-गलतियाँ हो। मैं कमी-कमी इसको रोकना चाहता, फिर यह साँचकर चुप लगा जाता कि नौकर-वाकर तो मार-पीट खाते ही रहते हैं।

एक दिन रविवार को मेरी पतली के एक रिश्तेदार आए। वे बीवी-वच्चे के साथ थे। वे अपने किसी खास संबंधी के यहाँ आए थे, तो यहाँ भी मेरे-मुलाकात करने के लिए चले आए थे। घर में बड़ी चहल-पहल मच गई। मैं बाजार से रोहू मछली और दहरादूरी चालू ले आया। नाशो-पानी के बाद बातों की जलबी छनने लगी। पर इसी समय एक घटना हो गई।

अधानक उस रिश्तेदार की पतली नौचे फर्श पर झुककर देखने लगी। फिर उसने चारपाई के अंदर झूककर देखा। अंत में कमरे के अंदर चली गई और फर्श पर पड़े हुए कागज़ों को उठाकर जीव-पड़ताल करने लगी।
— क्या बात है?—मैंने पूछा।
रिश्तेदार की पत्नी जबरदस्ती मुसकराकर मजबूरी में सिर हिलाते हुए बोली — क्या बताएँगा ... ग्यारह रुपए साड़ी के खूंट से निकालकर यहाँ चारपाई पर रखे थे... पर वे मिल नहीं रहे हैं ...
आपको ठीक याद है न...
— हां-हां। खूब अच्छी तरह याद है। ये रुपए मैंने खूंट में बूंढकर रखे थे... रिश्तेदार को देने के लिए खूंट खोला ही था, फिर वे रुपए चारपाई पर रख दिए थे कि चार रुपए की मिठाई मैंना खूंटी और कुछ बच्चों के हाथ पर रख दूंगी। रास्ते में कोई तंग की दुःखनाथ ही मिली थी, नहीं तो उठरा से ही लाती। किसी के यहाँ खाती हाथ जाने में अच्छा नहीं लगता। बताएँगा, अब तो मैं कहीं की न रही। फिर मेरी ओर शुककर धीमे स्वर में कहा था — जरा उससे पूछिए न। वह झर आया था। कुछ देर तक वह यहाँ खड़ा रहा, फिर तेजी से बाहर चला गया था।
— अरे नहीं, वह ऐसा नहीं है — मैंने कहा।
— यू दू नॉट नो, दीज पीपुल आर एक्सपर्ट्स इन दिस आर्ट — रिश्तेदार ने कहा। मैंने बहादूर की ओर तिरस्कृ दृष्टि से देखा। वह सिर शुककर आटा खूंट रहा था। उसके चेहरे पर संतुष्टि एवं प्रसन्नता थी। उसने ऐसा कहा कि कभी नहीं किया, बल्कि जब कभी उसने दो-चार बार आने इधर-उधर पड़े देखकर उठाने का हाथ में दे दिया था। पर, किसी के दिल की बात कोई उसे जान सकता है? न मानसून अचानक मुझे क्या हो गया और मैं गुस्से में आ गया।
— बहादूर! मैंने कहीं स्वर में पूछा।
— जी, बाबू जी।
— इधर आओ।
वह आकर खड़ा हो गया।
— तुमने यहाँ से रुपए उठाए थे?
— जी नहीं, बाबू जी — उसने निर्मय उठाया।
— ठीक बताओ... मैं बुरा नहीं मानूगा।
बहादुर

- नहीं बाबू जी। मैं लेता, तो बता देता।
- तुम यहाँ खड़े नहीं थे? — रिस्तेदार की पत्नी ने कहा — फिर तेज़ी से बाहर चले गए थे। देखो मैं भैया, सब-सब बता दो। मिलाई खूंटीदेने और बच्चों को देने के लिए ये रुपए रखे थे। मैं तो बुरी फँसी। अब वापस जाने के लिए रिक्षा के भी पैसे नहीं।
- मैं तो बाहर नमक लेने गया था।
- सब-सब बता बहादुर ! अगर नहीं बताएगा, तो बहुत पीतूंगा और पुलिस के सुपुर्द कर दूंगा। मैं चिल्ला पड़ा।
- मैं नहीं लिया बाबू जी, — बहादुर का मूंह काला पड़ गया।

पता नहीं मुझे क्या हो गया। मैंने सहसा उछलकर उसके गाल पर एक तमामा जड़ दिया। मैं आशा कर रहा था कि ऐसा करने से वह बता देगा। तमामा खाकर वह गिरते-गिरते बचा। उसकी आँखों से औरू गिरने लगे।

- मैं नहीं लिया...

इसी समय रिस्तेदार साहब ने एक अजीब हरकत की — अच्छा छोड़कर, इसकी पुलिस के पास ले जाता हूं। इतना कहकर उन्होंने बहादुर का हथ पकड़ लिया और उसको दरवाज़े की ओर घसीटकर ले गए। पर, दरवाज़े के पास उससे धीरे से बोले — देखो, तुम मुझे बता दो...मैं कुछ नहीं कहता, बल्कि तुम्हें ईमान में दो रुपए दे दूंगा।

पर, बहादुर ने इनकार कर दिया। इसके बाद रिस्तेदार साहब दो-तीन बार उसको दरवाज़े की ओर खींचकर ले गए, जैसे पुलिस को देने ही जा रहे हैं। लेकिन आगे बढ़कर वे रुक जाते और उससे धीमे-धीमे शब्दों में पूछ-ताछ करते लगते।

अंत में हाफ़र उन्होंने उसको छोड़ दिया और वापस आकर चारपाई पर बैठते हुए हंसकर बोले — जाने दोजिए...ये सब बड़े धांधे होते हैं। किसी झाड़ी-बाड़ी में छिपा आया होगा या जमीन में गाढ़ आया होगा। मैं तो इन सबों को छूट जानता हूं। भालू-बंदर से कम थोड़े होते हैं ये। चालिए, इतना नुकसान लिया था।

इसके बाद निर्माना ने भी उसको दराया-धमकाया और दो-चार तमामे जड़ दिए, पर वह 'नहीं-नहीं' करता रहा।

इस घटना के बाद बहादुर काफी डॉट-मार खाने लगा। घर के सभी लोग उसको कुत्ते की तरह दुरुस्तरा करते। किशोर तो जैसे उसकी जान के पीछे पड़ गया था। वह उदास रहते लगा और काम में लापरवाही करते लगा।
बहादुर

एक दिन में दप्तर से दिलंब से आया। निर्मला ऑगन में चुपचाप सिर पर हाथ रखकर बैठी थी। अन्य लड़कों का पता नहीं था, केवल लड़की अपनी मां के पास खड़ी थी। अंगीठी अभी जाली नहीं थी। ऑगन गंदा पड़ा था। बल्ला बिना मले हुए रखे थे। सारा घर जैसे काट रहा था।

- क्या बात है? – मैंने पूछा।
- बहादुर भाग गया।
- भाग गया! क्यों?
- पता नहीं! आज तो कुछ हुआ भी नहीं था। सबेरे से ही बड़ा प्रसन्न था। बाराबर माता जी-माता जी पढ़ कर जा रहा था। दीपावली में खाना खाया। उसके बाद ऑगन से सिल-बड़टा लेकर बरामदे में रखने जा रहा था कि फिर हाथ से हटकर मिर गईं और दो टोकड़े हो गईं। शायद इसी डर से वह भाग गया कि लोग मारे। पर, मैं इसके लिए उसको ठोंड़े कुछ कहती? क्या वताउँ, मेरी किस्मत में आराम ही नहीं...

- कुछ ले गया?
- यही तो अफसोस है। कोई भी सामान नहीं ले गया है। उसके कपड़े, उसका वस्त्र, उसके जूते – सभी छोड़ गया है। पता नहीं उसने हमें क्या समझा? अगर वह कहता, तो मैं उसे रोकती थोड़े। क्यों उसको खूब अच्छी तरह पहना-ओढ़कर भेजती, हाथ में उसकी तनख़ाह के रुपए रख देती। दो-चार रुपए और अधिक दे देती। पर वह तो कुछ ले ही नहीं गया।

- और वे ग्यारह रुपए?
- अरे, वह सब झुठ है। मैं तो पहले ही जानती थी कि वे लोग बच्चों को कुछ देना नहीं चाहते, इसलिए अपनी गलती और लाज छिपाने के लिए यह प्रचंड रच रहे हैं। उन लोगों को क्या मैं जानती नहीं? कभी उनके रुपए रास्ते में गुम हो जाते हैं... कभी वे गलती से हार ही पर छोड़ आते हैं। मेरे कलेजों में तो जैसे कुछ हीड़ रहा है। किशोर को भी बड़ा अफसोस है। उसने सारा शहर छान मारा, पर बहादुर।
बहादुर

नहीं मिला। किशोर आकर कहने लगा—अम्मा, एक बार भी अगर बहादुर आ जाता तो मैं उसको फकड़ लेता और कभी जाने न देता। उससे माफ़ी मांग लेता और कभी नहीं मारता। सच, अब ऐसा नींदक कभी नहीं मिलेगा। कितना आराम दे गया यह। अगर वह कुछ चुराकर ले गया होता, तो संतोष हो जाता...

निर्मला और तैयार रखकर रोने लगी। मुझे बड़ा कोढ आया। मैं खिलाना चाहता था, पर भीतर ही भीतर मेरा कलेज़ा जैसे बैठ रहा हो। मैं वहाँ चारपाई पर सिर झुका कर बैठ गया। मुझे एक अजीब-सी लघुता का अनुभव रहा था। यदि मैं न मारता, तो शायद वह न जाता।

मैंने और में नजर दौड़ाई। एक ओर स्टूल पर उसका बिस्तरा रखा था। अलगनी पर उसके कुछ कपड़े टैंगे थे। स्टूल के नीचे वह भूरा जूता था, जो मेरे साले साहब के लड़के का था। मैं उठकर अलगनी के पास गया और उसके नेकर की जेब में हाथ डालकर उसका सामान निकालने लगा—वही गोलिया, पुराने पात्र का गढ़ी, खूबसूरत पत्थर, ब्लेड, काळज की नावें...

— अमरकांत

बोध प्रश्न

सर्वाधिक उपयुक्त विकल्प चुनकर पूछे गए प्रश्नों के उत्तर दीजिए:

1. “माँ-बाप का कर्ज़ा तो जन्म भर भरा जाता है” — यह वाक्य किसका है?
   (क) निर्मला का  (ख) वाणक का  (ग) बहादुर का  (घ) किशोर का

2. “देख बे, मेरा काम सबसे पहले होना चाहिए। अगर एक काम भी छूटा, तो मारनेमाराते हुलिया टाइट कर दूंगा”— यह कथन किसका है?
   (क) बहादुर का  (ख) वाणक का  (घ) किशोर का  (घ) रिस्ते-दार का

3. “महीन खाने से नींदकों की आदत बिगड़ जाती है” — यह बात निर्मला से किसने कही?
   (क) उसके पति ने  (ख) पड़ोसिन ने  (घ) रिस्ते-दार ने  (घ) रिस्ते-दार ने
1.2 आगे समझें

आइए, अब हम इस कहानी को समझने की कोशिश करते हैं। कहानी में मुख्यतः पौंच तत्त्व होते हैं— कथावस्तु, पात्र, संवाद, देशकला या वातावरण और भाषा-शैली। हम इन्हें को ध्यान में रखते हुए इस कहानी की विवेचना करेंगे। कथावस्तु में मुख्य कथा या कहानी के विषय-क्षेत्र का बात की जाती है। समय-समय पर उपस्थित होने वाले पात्रों को समझने का काम पात्र और चरित्र-चित्रण के अंतर्गत किया जाता है। कहानी में पात्र केवल उपस्थित ही नहीं होते। वे अपना व्यक्तित्व साथ लेकर आते हैं। संवाद कहानी का मुख्य अंग होता है। इन्हें से कहानी आगे बढ़ती है और पात्र का व्यक्तित्व भी प्रकट होता है। कहानी की भाषा व शैली नामक तत्त्व के अंतर्गत भाषा एवं प्रस्तुति की शैली का अध्ययन किया जाता है अर्थात् कहानी की भाषा कैसी है? शब्द-चयन कैसा है?

कहानी कहने का तरीका क्या है? देशकला या वातावरण में हम यह समझने का प्रयास करते हैं कि कहानी में किन परिस्थितियों अर्थात् किस समय और परिवेश की बात की गई है।

1.2.1 कथावस्तु

जरा सोचिए, लेखक ने इस कहानी का विषय जीवन के किस हिस्से से उठाया है यानी इसकी कथावस्तु क्या है? हम देखते हैं कि कहानी का एक पात्र यह कहानी सुना रहा है। उसे हम वाचक कहेंगे। उसी ने अपने परिवार और रिश्तेदारों के माध्यम से कम उम्र के घरेलू नौकरों के प्रति मध्यवर्ती का व्यवहार का विचार किया है। हमारी समाज का यह खाता-पीता हिस्सा, जो बहुत अमीर तो नहीं है, लेकिन गरीब भी नहीं है— मध्यवर्ती कहलाता है। वाचक का परिवार मध्यवर्ती है।

हम कह सकते हैं कि वाचक और उसके परिवार द्वारा कहानी के शुरू में बहादुर को सताया नहीं जाता, बल्कि उसकी चिंता की जाती है। यह भी कहा गया है कि इस घर में नौकरों के पाये वस्त्रों की तरह रखा जाता है। बहादुर के अने से घर का महान भी उसाहपूर्ण है। बहादुर की चिंता करने का एक और कारण है, वह है— दूसरों के सामान अपने को बढ़ा-बढ़ाकर दिखाना। इसलिए निर्मला बहादुर के प्रति अपनी चिंता के बारे में लोगों को सुना-सुनाकर बहुत कुछ कहती है।

कहानी शुरू कैसे होती है— इस पर विचार करें, तो पाएंगे कि वाचक अचानक अपने गंभीर हो जाने की बात कहता है, बहादुर का नाम नहीं लेता, उसके लिए ‘यह’ का प्रयोग करता है। फिर, निर्मला की चमकती हुई दृष्टि का उल्लेख करता है। लेखक ने पूरी सुवनाएं देने के स्थान पर केवल यह प्रकार के संकेत दिया क्यों दिएं? इस प्रकार की प्रस्तुति के कारण हम इस कहानी को पढ़ने के लिए प्रेरित होते हैं।
बहादुर

अगले दो अनुच्छेदों में हमें कुछ सूचनाएँ मिलती हैं। ये हमारी कुछ जिज्ञासाओं को शांत करती हैं। जैसे, नौकर रखने की जरूरत क्यों पड़ी? बहादुर कौन है? कहाँ से आया है? क्यों आया है? उसका परिवार कैसा है? आदि। यहाँ पर एक संकेत ऐसा भी है, जिसका विकसित रूप हम कहानी में आगे देखते हैं कि बहादुर की माँ बहुत गुस्सेवाली है। वह बहादुर के काम न करने पर उसे मारती है। बहादुर की माँ मैस के कारण बहादुर को इतना क्यों मारती है? कारण है कि बहादुर काम में सहायता तो नहीं करता, उल्टे उस मैस को भी मारता है, जो परिवार का पालन-पोषण करने में सहायक है। बहादुर बच्चा है, इस बात को समझ नहीं पाता। उसे लगता है कि माँ को उससे ज्यादा मैस प्यारी है। उसे माँ का मारना बहुत कुछ लगता है और वह घर से भाग जाता है।

कहानी में ऐसी स्थिति आगे भी आती हैं। छोटी-छोटी गलतियाँ पर किशोर उसे मारता है। वाचक झूठे रिसेप्टरों के कारण बहादुर की पिटाई करता है। तीनों स्थितियों में बहादुर पिटाई होने के कारण बहुत दुखी होता है।

इस कहानी की तीन घटनाओं से आप भी बहुत दुखी हुए होंगे। इन तीनों का संबंध बहादुर के पिटने से है। कहानी में वाचक के बेटे किशोर के उल्लेख के बाद परिवर्तन तेजी से होने लगता है। उससे पहले सब कुछ ठीक-ठाक दिखाई देता है। वाचक के घर में बहादुर को सवसे पहले किशोर पीटता है। दूसरी घटना वह है, जब निर्मला बहादुर के लिए रोटियाँ बनाना बंद कर देती है। मोहल्ले की किसी महिला ने उसे समझ दिया है कि अभिनव खाने से नौकरों की आदत बिगड़ जाती है। यहाँ पर बहादुर दुसरा अपनी रोटियाँ स्वयं न बनाने पर वह उसे मारती भी है। यहाँ हम एक और संकेत देख सकते हैं, जो बहादुर के इस कथन में निहित है—“मेरी माँ भी सारे घर की रोटियाँ बनाकर मुझे रोटियाँ संकेतवाती थी।” इसका अर्थ है कि बहादुर की माँ उसे मारती भी थी और उसके लिए रोटियाँ भी नहीं बनाती थी, इसलिए वह घर से भागा। यही स्थितियाँ वाचक के घर में भी बन रही हैं, लेकिन अभी बहादुर भागता नहीं है। वह प्रसन्न दिखने को कोशिश करता है, पर अब वह पहले वाता बहादुर नहीं रहता। उसे हर समय भय बना रहता है कि कहीं पिटाई न हो जाए। इस कारण वह अधिक गलतियाँ करने लगता है।

आइए, अब तीसरी घटना देखते हैं, जो इस कहानी के अंत को तय कर देती है। इस घटना में खुद वाचक बहादुर को पीटता है। क्यों पीटता है—यह आप पढ़ ही चुके हैं।
बहादुर

वाचक द्वारा पीटे जाने का बहादुर पर बहुत गहरा प्रभाव पड़ता है। उसका चेहरा भय से काला पड़ जाता है। अंततः वह ऊँट लेता है। बहादुर को पीटा तो किशोर और निर्मला भी है। पिटने पर वह पहले भी रोया है, लेकिन उसे भय पहली बार लगा है। अंततः वह ऊँट लेता है। बहादुर ऊँट लेते हुए उसे भय पीटने में आते हैं। बहादुर अंदर तक दुखी भी यहीं होता है। जैसे-जैसे वह वहाँ चलता जाता है उसे भय पहली बार लगा है। बहादुर भागते-भागते भी अपने निर्देश होने का सपना दे जाता है। जब वह अपने घर से भागा था, तो कम-से-कम दो रुपए तो लेकर भागा था। वह भी वह अपनी तनबुखार के पैसे और अपना सामान भी छोड़ गया।

वाचक को लगता है कि उसने बहादुर की पिटाई करके बहुत बड़ा अपराध किया है। वह अपनी नजरों में खुद को छोटा महसूस करता है। अंततः अनुभव में वह बहादुर के नेत्र की जब से वह सामान निकालता है, जिस सामान को देखकर बहादुर अपने नेत्र और अपनी माँ, अपने गाँव, अपने देश को याद करता था। इस घटना से दो बातें स्पष्ट होती हैं। पहली तो यह कि बहादुर स्वाभाविक है। उसी बात कि बाद, जिस पर चोरी का आरोप लगाया गया था, घर का सामान तो क्या, अपनी वे चीजें भी छोड़ जाता है, जो उसे बेहद प्रिय थीं। दूसरी बात यह कि घर में काम करने वाला नौकर भी आवश्यक होता है, कोई वस्त्र नहीं, जिसका मनमानी इस्तेमाल करते रहे। उसके भी दिल होता है। वह भी अपने प्रति अच्छे-चाहे वाहक को समझता है, सोचता है, महसूस करता है। वाचक इस घटना के माध्यम से यह दिखाना चाहता है कि नौकर के प्रति बुरा व्यवहार और निर्देश किसी तरह अंतर: पछतावे का कारण बनते हैं।

क्रियाकलाप-1.1

मैं दुर्भाग्य है जब बहादुर घर से भाग जाता है। बहादुर की जगह आप होते हैं, तो निम्नलिखित में से कौन सा विकल्प चुनते? चुने गए विकल्प के पक्ष में अपने तर्क भी लिखें—
Adolescence Education Programme

Learning Together
Learning Better

Episode 3
Methodology used: Lecture and Practical Demonstration, Survey, PPT/Flash Card/Quiz, Value Prioritization
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## COORDINATOR

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## COVER DESIGN

Sh. Sunder Singh Rawat
Office Assistant (AEP)

*Developed under MHRD-UNFPA Supported: Adolescence Education Programme*
Greetings from NIOS!

National Institute of Open Schooling (NIOS) is an autonomous organization under Ministry of Human Resource Development (MHRD) Government of India and caters to the educational requirements of out of school children and youth of India. With over two million learners on rolls, NIOS has emerged as the largest open schooling organization in the world.

The NIOS in collaboration with MHRD-UNFPA has been engaged in addressing issues and concerns of adolescent learners and empowering them with life skills through ‘Adolescence Education Programme’. Cognizant of the delivery model, NIOS followed a curricular approach and integrated critical adolescent issues and concerns within the self-learning material.

Integration was carried out with the rationale to equip the learners with skills that would make them better humans and more productive for the society while studying for their secondary course. Through a series of capacity building workshops for the lesson writers and providing them continuous support, NIOS was able to realize the aim that seemed daunting initially.

Life Skills have been seamlessly woven into the course content so that the learners, while studying the main syllabus get empowered to apply the core content in real life situations. This teaching material will help you transact not only the subject specific content but it will also help you empower the learners with important skills such as communication skills, critical and creative thinking etc.

It gives me great pleasure to share with you the this teacher-training package of Life Skills enriched lessons from five subjects- Hindi, English, Science, Home Science and Social Science at secondary level along with a set of CDs Learning Together Learning Better. I hope you will find them useful.

Yours sincerely,

Dr. S.S. Jena
Dear Teachers,

The Academic Department at the National Institute of Open Schooling has revised the curriculum in all the subjects at the secondary level. The National Curriculum Framework 2005 developed by the National Council for Educational Research and Training was kept as a reference point. After making a comprehensive comparative study of various state boards, we developed the curriculum that was functional, related to life situations and simple. Leading educationists of the country were involved in developing this material.

Hindi, English, Science and Technology, Home Science and Social Science at secondary level were enriched with life skills under the MHRD UNFPA supported Adolescence Education Programme. The integration of life skills is aimed at instilling an adaptive and positive thinking, feeling and behaviour in the learners.

I sincerely hope that you will find the selected lessons interesting, exciting and useful. Any suggestions for further improvement are welcome.

Let me wish you all a happy and successful future.

(Dr. Kuldeep Agarwal)
Director (Academic)
diracad@nios.ac.in
Dear Teacher,

Welcome to NIOS!

You have just taken your first step towards realizing your goal of empowering students to become global citizens. Globally, the education system is undergoing a change in terms of approach as well as objective. NIOS has initiated a unique process of developing life skills enriched materials and methodologies for the student’s benefit. We have a vision to guide you to enhance your teaching skills such that the student not only does well academically but also enhances his personal and social competencies. Along with subject knowledge, the student should be able to deal with the stress and strain of life. They should have the ability to discriminate between right and wrong, good and bad, and take the correct decisions regarding their life and career. The methodology adopted by NIOS is to integrate these life skills seamlessly with the content of the subject.

While going through these study materials, you will find a number of activities, including intext questions, in between the lessons. These activities have been carefully designed to provide an opportunity to learn and practice. The intext questions are devices to help assess the extent of learning and enhance it. Life skills are abilities that each of us possesses, and yet conscious efforts need to be made to enhance these abilities. Attempting these exercises will help in developing life skills without an extra effort.

I hope you will find these life skills-enriched study materials and methodologies rewarding and helpful for empowering the students.

Asheema Singh
Project Coordinator
(Adolescence Education Project)
asheemasingh@nios.ac.in
Contents

EPISODE-1
Methodology: Role Play, Use of Media (Films), Conducting Experiments
1. Adolescence: Charms and Challenges (Home Science)
2. People’s Participation in the Democratic Process (Social Science)
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4. Life Processes - Reproduction (Science and Technology)
5. Religious and Social Awakening in Colonial India (Social Science)
6. Climate (Social Science)
A group of students were chatting during lunch break. Charles complimented Joseph for his favourite sparkling white shirt that they had brought together almost two years ago. Just then Purnima said that she was very unhappy about the condition of her silk blouse after one washing. A kbar said he too could not wear his expensive pure wool cardigan after the first wash. Then K abir told them that he has acquired knowledge regarding care of different types of fabrics in a housekeeping course. He told them that they should not wash all types of fabrics with one detergent. He further added that there are different methods of washing and finishing different types of clothes. He advised that a little care can keep their favourite dress as good as new.

Do you know that clothes speak volumes about the wearer’s personality? It is good to select clothes carefully. But even more important is to wash and finish them regularly for a well-groomed appearance. Let us learn how to take care of clothes so that we have no regrets later.

**OBJECTIVES**

After reading this lesson you will be able to do the following:

- explain the meaning and need of brushing, airing and laundering your clothes;
- remove stains using appropriate reagents and techniques;
- check care labels and colour fastness of your clothes before washing;
- launder different fabrics using appropriate cleaning methods and finishing agents and;
- store laundered clothes suitably.
9.1 ROLE OF SHAKING, BRUSHING, AIRING AND LAUNDERING CLOTHES IN CARE AND MAINTENANCE OF FABRICS

We all know that when we wear clothes they become dirty and need laundering. The dirt is due to stains, dust, grease and perspiration. When left on fabrics, these can lead to the following damages:

- Stains and dirt on clothes become medium for the growth of bacteria, fungus or other harmful organisms which may lead to skin problems and poor personal hygiene.
- Dirty clothes lose their freshness and smell unpleasant.
- Left on clothes the dirt and stains reduce the strength of the fabric.
- No one feels good wearing stained and dirty clothes.

Clothes need not be washed every time they are worn. It depends on the weather in which these have been worn and how much sweat they have absorbed. When the weather is good and you do not sweat, you can safely reuse your clothes. But before putting them away for reuse keep the following steps in mind to maintain your clothes.

9.1.1 Shaking, Brushing and Airing

‘Shaking’ helps in removing loose dust from the fabric. Hold the dress with both hands and shake it vigorously.

Have you seen materials like velvets, corduroy, chenille, blankets and carpets? They are thick and have a pile on their surface which holds dust easily. To remove it we need to gently brush the surface with a soft clothes-brush, in the direction of pile (fuzzy surface).

Thus brushing is for removing loose dirt from fabrics which have a pile on them suits and coats are also brushed.

‘Airing’ helps in drying and removing bad odours from fabrics. It is done preferably outdoors in the sun or in a well-ventilated room.

9.1.2 Laundering

Laundering of clothes does not mean only washing of clothes. It consists of the following three steps:

i. Washing or dry-cleaning garments to removed dirt, perspiration and smell, e.g. your school uniform is washed and your woolen coats and jackets etc. are dry cleaned.
ii. Finishing the garments with stiffening agents like starch and gum, brightening or bleaching agents, drying them then ironing or pressing, folding and hanging garments, e.g. cotton dupattas and sarees are starched.

iii. Storing the garments for a short or long time, e.g. when the winter season arrives you put away summer clothes and take out woolen shawls, sweaters, coats etc.

**Remember**, washing and dry cleaning are two different processes used for cleaning different types of clothes.

<table>
<thead>
<tr>
<th>Washing</th>
<th>Dry-cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colourfast fabrics can be easily washed.</td>
<td>Leather and fur, selected silks and woolens, zari and other costly fabrics are dry cleaned.</td>
</tr>
</tbody>
</table>

**INTEXT QUESTIONS 9.1**

1. Meena has a basket full of soiled clothes. These include her silk blouse, zari saree, cotton shirt, cotton payjama and woolen shawl. Which of these would you recommend her to wash at home and which clothes should she send for dry cleaning? Why?

2. Summer season has set; you have to put away the winter clothes. What steps would you suggest to your friend to ensure that his clothes are clean and ready to store till the next season?

**9.2 GETTING READY TO LAUNDER CLOTHES AT HOME**

Whenever you are ready to launder clothes at home remember that there are certain preparations required. What are these? Why are these preparations necessary? How and what we need to do, let us find out.
9.2.1 Collection of clothes and supplies

If you have a set place to keep your dirty clothes and supplies for washing, then this step is already taken care of. If not then collect all the dirty clothes and supplies needed for washing, at one place. It helps to conserve energy while washing. Can you explain how?

9.2.2 Mending damaged garments

The old saying- ‘a stitch in time saves nine’ stands true in this case. If any garment has been damaged, its handling during washing may make the yarns come out from its torn areas and make the tear larger. It may become very difficult or impossible to mend them neatly. That is why it is advisable to mend (repair) all tears before the garments are washed.

9.2.3 Sorting

It refers to separating the clothes on the basis of (i) the type of fabric (ii) colour (iii) size and weight (iv) amount of dirt (v) utility of the article (vi) soaking time (vii) amount of detergent and bleach required as these are all different for different fabrics.

If you ignore this sorting, white fabrics may acquire colour stains if the colour of any other garment bleeds. For maintaining good hygiene dusters, kitchen towels and dish clothes, under garments, socks, need to be washed separately.
9.2.4 Read labels on the garments

Generally, all textiles and textile products carry labels which provide basic information about the product, for example, the contents of the product, its washing and ironing instructions, etc. These instructions are stamped at the beginning and end of the fabric roll or along its selvages. Reading these thoroughly will help you take better care of your fabrics. Following are some of the stitched and stamped labels on garments.

![Fig. 9.4 Hanging and sewn tags on readymade garments](image)

**ACTIVITY 9.1**

Collect and study 3-4 labels on textile items and fill the following table:

<table>
<thead>
<tr>
<th>Item on which found</th>
<th>Information contained</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardigan</td>
<td><img src="image" alt="Label" /></td>
<td>Information about - contents - washing and drying</td>
</tr>
</tbody>
</table>
9.3 CHECK STAINS AND REMOVE THEM

Ink, lipstick, nail polish, grease, paint, tea and coffee, are some marks that may spoil our clothes at one time or the other. A **stain** is an unwanted mark of discolouration on a fabric caused due to contact with another substance. Generally, a stain requires special treatment for removal. If you have ever accidentally spilled tea on your clothes and washed it off immediately you must have realized that the stain gets removed quickly. Old stains take long and also a lot of effort to remove, often with poor results. Hence, the best way to get rid of stains is to remove them as soon as possible. Do not allow these to penetrate deep into the fabric or get dry and set.

**Remember** stains must be removed before washing as some of them may become permanent when exposed to chemicals in soaps or detergents, hot water and ironing.

Different types of stains require specific stain removing techniques and agents, depending on the type of fabric. Use of incorrect stain removing agent can spoil the fabric or its colour. Hence always try to identify the stain and select appropriate techniques and stain removing agent.

Most of the stains can be identified by their colour, smell and feel. Let’s find out more about them.

a) **Colour:** Every stain has a specific colour. For example, the colour of curry/pickle stain is yellow, a coffee/tea stain is brown, a grass stain is green and so on. Try and collect some more stains with colours.

b) **Smell:** Most stains have a peculiar smell. Recall the smell of egg or paint or shoe polish. The stain on a fabric will have the same smell.

c) **Feel:** Stains can also change the feel of the fabric and can thus be recognized on this basis. Have you ever observed that paint or sugar make the fabric hard and stiff to touch, whereas lipstick or shoe-polish make the fabric feel slippery.

**ACTIVITYS 9.2**

Take an old white cotton cloth and cut out 4 (5x5 cm) pieces. Stain each piece with a different stain and keep it to dry. Now observe the colour, feel and smell of each stain. Stick each stain on a big paper and write its description.
9.3.1 Classification of stains

Stains can be grouped on the basis of their origin, e.g., tea and coffee and many oils, vanaspati and ghee come from vegetable source. While removing these stains you can use more or less the same removing agents and method. Let us classify all stains on the basis of their origin.

<table>
<thead>
<tr>
<th>Category of stain</th>
<th>Stains</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vegetable stains</td>
<td>Tea, coffee, fruit</td>
</tr>
<tr>
<td>2. Grease stains</td>
<td>Butter, ghee, oil, curry, shoe polish, tar, oil paints</td>
</tr>
<tr>
<td>3. Animal stains</td>
<td>Blood, milk, egg</td>
</tr>
<tr>
<td>4. Mineral stains</td>
<td>Rust</td>
</tr>
<tr>
<td>5. Miscellaneous stains</td>
<td>Dye, ink, mildew, grass, perspiration</td>
</tr>
</tbody>
</table>

9.3.2 Techniques of stain removal

There are two methods of stain removal: (i) Sponging and (ii) Dipping. Let us learn how stains are removed by using these methods.

Sponging

- Place an absorbent paper or fabric under the stain so that the right side of the stain faces the absorbing surface. Sponging should always be done on the wrong side of the stain.
Care and Maintenance of Fabrics

- Take a soft cloth, dip it in the stain-remover and gently rub the stain starting from its outer corner moving inwards, towards the centre.
- Use light, circular strokes as these prevent the stain from spreading.
- The absorbent paper or fabric (commonly known as blotter) must be changed as soon as it starts showing the stain.

Dipping

Dipping is the method in which the entire fabric can be immersed in the stain removing agent. It is suitable if there are many stains or a large stain on the fabric. We can choose the stain removing re-agent depending upon the type of stain.

Some of the common reagents used for stain removal are borax powder, ammonia, hydrogen peroxide, oxalic acid and ready to use bleaches.

<table>
<thead>
<tr>
<th>Type of stains and method of removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vegetable stains</td>
</tr>
<tr>
<td>Consideration for removal</td>
</tr>
<tr>
<td>Stains</td>
</tr>
<tr>
<td>Fresh tea/coffee, chocolate, fruit</td>
</tr>
<tr>
<td>Old Dip the stained portion in glycerin. Or spread borax powder over stain and pour boiling water while holding the stained portion on the mouth of a mug or pan.</td>
</tr>
</tbody>
</table>
## Care and Maintenance of Fabrics

### Henna (Menhdi)

<table>
<thead>
<tr>
<th>Fresh</th>
<th>Old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dip in warm milk for half an hour</td>
<td>Repeat the above two or three times</td>
</tr>
<tr>
<td>Same as for white cotton</td>
<td>Same as for white cotton</td>
</tr>
</tbody>
</table>

### Animal Stains

#### Consideration for Removal

Avoid heat as these stains contain protein which gets fixed on heat treatment.

<table>
<thead>
<tr>
<th>Stains</th>
<th>White Cottons</th>
<th>Coloured Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood, egg, meat</td>
<td>Fresh</td>
<td>Same as for white cotton</td>
</tr>
<tr>
<td>Wash with cold water and soap</td>
<td>Same as for white cotton</td>
<td></td>
</tr>
<tr>
<td>Old</td>
<td>Soak in salt water (2 tablespoons of salt + ½ bucket of water), or in diluted ammonia</td>
<td>Same as for white cotton</td>
</tr>
</tbody>
</table>

### Grease Stains

#### Consideration for Removal

Use grease absorbents and solvents like chalk, talcum powder to remove greasy matter and then, remove the colouring matter.

<table>
<thead>
<tr>
<th>Stains</th>
<th>White Cottons</th>
<th>Coloured Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter, ghee, oil, curry</td>
<td>Fresh</td>
<td>Same as for white cotton, but leave it in shade</td>
</tr>
<tr>
<td>Wash with hot water, and soap. Dry on grass or shrub/plant in the sunlight</td>
<td>Same as for white cotton, but leave it in shade</td>
<td></td>
</tr>
</tbody>
</table>
### Care and Maintenance of Fabrics

<table>
<thead>
<tr>
<th>Stains</th>
<th>Fresh Stains Treatment</th>
<th>Old Stains Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint, shoe polish, nail polish,</td>
<td>Scrape all the excess stain (a) Sponge gently with methylated spirit or kerosene</td>
<td>Same as for white cottons</td>
</tr>
<tr>
<td>lipstick, ball pen</td>
<td>(b) Sponge with turpentine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Repeat the above method two or three times</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Same as for white cottons</td>
<td></td>
</tr>
</tbody>
</table>

### 4. Mineral Stains

- Rust and some medicines

#### Consideration for Removal

These stains contain metallic compounds and therefore, require treatment with mild acidic reagents followed by alkaline solutions to neutralise.

<table>
<thead>
<tr>
<th>Stains</th>
<th>White Cottons</th>
<th>Coloured Cottons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron rust</td>
<td>Rub lime juice and salt</td>
<td>Same as for white cotton</td>
</tr>
<tr>
<td></td>
<td><strong>Old</strong></td>
<td><strong>Same as for white cotton</strong></td>
</tr>
<tr>
<td></td>
<td>Apply dilute oxalic acid and neutralise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with dilute borax solution</td>
<td></td>
</tr>
</tbody>
</table>

### 5. Miscellaneous Stains

Dye, ink, mildew, grass, perspiration, etc.

#### Consideration for Removal

Give specific treatment to each of these stains.

<table>
<thead>
<tr>
<th>Stains</th>
<th>White Cottons</th>
<th>Coloured Cottons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass</td>
<td>Wash with soap and water</td>
<td>Same as for white cotton</td>
</tr>
<tr>
<td></td>
<td><strong>Old</strong></td>
<td><strong>Same as for white cotton</strong></td>
</tr>
<tr>
<td></td>
<td>Sponge the stained portion with methylated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spirit</td>
<td>Same as for white cotton</td>
</tr>
</tbody>
</table>

---
betal leaf (paan)

<table>
<thead>
<tr>
<th>Fresh</th>
<th>Old</th>
</tr>
</thead>
<tbody>
<tr>
<td>apply a paste of onions and leave in the sunlight</td>
<td>repeat above method two or three times</td>
</tr>
<tr>
<td>same as for white cottons but leave in shade</td>
<td>same as for white cotton</td>
</tr>
</tbody>
</table>

ink

<table>
<thead>
<tr>
<th>Fresh</th>
<th>Old</th>
</tr>
</thead>
<tbody>
<tr>
<td>wash with soap and cold water</td>
<td>(a) soak in sour butter milk (lassi) for half an hour</td>
</tr>
<tr>
<td>same as for white cotton</td>
<td>(b) apply lime juice and salt and leave in the sun</td>
</tr>
<tr>
<td></td>
<td>(c) bleach the stain</td>
</tr>
</tbody>
</table>

9.3.3 Precautions while removing stains

- As far as possible, remove the stain when it is still fresh.
- For delicate and/or coloured fabrics, first try out the chemical on a small portion of the fabric on the inner side of the seam or some portion of the garment which is not visible when worn. In case the fabric or its colour gets damaged, do not use the chemical.
- Use dilute and mild reagents as these are less harmful, though it may take a little longer to remove the stain.
- Rinse the fabric several times after the removal of the stain, or the reagent may damage the fabric on drying.

ACTIVITY 9.3

Shyna wore a very beautiful white silk suit for an interview. She was very cautious about protecting it all through. After the interview she came home and changed her clothes. While she was folding her suit she noticed a big curry stain on it. She was very
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tired hence she did not do anything about it. Next morning she dusted talcum powder on the stain and left it for a little while. Then, she soaked the suit in a strong hot detergent solution for an hour. She hung the suit on the line until it dried. The stain was still there though a little less prominent. She treated the stained portion with hydrogen peroxide. The stain had disappeared. She rinsed the suit many times to remove all traces of the chemical and then dried it in shade.

List each step that Shyna followed to handle the stain and comment if it was correct or incorrect. Give reason for your answer.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Steps</th>
<th>Correct</th>
<th>Wrong</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INTEXT QUESTIONS 9.3**

1. For removing each of the following stains, tick (√) the most appropriate option:

   (i) **Old tea stain on white cotton fabric:**
       (a) Use salt water
       (b) Soak in glycerin
       (c) Soak in lime juice
       (d) Pour boiling water over borax

   (ii) **Old blood stains on coloured cotton fabric:**
       (a) Soak in salt water
       (b) Soak in glycerin
       (c) Soak in hot water
       (d) Wash with soap and hot water

   (iii) **Lipstick stain:**
       (a) Use of salt water
       (b) Soak in ammonia
       (c) Sponge with methylated spirit
       (d) Wash with hot water and soap
(iv) **Rust stain:**
(a) Use of salt water
(b) Use lime juice and salt
(c) Soak in methylated spirit
(d) Wash with soap and cold water

(v) **Nail polish stain on polyester fabric:**
(a) Sponge with methylated spirit
(b) Soak in warm borax water
(c) Rub lime juice and salt
(d) Soak in warm water and soap

After removing stains, the next step is laundering. General laundering is dealt with here while specific washing of different fabrics has been dealt with later in the lesson.

**9.4 LAUNDERING**

Laundering of clothes involves the following steps:

```
Laundering
  ------------
  Soaking       Rinsing       Drying         Storing
  |             |             |               |
  Ironing       Washing       Finishing
```

**Fig. 9.8 Process of Laundering**

**9.4.1 Soaking**

Soaking of fabric in water loosens the non-greasy dust particles because of up and down movement of water molecules. Fabrics which become weak when wet must not be soaked for long. Do not soak too many clothes in one bucket. There must be a room for dirt to disentangle from the fabric. Fabrics must not be soaked for longer than half an hour otherwise loosened dust will resettle on the fabrics.
9.4.2 Washing

As said earlier, soaked clothes must be washed soon. The process of washing involves removal of dirt that has been loosened from fabrics by soaking. There are many ways to do this and the choice depends on the fabric being washed. You will now learn about these methods and their suitability to various types of fabrics.

Methods of Washing

i. **Friction method:** For washing strong fabrics like cotton and linen this is the right method. You can apply friction in any of the following three ways.

   • **Hand friction:** This is the most common method of washing clothes. Rub dirty areas vigorously with the hand till the dirt is removed. It is suitable for cleaning very soiled small sized areas in the garment like cuffs, collar and bottom of the lower garments, handkerchief and lace.

   • **Scrubbing brush:** While cleaning kitchen dusters which are very soiled use a brush to remove dirt, grease and stains. Remember to place the fabric on a flat hard surface before scrubbing. Hard scrubbing can clean the fabric well but wears it out. Have you noticed that if you use brush on shirt collars they get worn out? Therefore, scrubbing has to be used as per the nature of the fabric.

   • **Beating stick:** While washing large clothes like bed sheets and towels use a wooden beating stick to provide friction. Remember that this is done only on a clean, flat and hard surface. Spread the fabric on the floor, apply soap and then beat it with the stick, constantly changing the surface of the fabric with the other hand.

ii. **Washing by kneading and squeezing:** This method is for delicate fabrics like silk, wool, rayon, etc. This does not damage the fabric or change its shape because only gentle pressure is applied repeatedly with hands. While it is still in the soapy solution, while using this method dip the cloth in soap solution, take it out and squeeze
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iii. **Washing in machines:** ‘Washing machine’ a labour saving device and provides all the friction required for cleaning the clothes. The washing time varies with the type of fabrics and amount of soiling. For example, wool fabrics take less time for cleaning than cottons. Washing machines available in the market are automatic, semi-automatic and non-automatic. The advantage of using automatic washing machine is that it has a spinner which can wring the clothes after washing to the extent that these are almost dry. This is especially useful while washing large and heavy articles like bedcovers, curtains, etc. The instructions about using the machine should be read carefully before using it. One should be careful while loading clothes for washing in a machine as the colour of some fabrics may bleed and spoil the other clothes in the machine.

9.4.3 **Rinsing**

Washed fabrics must be rinsed at least thrice or till they leave behind clear water. Why do we need to do that? If not rinsed well the contents of leftover detergent would harm the fabric.

9.4.4 **Finishing Agents**

Some of your clothes require the application of a finishing agent before they are spread for drying. A finishing agent is nothing but something which helps to brighten and/or stiffen the fabric and give it a brighter and fresher look. You know what starch and/or blue your white cotton clothes need. Both these are finishing agents for cottons. For silks, a different starch is used. It is called ‘gum arabic’. Similarly, there are ‘blues’ and brightening agents to brighten you white clothes. You will know more about these in the chapter on fabric finishes.

9.4.5 **Drying**

Clothes should preferably be dried outside in fresh air and sun. Use a clothes line and pegs or clips to hold the clothes or a clean stain free metal rack. Hang or spread the clothes and place the rack in the sun or shade depending on the type of clothes you have washed. Remember to
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Turn clothes inside out if they are coloured. If you are using a clothes line, see that you spread your clothes on it in such a way that it allows air to pass through them. Not only do the clothes dry up much faster this way, it is an environment friendly method. Sunlight also kills some germs. Hence, it is recommended that under garments and the clothes used as sanitary napkins must be sun dried.

9.4.6 Ironing or steam pressing and folding

This process is applied on clothes to give them a smooth look. An electric or coal iron is used to carry out this job. There are various types of electric irons available in the market. Those with metal heating surface, Teflon (non-stick coated surface or steam irons). You can buy any of them and learn to use them from the instructions given along in the package.

9.4.7 Storing

Remember that clothes are stored back in a cupboard or box only after they are completely dry. Since you need to dampen the clothes for ironing, spread the clothes again in fresh air after ironing till they are completely dry. Put them back in the cupboard or box for final storage.

Moist clothes should not be stored because they will allow fungus and bacteria to grow on them.

**ACTIVITY 9.4**

One winter evening, Venkat wore a beautiful khadi kurta and went to a party. He enjoyed the party thoroughly. On the way back home, it started raining suddenly and his kurta got damp. Since that was his favourite kurta, he immediately took it off, folded it and kept in the cupboard. When he took it out a few days later, he was shocked to see stains and a white powdery substance on the kurta. Besides, it smelt awful. Venkat was upset because he knew that his favourite kurta was totally spoilt.

Discuss the problem with your friends or other learners during the personal contact programme and answer the following questions:

1. What do you think went wrong with Venkat’s kurta?
2. If you were in his situation, what would you have done to save your khadi kurta?
9.5 LAUNDERING OF SPECIFIC FABRICS

You have learnt the basics of laundering clothes. Is this information sufficient to launder all types of clothes you use at home? Let us now use this knowledge for laundering dirty clothes at home and see what more we need to know.

Collect all the dirty clothes in your house and see what you have. Do you remember the pre-preparation you need to do before washing and finishing these clothes? Let us see. Here is a pile of dirty clothes. What is your first step? Yes you are right it is sorting out the clothes. So you make the following piles after sorting:

i) Cottons clothes consisting of white inner garments, payjama, salwar, petticoat, shirts, dusters from kitchen, bed-sheets, pillow slips, and so on.

ii) Coloured cottons like saree, blouse, salwar suits and dupattas.

iii) Synthetics consisting of shirts, saree, blouse, dupatta and socks, etc.

iv) Silk saree, blouse, shirt, etc.

v) Woolen sweater, muffler and a shawl.

Separate very dirty clothes from less dirty ones, see if there are any repairs to be done and then see if there are any stains to be removed. If there is a care label attached, read it because it will tell you about the “do’s” and “don’ts” while washing the item. You are now ready for the next step. Let us handle each pile you have separated, one by one.

Laundering of cottons

i) Soaking: How and why will you soak your cotton items? Only white cottons are soaked to loosen the dirt settled or stuck to the fabric. They are soaked preferably in warm or hot water for half an hour depending on how dirty they are. Soak very dirty clothes separately. Yes, for two reasons, one because these are soaked for longer duration and in hot water and soap/detergent. Secondly, the loosened dirt from very dirty clothes will settle on the less dirty ones and make them dirtier. It is much easier to clean soaked fabrics. Do not put too many clothes together. Do you know why?

ii) Washing: Dip all white clothes in soap/detergent solution. Apply extra soap on the heavily soiled areas and rub. Wash the light weight and lightly soiled cotton fabrics by using knead and squeeze method and big and heavy clothes using a stick. Rub areas which are very dirty with hands or with a brush. Do you remember why?

iii) Rinsing: Why should we rinse clothes after washing? You have already learnt about it earlier in the lesson. If you do not remember go back and refer to it.

Cottons require application of a whitening agent in the last rinse. Why? What could you use for whitening? Yes you are right. You use blue which is available
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as powder or liquid. These days you get chemicals like optical brighteners in the market. These are colourless florescent dyes which turn pale fabrics white and make them look brighter temporarily.

iv) Starching: Putting starch on the white clothes is another procedure which must be carried out before they are spread for drying. It is done to give cottons a smooth and shining fresh look. Also, starched articles do not get dirty that easily.

2 table spoons of starch mixed in 5 liters of water is sufficient for starching 4-5 clothes

You can prepare your own starch using arrowroot.

- Dissolve arrow root in a little cold water to prepare a thick batter. Add boiling hot water to this batter stirring all the time till it changes colour to transparent. Your starch is ready.

- Now add some of this starch paste that you have made in a basin of water and mix well. The strength of starch depends on the thickness of fabric and stiffness required. To make the fabric very stiff, dilute the full strength starch with 2-3 times water. But add 4-6 times water to get reasonably good stiffness.

- Before starching a garment turn it inside out, open and dip it in water for even spread of starch in it. Wring out the excess water and then dip it in the starch solution.

- Squeeze the fabric well and hang it in the sun to dry.

Note:

i) The amount of stiffness is a matter of personal preference. Generally, we starch table linens like mats, tray cloths and napkins, heavily and inner wear garments lightly.

ii) Do not starch under garments and those garments which are close fitting like a blouse, as the starch it may cut into your skin and make you uncomfortable.

iii) If the articles have to be starched as well as blued, do it together in one solution, by adding blue to the diluted starch and water solution.

Remember: If the article gets over blued, dip it in plain water with a few drops of white vinegar or lime juice. The extra blue will get removed.

iv) Drying: After rinsing, starching and bluing the clothes are dried. Hang the clothes by their strongest part along the clothes line. Articles dried in the sun should be removed as soon as they dry. Over exposure to sunlight can weaken the fabric and cause yellowness.


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v) **Ironing:** Cotton clothes are ironed best when they are evenly damp. But if they are starched they must dry completely before they are brought in. Sprinkle water evenly on them, roll them tightly and leave them for some time. Now open them one by one and iron with a hot iron. Leave them for sometime to dry before storing.

vi) **Storing:** Remember, fungus grows quickly on cotton fabrics. Hence, while storing cottons make sure that they are completely dry.

**Laundering of coloured cottons**

- Do not soak cottons, especially when their colour bleeds.
- Use mild or neutral soap for washing.
- Wash using kneading and squeezing method.
- Rinse thoroughly and apply starch after turning clothes inside out in the last rinse.
- Dry in shade.
- Iron clothes after making them evenly damp.
- Store clothes when completely dry.

**INTEXT QUESTIONS 9.4**

Fill in the blanks with the most appropriate word from those given in brackets:

i. Soaking clothes for some time helps to __________ dirt. (loosen, fix, settle).

ii. Starching is done to give cotton clothes a __________ look. (dull, crisp, shining).

iii. __________ should not be starched. (table linen, saris, undergarments).

iv. Coloured cotton articles should be dried in the __________ (sun, shade, daylight).

v. Long exposure to sunlight makes fabrics __________ (bright, weak, dull).

vi. __________ should be used to wash very dirty white articles (hot water, boiling water, luke-warm).

vii. When cotton articles are stored moist, they develop __________ (dullness, brightness, mildew).

viii. Fabric that is not properly rinsed becomes __________ (weak, yellow, bright).

ix. Clothes must be __________ before washing. (blued, repaired, ironed).

x. __________ articles should not be soaked before washing. (coloured, white, dirty).
Care and Maintenance of Fabrics

Laundering of Synthetics

Nylon, polyester and acrylic are synthetic fibers. Hence laundering synthetics is slightly different.

- Use luke-warm or cold water. Do not use hot water as synthetics will wrinkle very badly. Do you remember why? Yes, they soften and melt easily.
- Use any good soap, light pressure and light rubbing while washing.
- Rinse well in cold water to remove soap completely.
- To avoid wrinkles, do not squeeze tightly.
- Preferably dry on a hanger. It will help to maintain the original shape.
- When dry, if necessary, iron with a warm iron and not a hot one (Refer to ironing temperature chart given later in the lesson). Do you recall why?
- Store when completely dry.

**Remember:** While washing you can treat terrycot as synthetic fabrics.

Laundering of Silks

- Use luke-warm or cold water, a good neutral soap, light pressure and light rubbing while washing. There is no need to soak silks.
- Rinse well in cold water to remove soap completely.
- Apply starch (gum arabic) and dry in shade.
- Pick up the clothes when evenly damp and iron with a warm iron. Do you remember why? Yes you are right, silk gets stained if water is sprinkled on dry clothes.
- Store preferably on hangers when completely dry.

Laundering of Woolen Clothes

Woolens are more delicate than any of the fabrics used in the house. Wool has hairy surface which causes felting if handled roughly. Hence woolens need utmost care while washing.

Knitted woolen clothes lose shape when wet hence these need to be put back to shape after washing and need to be dried on a flat surface. Following steps should be followed for washing woolens:

- Take outline of the knitted dress on a paper before washing.
- Use mild alkaline soap/detergent dissolved in luke warm water all through.
- Use kneading and squeezing method to wash.
- Rinse thoroughly.
- Knitted items must be brought back into shape by putting them back on the paper
draft taken earlier and dried on flat surface in shade.
- Steam press if necessary.
- Store them when completely dry in a dry place either on a hanger or on a flat
surface and along with naphthalene balls or odonil tablets.

**9.6 HANDY HINTS FOR IRONING**

Prepare an ironing table. Cover it with an old blanket and then with a white cotton
sheet. Keep the height of the table comfortable so that you need not bend or stretch
while ironing. Usually, an 80 cm high table is very comfortable.

- Keep some water handy. Spraying water on cotton and linen produces good
results.
- Sleeves, collars, laces, etc., should be ironed first.
- Iron laces, buttons, hooks, embroidered and embossed clothes from the wrong
side. The embroidery will stand out and look more beautiful. It will also not break
or melt due to high temperature.
- Iron the fabric along the length as the yarns are stronger in this direction.

**Important:** Follow ironing instructions on the **labels**, if any. Otherwise follow the
ironing temperature chart given below.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Fibre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm</td>
<td>150°C Wool, silk, polyester and nylon</td>
</tr>
<tr>
<td>Hot</td>
<td>180°C Cotton and rayon</td>
</tr>
<tr>
<td>Extra hot</td>
<td>200°C Cotton and linen</td>
</tr>
</tbody>
</table>

**INTEXT QUESTIONS 9.5**

1. Tick mark the statements that are true. Correct the false statements.

   i. Neutral liquid soaps should be used for washing silks. True/False

   ii. Cold water should be used while washing woolen articles. True/False
Care and Maintenance of Fabrics

iii. Wool articles should be soaked in water. True/False

iv. Wool articles can be cleaned with any detergent solution. True/False

v. Friction cannot be applied to clean woolen articles. True/False

vi. Synthetics are squeezed well before drying True/False

vii. Synthetics are ironed, if necessary, with a warm iron. True/False

1. Match the columns:

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
<th>Ans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Wet silk or wool</td>
<td>a Strength decreases</td>
<td></td>
</tr>
<tr>
<td>2 Wet cotton</td>
<td>b Neutral detergents</td>
<td></td>
</tr>
<tr>
<td>3 Coloured cottons</td>
<td>c Detergent powders/cake</td>
<td></td>
</tr>
<tr>
<td>4 Silk</td>
<td>d No effect on strength</td>
<td></td>
</tr>
<tr>
<td>5 Wet viscose rayon</td>
<td>e Strength increases</td>
<td></td>
</tr>
<tr>
<td>6 White cotton</td>
<td>f Liquid detergent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g Alkaline detergent</td>
<td></td>
</tr>
</tbody>
</table>
WHAT YOU HAVE LEARNT

Care and maintenance

Brushing and airing  Mending  Stain removal

Sorting

Steeping

Washing

Rinsing

Starching

Bluing

Drying

Finishing

(For cottons only)

- friction-hand/brush
- kneading and squeezing
- machine wash

- cotton (arrowroot)
- silk (gum)

- Whitecottonsandlinen

- Pressing
- ironing
- storing

TERMINAL QUESTIONS

1. Explain the meaning of the word ‘laundering’.

2. What is a stain? How would you classify stains?

3. Describe the steps for removing the following stains from a cotton fabric. (i) Ghee (ii) Nail polish (iii) Red ink (iv) Grass (v) Paan (Betal leaf)

4. How will you wash a white cotton garment? Explain with reasons

5. How does the laundering of synthetics differ from laundering of cottons?
6. Shelly bought a white woolen cardigan. After wearing it twice she washed it together with other clothes in a washing machine. Predict the effect on the cardigan and the reasons for it.

7. Rehman wants to wash his brightly printed silk scarf at home. Tell him the correct procedure.

### ANSWER TO INTEXT QUESTIONS

**9.1**
1. wash at home- cotton shirt, cotton payjama
   dry clean- silk blouse, zari saree, woolen shawl
2. Refer text

**9.2**
1. (a) true, dirty clothes become medium for growth of bacteria or fungus
   (b) false, laundering consists of washing or dry cleaning, finishing and storing
   (c) true, airing helps in drying and removing bad odours.
   (d) true, stains may become permanent when exposed to chemicals in soaps or detergents

**9.3**
1. (i) d    (ii) a     (iii) c     (iv) b     (v) d

**9.4**
(i) loosen  (ii) shining (iii) under garments (iv) shade (v) weak (vi) hot water (vii) mildew (viii) yellow (ix) mended (x) coloured.

**9.5**
1. (i) True (ii) False – Luke warm water should be used for washing woolen articles (iii) True (iv) False - woolen articles can be cleaned with mild alkaline detergent solution (v) True (vi) False – synthetics should not be squeezed and dried on a hanger. (vii) True

2.

<table>
<thead>
<tr>
<th>Column A</th>
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<th>Ans.</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>g Alkaline detergent</td>
<td></td>
</tr>
</tbody>
</table>
LIGHT ENERGY

Light is the common form of energy. It makes the objects visible to us. You might have seen in torches there is curved sheet of metal around the bulb. Can you think why it is so? You may have also seen the stars twinkling in the sky in a clear night. Also on a clear day the sky appears blue at the time of sun rise or sun set while sun near the horizon it appears orange or red.

Have you ever tried to find out the reason for such natural phenomenon? In this lesson you will find the answer to all such questions. You will also study the defects of human eyes and image formation in mirrors and lenses.

OBJECTIVES

After completing this lesson, you will be able to:

- define reflection of light and state the laws of reflection;
- describe the image formation by plane and spherical mirror with suitable ray diagrams in different cases;
- write mirror formula and define magnification;
- define refraction of light and state the laws of refraction;
- define refractive index of a medium and states its significance;
- give some examples in nature showing the refraction of light;
- describe various types of lenses and explain image formation by convex and concave lens with the help of ray diagrams;
- write the lens formula and define magnification;
- explain power of lens and define diopter;
- explain the correction of defects of vision (near and far) by using lenses;
- explain how white light disperse through a prism and describe the scattering of light and give examples of its application in daily life.
15.1 REFLECTION OF LIGHT

Can you think how an object becomes visible to you? When we see an object we do so because light from the object enters in our eyes. Some objects such as sun, stars, burning candles, lamp, etc. which emit light by their own are called luminous objects. Some other objects may bounce back a part of the light falling on them from any luminous object. This bouncing back of light after falling on any surface is called reflection of light.

Thus, when a beam of light comes in contact with an object, a part or all of it gets bounced back. This phenomenon is called reflection of light. Some objects having smooth and shiny surface reflect better than others. A smooth shining surface, which reflects most of the light incident on it, is called a mirror. In Fig. 15.1 reflection from a plane mirror is shown.

Greek mathematician Euclid explained how light is reflected. The phenomenon of reflection was translated into laws by an Arabian scientist Alhazan in about 1100 A.D.

Alhazen (Ibn al-Haytham) (965-1040)

To understand the phenomenon of reflection of light ray we define some terms. The direction of propagation of light, a beam of light consists of number of rays. The incident ray is the ray of light falling on the reflecting surface. The normal is the line drawn at 90° to the surface at the point where the incident ray strikes the surface. The light coming back from the reflecting surface is called reflected ray. The angle of incidence is the angle between incident ray and normal and angle of reflection is the angle between reflected ray and normal.

15.1.1 Laws of reflection of light

Suppose a ray of light \((IO)\) falls on a reflecting surface \(AB\) at \(O\), after reflection it goes along \(OR\) as shown in Fig. 15.2. The reflection of light from the surface takes place according to the following two laws.
(i) Incident ray, reflected ray and the normal at the point of incidence, all lie in the same plane.

(ii) The angle of incidence is equal to the angle of reflection i.e.,

\[ \angle i = \angle r \]

During reflection, there is no change in speed, frequency and wavelength of light. Reflection of light may be classified as regular reflection and diffused reflection.

15.1.2 Regular reflection

When reflecting surface is very smooth and the rays of light falling on it are reflected straight off it, then it is called \textbf{regular reflection}, as shown in Fig. 15.2.

![Fig. 15.2 Regular reflection from a smooth plane surface](image)

15.1.2 Diffused reflection

When the reflection of light takes place from rough surface the light is reflected off in all directions as shown in Fig. 15.3 is called \textbf{diffused reflection}.

![Fig. 15.3 When surface is rough, parallel incident rays do not reflect parallel](image)

In diffused reflection due to roughness of the surface normal drawn at the point of incidence of parallel incident rays are not parallel, hence the reflected rays reflect in all direction but obey the laws of reflection.

15.2 FORMATION OF IMAGES DUE TO REFLECTION

You might have learnt that to see an object or image, the light from it should reach to the eyes of the observer. It means light coming from an object or image should fall on retina where from it will be sensed by brain with the help of optical nerves.
When light rays coming from the object meet or appear to meet at retina of eye, the object become visible and we say that the image of object is formed at retina.

When an object is placed infront of a mirror its image is formed by reflection. Every point on the object acts like a point source, from which a number of rays originate. In order to locate the image of the point object, an arbitrarily large number of rays emanating from the point object can be considered. However, for the sake of simplicity, we take any two rays of light (starting from the point object). The paths on reflection from the mirror (reflected rays corresponding to the incident rays) are traced using laws of reflection. The point where these two rays actually meet is the real image of the point object. If these rays appear to come from and not actually coming, the virtual image of the point is formed. Real images obtained by actual intersection of reflected rays, hence they can be projected on screen. Virtual images are obtained when the rays appear to meet each other but actually do not intersect each other, hence they cannot be cast on screen.

**ACTIVITY 15.1**

Take a plane mirror on paper in vertical position. Use a pipe (straw) as incident beam at certain angle and coincide its image with another pipe (straw). You have to put the second pipe in such a way that the image and this pipe remain in same line. The second pipe (straw) will represent the reflected beam. Can you touch this image? Can you cut some part of this image by cutting the paper on which it is seen? You can not do it because the image formed is a virtual image.

**15.3 IMAGE FORMATION IN PLANE MIRROR**

To understand the image formation in a plane mirror

(i) Put the mirror $M_1M_2$ in a vertical position over the sheet as shown in Fig. 15.5.
(ii) Put two pins, one at ‘A’ some distance away from the mirror and another one very near to the mirror at ‘B’ so that, the line AB makes an angle with the line $M_1M_2$ showing the position of the mirror.

(iii) Look at the images of A and B of the two pins through the mirror, put two other pins at C and D so that all four pins A, B, C and D are in the same straight line.

(iv) Now, look at the images of all these pins closing one of your eyes and moving your face side ways. If the image of the two earlier pins and the two pins you have put just now appear to be moving together you can say your observation is free from parallax error.

(v) Join the positions of the pins by straight lines.

(vi) Keeping the first pin as it is, take out other three pins and repeat the experiment described above by putting the pins in new positions. This way takes a few more reading.

To understand the formation of image, you may consider the light rays emerging out of the object A. We have drawn only three rays namely (a), (b), and (c). These rays after striking the mirror $M_1M_2$ get reflected in the direction (d), (e) and (f), respectively, (as above shown in Fig. 15.5) obeying the laws of reflection.

It is clear that these reflected rays never meet with each other in reality. However, they appear to be coming emerging out from the point $A'$, inside the mirror i.e., if the reflected rays (d), (e) and (f) are extended in the backward direction, they will appear to meet with each other at $A'$. Thus at $A'$ we get the image of object A.

From the above activity we find that the image formed by a plane mirror has the following characteristics.

- This image is virtual (i.e. it is not real), erect and the same in size as the object.
- The object distance and the image distance from the mirror are found to be equal. i.e.,

$$OA = OA'$$

Hence, the image of a point in a plane mirror lies behind the mirror along the normal from the object, and is as for behind the mirror as the object is in front. It is an erect and virtual image of equal size.
15.3.1 A few facts about reflection

Put your left hand near a plane mirror. What do you see in the image formed by reflection? The image of your left hand appears as right hand of the image as shown in Fig. 15.6(a). Similarly, the number 2 will appear in an inverted fashion on reflection as shown in Fig. 15.6 (b).

Hence, due to reflection in a plane mirror left handedness is changed into right handedness and vice-versa. This is known as lateral inversion. However, the mirror does not turn up and down. The reason for this is, that the mirror reverses forward and back in three dimensions (and not left and right), i.e., only $z$-direction is reversed resulting in the change of left into right or vice-versa.

For example a left handed screw will appear to be a right handed screw on reflection as shown in Fig. 15.6 (c).

Similarly, if you read the sentence नीचे हि ग्राहण च्यामक तः ग्राह in a mirror it will appear as आप का कमाल आप ही जानें.

In a plane mirror the distance of the image is same as the distance of object from the mirror. If object distance from the mirror changes, the distance of image from the mirror will also change in the same way. It means if an object moves with velocity $v$ towards the mirror, image will also move with same velocity $v$ towards the mirror and at every time the distances of the object and image from the mirror remain equal. However, the velocity of image towards the object will be $2v$.

By drawing a ray diagram you conclude that you can see your full image in a plane mirror whose height is half of your height. See the ray diagram in Fig. 15.7.
### Think and Do

Take a L-shaped object and try to get the images as given below and describe the position of object in each case

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>B</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>C</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>D</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

### Do you know

Our eyes can notice the light of wavelength 400 nm (nanometre) to 70 nm. The light in this range of wavelength is called visible light. The light of wavelength more than 700 nm (i.e., of red colour) is called **infrared light** and less than the wavelength of 400 nm (i.e., of violet colour is called **ultra-violet light**. All sources of light emit the combination of these three types of lights. Sun is a source which emits very high percentage of visible light. In sun light 50% visible light, 40% infrared light and 10% ultra-violet light are present. Sun is the ultimate source of all types of energy for us. Sun radiates 3.92 × 10^{26} joule of energy every second. Out of total energy radiated by sun about 0.0005% of energy reaches to earth. Earth receives 1.388 joule of energy per unit area every second from the sun.

### Do you know

The earlier fact about the nature of light was given by Pythagoras, a Greek philosopher, in 6th century B.C. The objects are visible because of light travelling from eyes to the object and then back again. This theory could not stand the test of times and modified. This was due to the contributions of Newton (1642-1727) and Huygen (1670).

### ACTIVITY 15.2

Place the following objects in front of a plane mirror and draw their corresponding images in the given table.
Try to draw conclusion from this activity regarding image formation in a mirror.

**ACTIVITY 15.3**

Place a plane mirror at angle of 30°, 45°, 60° and 90° with horizontal. Now place an object (linear) in such a way that its image formed by plane mirror is always straight. Note down the angle made by object with horizontal in the given table.

**Table 15.2**

<table>
<thead>
<tr>
<th>Angle of mirror $\alpha$</th>
<th>Angle of object $\theta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>..........................</td>
</tr>
<tr>
<td>45°</td>
<td>..........................</td>
</tr>
<tr>
<td>60°</td>
<td>..........................</td>
</tr>
<tr>
<td>90°</td>
<td>..........................</td>
</tr>
</tbody>
</table>

**INTEXT QUESTIONS 15.1**

1. In column A, some sources of light are given. In column B, you have to write whether these are luminescent or non-luminescent.

<table>
<thead>
<tr>
<th>Source (A)</th>
<th>Nature of source (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Glowing bulb</td>
<td>1. ......................</td>
</tr>
<tr>
<td>2. Burning candle</td>
<td>2. ......................</td>
</tr>
<tr>
<td>3. Moon</td>
<td>3. ......................</td>
</tr>
<tr>
<td>4. Fire fly</td>
<td>4. ......................</td>
</tr>
<tr>
<td>5. Shining steel plate</td>
<td>5. ......................</td>
</tr>
</tbody>
</table>
2. Write two differences between real and virtual image.

3. When you are standing in front of a plane mirror, a virtual and correct image of you is formed. If someone is taking a photograph of it using camera, what will be the nature of image on photograph?

4. A light ray is falling on a plane mirror at $30^\circ$ as shown in the diagram. If plane mirror is rotated by $30^\circ$ without changing the direction of incident ray, by what angle the reflected ray will rotate?

![Fig. 15.9](image)

5. An object of height 10 cm is placed in front of a plane mirror of height 8 cm. What will be the height of image formed? Taking the distance of object from the mirror 6 cm, draw the ray diagram.

6. The image of an object placed at 10 cm from the mirror is formed at 10 cm behind the mirror. If the object is displaced by 4 cm towards the mirror, by what distance will the image be displaced with respect to the (i) mirror (ii) object?

7. An object is moving with velocity $6 \text{ ms}^{-1}$ towards a plane mirror, what will be the velocity of image towards the (i) mirror (ii) object?

8. Some letters are given in following boxes. Make the meaningful words related to reflection of light choosing the horizontal and vertical sequencing.

<table>
<thead>
<tr>
<th>N</th>
<th>E</th>
<th>P</th>
<th>R</th>
<th>E</th>
<th>C</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>P</td>
<td>X</td>
<td>V</td>
<td>R</td>
<td>T</td>
<td>U</td>
</tr>
<tr>
<td>R</td>
<td>L</td>
<td>V</td>
<td>I</td>
<td>R</td>
<td>T</td>
<td>U</td>
</tr>
<tr>
<td>M</td>
<td>A</td>
<td>L</td>
<td>R</td>
<td>E</td>
<td>A</td>
<td>L</td>
</tr>
<tr>
<td>A</td>
<td>N</td>
<td>I</td>
<td>T</td>
<td>C</td>
<td>A</td>
<td>R</td>
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<td>T</td>
<td>A</td>
<td>E</td>
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<td>A</td>
<td>I</td>
<td>M</td>
<td>A</td>
<td>G</td>
<td>E</td>
<td>J</td>
</tr>
<tr>
<td>N</td>
<td>K</td>
<td>N</td>
<td>L</td>
<td>E</td>
<td>N</td>
<td>C</td>
</tr>
</tbody>
</table>

9. The distance and height of an object placed in front of a plane mirror are given in column A and B respectively. In column C and D the distance of image and height of image are given but not in same order. Correct the order.
15.4 REFLECTION AT SPHERICAL MIRRORS

A spherical mirror is a section of a hollow sphere whose inner or outer surface is polished. Thus, there are mainly two types of spherical mirrors (i) convex mirror and (ii) concave mirror.

(i) **Convex mirror:** It is a mirror in which the reflection takes place from the bulging surface (i.e. inner side is painted and reflected surface is polished to make the surface smooth as shown in Fig. 15.10.

(ii) **Concave mirror:** It is a mirror in which the reflection takes place from the cave side surface (i.e. outer side is painted and the inner or cave side surface is polished to make the reflected surface smooth as shown in Fig. 15.10.

To understand the reflection at spherical surface certain important terms are very useful. They are shown below in Fig. 15.11.
(i) **Pole (P):** It is the mid point of the spherical mirror. Point P is the pole in Fig. 15.11.

(ii) **Centre of curvature (C):** It is the centre of a hollow sphere of which the spherical mirror is a part. It can be determined by finding the point of intersection of two normal drawn at the spherical surface of the mirror. The point C is the centre of curvature in Fig. 15.11.

(iii) **Radius of curvature (R):** It is the distance between the pole and centre of curvature of the mirror. CF is the radius of curvature in Fig. 15.11.

(iv) **Principal axis:** It is an imaginary line joining the pole to the centre of curvature. Extended line CP is the principal axis in Fig. 15.11.

(v) **Principal focus (F):** The rays of light parallel and closed to the principal axis of the mirror after reflection, either pass through a point (in concave mirror) or appear to be coming from a point (in convex mirror) on the principal axis; this point is called principal focus of the mirror. Point F is the principal focus in Fig. 15.11.

(vi) **Focal length (f):** It is the distance between the pole and the principal focus of the mirror. PF is the focal length in the Fig. 15.11.

### 15.5 RELATIONSHIP BETWEEN FOCAL LENGTH AND RADIUS OF CURVATURE

Consider the reflection of light of ray IM at M at a concave mirror. CM is the normal drawn at the surface which passes through centre of curvature and MF is the reflected ray which passes through the focal point.

\[ \angle i = \angle r \quad (\text{as we know that angle of incidence and reflection are equal}) \]

\[ \therefore \quad \text{in } \triangle CMF, \quad MF = CF \]
For small aperture of the mirror,

\[ MF = PF \]

\[ \Rightarrow PC = PF + CF = PF + PF = 2PF \]

\[ R = 2f \]

where \( R \) = radius of curvature and \( f \) is the focal length of the mirror.

15.6 RULES OF IMAGE FORMATION BY SPHERICAL MIRRORS

The ray diagram for image formation by mirrors can be drawn by taking any two of the following rays. The point where these two rays meet or appear to be coming from the point will be the image point which determines the position of image.

(i) **Ray striking the pole:** The ray of light striking the pole of the mirror at an angle is reflected back at the same angle on the other side of the principal axis (Ray no. 1 in Fig. 15.13).

(ii) **Parallel ray:** For concave mirror the ray parallel to the principal axis is reflected in such a way that after reflection it passes through the principal focus. But for a convex mirror the parallel ray is so reflected that it appears to come from principal focus. (Ray no. 2 in Fig. 15.13)

(iii) **Ray through centre of curvature:** A ray passing through the centre of curvature hits the mirror along the direction of the normal to the mirror at that point and retraces its path after reflection (Ray no. 3 in Fig. 15.13)

(iv) **Ray through focus:** A ray of light heading towards the focus or incident on the mirror after passing through the focus returns parallel to the principal axis.

![Image formation by spherical mirror](image)

**Fig. 15.13** Image formation by spherical mirror (a) concave mirror (b) convex mirror

15.6.1 Formation of image by concave mirror

Using the above rules of image formation, the ray diagram for the image formed for different positions of an object are given below.
15.6.2 Formation of image by convex mirror

Image formation in convex mirror is shown in Fig. 15.15.

Fig. 15.15 Image formation by a convex mirror

The position, nature and size of the image formed in concave mirror and convex mirror can be summarized as given in table below:

Table 15.3

<table>
<thead>
<tr>
<th>Position of the object</th>
<th>Position of image formed</th>
<th>Nature of image</th>
<th>Size of image</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) For concave mirror</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) between $P$ and $F$</td>
<td>behind the mirror</td>
<td>virtual</td>
<td>larger</td>
</tr>
<tr>
<td>(ii) at $F$</td>
<td>at infinitely beyond $2F$</td>
<td>real</td>
<td>highly enlarged</td>
</tr>
<tr>
<td>(iii) between $F$ and $2F$</td>
<td>real</td>
<td></td>
<td>larger</td>
</tr>
</tbody>
</table>
(iv) at $2F$
(v) beyond $2F$
(vi) at infinity

(B) For convex mirror
anywhere
infront of mirror

<table>
<thead>
<tr>
<th>Condition</th>
<th>Image性质</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>at $2F$</td>
<td>real</td>
<td>same size</td>
</tr>
<tr>
<td>between $F$ and $2F$</td>
<td>real</td>
<td>smaller in size</td>
</tr>
<tr>
<td>at $F$</td>
<td>real</td>
<td>highly diminished</td>
</tr>
<tr>
<td>between $P$ and $F$</td>
<td>virtual</td>
<td>always smaller</td>
</tr>
</tbody>
</table>

Do you know

- Every part of a mirror may form a complete image of an extended object from a different angle and due to super-position of these images from different points final image is formed. The brightness of the image will depend on its light reflecting area. Thus a large mirror gives a brighter image than a small one. This phenomenon was used in a popular hindi film’s shooting at the Sheeshmahal of ‘Amer Fort’ in Jaipur (Rajasthan).

- Though every part of a mirror may form a complete image of an object, we usually see only that part of it from which light, after reflection from the mirror reaches our eyes. That is why:
  (i) to see the full image in a plane mirror a person requires a mirror of at least half of his height.
  (ii) to see complete image of the wall behind a person requires a mirror of at least $(1/3)$ of the height of the wall and the should be in the middle of wall and mirror.

- If two plane mirrors are placed inclined to each other at an angle $\theta$, the number of images of a point object formed

  $$\approx \left( \frac{360^\circ}{\theta} - 1 \right), \text{ if } \left( \frac{360^\circ}{\theta} \right) \text{ is even integer}$$

  $$\approx \frac{360^\circ}{\theta} \text{ if } \left( \frac{360^\circ}{\theta} \right) \text{ is odd integer}$$

  For example, there are 5 images formed by two mirrors at $60^\circ$ angle.

- Two mirrors inclined to each other at different angles may provide same number of images, e.g. for any value of $\theta$ between $90^\circ$ and $120^\circ$ the number of maximum images formed is $n = 3$. This in turn implies that if $\theta$ is given, $n$ is unique but if $n$ is given, $\theta$ is not unique.

- The number of images seen may be different from the number of images formed and depends on the position of observer relative to object and mirrors e.g., if $\theta = 120^\circ$ maximum number of images formed will be 3 but number of images seen may be 1, 2 or 3 depending on the position of observer.
15.6.3 Uses of mirrors

(i) Plane mirror is used
- in looking glasses,
- in construction of kaleidoscope, telescope, sextant, and periscope etc.,
- for seeing round the corners,
- as deflector of light etc..

(ii) Concave mirror is used
- as a reflector in searchlight, head light of motor cars and projectors etc.,
- for converging solar radiation in solar cookers,
- in flood lights to obtain a divergent beam of light to illuminate buildings,
- in reflecting telescopes etc..

(iii) Convex mirror is used
- as a rear view mirror in motor cars, buses and scooters,
- as safety viewers at dangerous corners and on upper deck of double decker buses etc..

15.7 SIGN CONVENTION AND MIRROR FORMULA

To measure distances with respect to a curved mirror, following convention is followed:

(i) All distances are measured from the pole of the mirror.

(ii) The distances measured in the direction of incident light, are taken as positive.

(iii) The distances measured in opposite direction of incident light, are taken as negative.

(iv) The distances above the principal axis are taken positive, whereas those below it are taken as negative.

You have seen the image formation in concave mirror. When an object is placed at 2f (centre of curvature) the image is formed at 2f. If f be the focal length of the concave mirror, u distance of object and v the distance of image, then

\[ u = -2f \]

and

\[ v = -2f \]

and \( f \) can be given as

\[ \frac{1}{f} = \frac{1}{-2f} + \frac{1}{-2f} \]
or
\[ \frac{1}{f} = \frac{1}{v} + \frac{1}{u} \]

This is called mirror formula and it can also be verified for convex mirror. Use this formula and justify the image formation given in image diagrams.

### 15.8 MAGNIFICATION IN SPHERICAL MIRRORS

Often we find that a spherical mirror can produce magnified image of an object. The ratio of the size of the image to the size of the object is called **linear magnification**.

i.e.,
\[ \text{linear magnification } (M) = \frac{\text{size of the image } (I)}{\text{size of the object } (O)} = \frac{v}{u} \]

where \( v \) = image distance from mirror, \( u \) = object distance from mirror.

---

**INTEXT QUESTIONS 15.2**

1. An object is placed infront of a concave mirror as shown in the Fig. 15.16. Write the position and nature of the image. What is the focal length of the mirror?

![Fig. 15.16](image)

2. In what condition, the image formed by concave mirror is virtual?

3. At what position will the reflected ray shown in Fig. 15.17 intersect the principal axis beyond focus or before focus?

![Fig. 15.17](image)
4. What type of image will be formed if an object is placed beyond centre of curvature in front of a concave mirror?

5. Find the position of the object placed in front of a concave mirror of focal length 20 cm if image is formed at the distance of 30 cm from the mirror.

6. Write two uses of concave mirror.

7. Write the nature of image formed in convex mirror.

8. Find the position of the image formed in convex mirror of focal length 12 cm when object is placed at the distance of (i) 8 cm, (ii) 12 cm and (iii) 18 cm from the mirror.

9. Complete the following table with corresponding positions of object and image in case of concave mirror.

<table>
<thead>
<tr>
<th>Position of object</th>
<th>Position of image</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) at ( F )</td>
<td>(i) ................</td>
</tr>
<tr>
<td>(ii) between ( F ) and 2( F )</td>
<td>(ii) ...............</td>
</tr>
<tr>
<td>(iii)</td>
<td>(iii) between ( F ) and 2( F )</td>
</tr>
<tr>
<td>(iv)</td>
<td>(iv) beyond 2( F )</td>
</tr>
<tr>
<td>(v) beyond 2( F )</td>
<td>(v) ...............</td>
</tr>
</tbody>
</table>

10. Write two uses of convex mirror.

11. Does concave mirror always converge the light rays?

12. Write the conditions to produce a magnified image in concave mirror.

15.9 REFRACTION OF LIGHT

Have you ever seen a coin placed at the bottom of a tumbler filled with water? The coin appears at smaller depth as its actual depth. Why does it happen so? We see an image where the light rays meet or at the point where light seems to be coming from.

When light comes out from water, it bends due to which the coin appears vertically displaced as shown in Fig. 15.18. Does it always happen? No, it does happen only when light passes from one medium to another obliquely. The bending of light depends upon the density of the medium.
When light passes from denser medium to rarer medium it bends away from the normal. When it passes from rarer medium to denser medium it bends towards the normal. This **phenomenon of bending of light is called refraction of light.** Refraction of light is shown in Fig. 15.19.

![Diagram of refraction of light](image)

**Fig. 15.19** **Refraction of light**

In Fig. 15.19 (b) and (c) light deviate from its path but in Fig. 15.19 (a) it does not deviate from its path. Is it refraction or not? Certainly it is refraction, for normal incidence light rays do not deviate from their paths. During refraction the frequency of the light remains unchanged but its wavelength changes hence the speed of light also changes.

**ACTIVITY 15.4**

To study the refraction of light place a glass slab on a dressing sheet fixed on a wooden drawing board, sketch a pencil boundary. Draw a line $OC$ meeting the boundary line obliquely. Fix the pins $A$ and $B$ on that line. Now look for these pins from the other side of the glass slab.

Take a pin and fix it on the sheet such that $A$, $B$ and $E$ are in a straight line. Now fix another pin $F$ such that it is in a straight line with pins $A$, $B$ and $E$. Remove the slab and the pins.

Draw a line joining the points $F$ and $E$ to meet the boundary at $D$. The line $ABC$ gives the direction of incident ray on the glass slab while the line $DEF$ gives the direction of emergent ray. The line $CD$ gives the direction of refracted ray within the glass slab. Draw normal $N_1CN_2$ at $C$ and $N_3DN_4$ at $D$ to the boundaries. Now you can conclude that the ray of light, when going from a rarer (air) to a denser (glass) medium, it bends towards the normal. Also, the ray of light when goes from denser to rarer medium it bends away from the normal.
15.9.1 Refractive Index of the Medium

When light travels from one medium to another its speed changes. A ray of light from a rarer medium to a denser medium slows down and bends towards the normal. On the other hand the ray of light going from a denser medium to a rarer medium is speeded up and bends away from the normal. It shows that the speed of light in different medium varies. Different s medium have different abilities to bend or refract light. This bending ability of a medium is known as the index of refraction or refractive index. It is defined as the ratio of the speed of light in vacuum to that in the material medium.

Therefore, refractive index of a medium,

\[ n = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}} \]

15.10 LAWS OF REFRACTION

The extent, to which a ray bends, depends not only on the refractive index of medium, but also on the angle of incidence. The laws of refraction are:

(i) **First law of refraction**: The incident ray, refracted ray and the normal at the point of incidence, all lie in the same plane (Fig. 15.19).

(ii) **Second law of refraction**: How much ray of light refracted depends on that medium. The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant and equal to the refractive index of that medium. This law is also called Snell’s law.
Refractive index \((n) = \frac{\sin \text{ of angle of incidence}}{\sin \text{ of angle of refraction}}\)

or

\[ n = \frac{\sin i}{\sin r} \]

**Does the colour of light change during refraction?**

The wavelength and frequency of light are related to the velocity as \(v = \nu \lambda\), where \(v\) is frequency and \(\lambda\) is wavelength.

**ACTIVITY 15.5**

Take a transparent bucket of plastic filled with water. Keep your head inside the water in bucket and hold it above the red colour light bulb as shown in Fig. 15.21. What do you observe? Is there any change in the colour of light seen by you from the water? No, there is no change in the colour of light. It means when light goes from one medium to another, only its speed and wavelength change but the frequency remains constant. It proves that colour is the function of frequency not the wavelength of light.

![Fig. 15.21 The red bulb is seen by a boy keeping his head inside the bucket filled with water](image)

**15.11 REFRACTION THROUGH SPHERICAL SURFACE**

In this section we will discuss refraction of light through a lens. A lens is a portion of a transparent refracting medium bounded by two surfaces. Depending upon the nature of surfaces lens may be of following types.
Convex lens: Convex lens has its two surfaces bulging outward. It makes the parallel rays of light to converge to a point. Hence, it is called **converging lens**. The point of convergence is called **focus** as shown in Fig. 15.23.

(ii) Concave lens: A concave lens has its two surfaces caving inward as shown in Fig. 15.24. It makes parallel rays of light to spread from a point. Hence it called **diverging lens**. The point where from light rays appear to diverge is called **focus** as shown in Fig. 15.24.
15.12 IMAGE FORMATION IN LENSES

In order to draw the image formed by any lens, only two rays are required. These two rays are:

(i) A ray parallel to the principal axis of the lens converges after refraction at the principal focus of convex lens. It appears to diverge off in the case of concave lens.

(ii) A ray towards the optical centre falls on the lens symmetrically and after refraction passes through it undeviated.

The image formations in convex and concave lenses are shown in Fig. 15.25.
(d) Object is at $2F_2$

(e) Object is beyond $2F_1$

(f) Object placed between optical centre and first focus

(g) Image by concave lens

Fig. 15.25 Image formation in convex and concave lens
All these images formed for different positions of object and nature of the image can be summarized as given in the table below:

<table>
<thead>
<tr>
<th>Position of the object</th>
<th>Position of image formed</th>
<th>Nature of image</th>
<th>Size of image</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) For convex lens</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) between ( F )</td>
<td>infront of lens</td>
<td>virtual and</td>
<td>enlarge</td>
</tr>
<tr>
<td>and pole</td>
<td></td>
<td>erect</td>
<td></td>
</tr>
<tr>
<td>(ii) at ( F )</td>
<td>at infinitely</td>
<td>real and</td>
<td>highly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>inverted</td>
<td>enlarged</td>
</tr>
<tr>
<td>(iii) between ( F )</td>
<td>beyond ( 2F )</td>
<td>real and</td>
<td>enlarge</td>
</tr>
<tr>
<td>and ( 2F )</td>
<td></td>
<td>inverted</td>
<td></td>
</tr>
<tr>
<td>(iv) at ( 2F )</td>
<td>at ( 2F )</td>
<td>real and</td>
<td>same size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>inverted</td>
<td></td>
</tr>
<tr>
<td>(v) beyond ( 2F )</td>
<td>between ( F )</td>
<td>real and</td>
<td>smaller in</td>
</tr>
<tr>
<td></td>
<td>and ( 2F )</td>
<td>inverted</td>
<td>size</td>
</tr>
<tr>
<td>(vi) at infinity</td>
<td>at ( F )</td>
<td>real and</td>
<td>highly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>inverted</td>
<td>diminished</td>
</tr>
<tr>
<td>(B) For concave lens</td>
<td>on the same side</td>
<td>virtual and</td>
<td>always</td>
</tr>
<tr>
<td>anywhere infront of</td>
<td>between ( F )</td>
<td>erect</td>
<td>smaller</td>
</tr>
<tr>
<td>lens</td>
<td>and pole</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 15.13 SIGN CONVENTION AND LENS FORMULA

In case of spherical lenses,

(i) all distances in a lens are to be measured from optical centre of the lens

(ii) distances measured in the direction of incident ray are taken to be positive

(iii) distance opposite to the direction of incident ray are taken to be negative

(iv) the height of the object or image measured above the principal are taken positive whereas below it, are taken negative.

Using the above mentioned sign convention and the image formation in Fig. 15.25 let us assume, the distance of object from the optical centre of the lens to be \( u \) distance of image from the optical centre to be \( v \) and focal length of the lens is \( f \) then the relationship between \( u, v \) and \( f \) for lens can be shown as:

\[
\frac{1}{f} = \frac{1}{v} - \frac{1}{u}
\]

This is called lens formula. Focal length for convex lens is positive, for concave lens it is taken negative.
15.14 MAGNIFICATION

You would have notice that in case of some lenses, the size of the image of an object is enlarged whereas in some other cases it is diminished. If we take the ratio of the size of the image to the size of the object for a particular lens it remains constant for that lens. The ratio of the size of the image to that of the object is called as the magnification of the lens.

\[
\text{Magnification} = \frac{\text{size of image (I)}}{\text{size of object (O)}}
\]

or

\[
m = \frac{(I)}{(O)}
\]

Also

\[
\frac{(I)}{(O)} = \frac{v}{u}
\]

or

\[
m = \frac{v}{u}
\]

INTEXT QUESTIONS 15.3

1. Name the type of lens which always produces virtual image.

2. Draw the ray diagram for the image formation in convex lens where object is placed at (i) \(F\) (ii) between \(F\) and \(2F\) (iii) beyond \(2F\).

3. Draw the ray diagram for image formation in concave lens.

4. The sizes of the image and object are equal in a lens of focal length 20 cm. Name the type of lens and distance of object from the lens.

5. An object of size 10 cm is placed infront of convex lens of focal length 20 cm. Find the size of the image formed.

15.15 DISPERSION OF LIGHT THROUGH GLASS PRISM

A prism is a transparent medium bounded by any number of surfaces in such a way that the surface on which light is incident and the surface from which light emerges are plane and non-parallel. Generally equilateral, right angled isosceles or right angled prisms are used.

When white light or sun light passes through a prism it splits up into constituent colours. This phenomenon is called dispersion and arises due to the fact that refractive index of prism is different for different colours of light. So, different colours
in passing through a prism are deviated through different angles. Rainbow, the most colourful phenomenon in nature, is primarily due to the dispersion of sunlight by rain drops suspended in air. Dispersion of light in glass prism is shown in Fig. 15.26.

![Dispersion of light](image)

**Fig. 15.26 Dispersion of light**

**ACTIVITY 15.6**

To produce a spectrum (display of different colour) using a prism and sunlight

(i) Take an empty card board box. Make a rectangular opening on its cover with a knife and close it with transparent white paper to see the spectrum.

(ii) Make a thin slit with knife on the opposite side of card board box.

(iii) Place the prism on a block inside the box.

(iv) Turn the slit-side face of the box towards sun light.

(v) See the coloured strips on the transparent paper.

The frequency of colours in decreasing order is violet, indigo, blue, green, yellow, orange, and red. It can be written as VIBGYOR.

**INTEXT QUESTIONS 15.4**

1. When light passes from air to a medium its speed reduces to 40%. The velocity of light in air is $3 \times 10^8$ ms$^{-1}$. What is refractive index of the medium?

2. When sunlight is passed through prism, it splits into seven colours as shown in Fig. By numbers write corresponding colours.
3. How do $r$ and $\delta$ change for same angle of incidence $i$ if the prism shown in Fig. is immersed in water.

4. Why does white light split into seven colours when it passes through a prism?

5. Write a natural phenomenon of dispersion of light.

**15.16 EYE AND ITS DEFECTS**

In eye a convex lens forms real, inverted and diminished image at the retina. The lens can changes its convexity to form a suitable image as the distance between eye lens and retina fixed. The human eye is most sensitive to yellow-green light having wavelength 5550 Å, the least to violet 4000 Å and red 7000 Å.

The size of an object as perceived by eye depends on its **visual angle**. When an object is distant, its visual angle $\theta_1$ and image $I_1$ at retina is small hence it will appear small. If it is brought near the eye, the visual angle $\theta^\circ$ is large and hence size of image $I_2$ will increase as shown in Fig. 15.29.

The far and the near points for normal eye are usually taken to be at infinite and 25 cm respectively. It means a normal eye can see very distant objects clearly but near objects only if they are at a distance greater than 25 cm from the eye. The ability of eye to see objects from infinite distance to 25 cm is called power of **accommodation**.
If an object is at infinity, i.e., parallel beam of light enters the eye, the eye is least strained and said to be relaxed or unstrained. However, if the object is at the least distance of distinct vision (= 25 cm), eye is under the maximum strain and visual angle is maximum. (The angle made by object at eye is called visual angle).

If image of the object does not form at retina the eye has some defects of vision. Following are the common defects of vision.

(i) **Myopia:** In this defect the distant objects are not clearly visible i.e., far point is at a distance lesser than infinity and hence image of distant object is formed before the retina as shown in Fig. 15.31. This defect is removed by using diverging (concave) lens. Myopia is also called short sightedness or near sightedness.
(ii) **Hypermetropia**: It is also called long sightedness or far sightedness. In it the near objects are not clearly visible i.e. near point is at a distance greater than 25 cm. So the image of near object is formed behind the retina. This defect is removed by using converging lens as shown in Fig. 15.32.

![Hypermetropic eye](image1) ![Corrected eye](image2)

*Fig. 15.32*

(iii) **Presbyopia**: In this defect both near and far object are not clearly visible i.e., far point is lesser than infinity and near point greater than 25 cm. This can be removed either by using two separate spectacles one for myopia and other for hypermetropia or by using bifocal lens. It is an old age disease. At old age ciliary muscles lose their elasticity so they can not change the focal length of eye lens effectively and eye loses its power of accommodation.

(iv) **Astigmatism**: It is due to imperfect spherical nature of eye lens. The focal length of eye lens is in two orthogonal directions become different so they can not see objects in two orthogonal directions simultaneously. This defect in direction can be removed by using cylindrical lens in a particular direction.

**INTEXT QUESTIONS 15.5**

1. Identify the eye having defective vision from the following diagrams. Write the type of defect in vision. How this defect can be removed?

![Eye Diagrams](image3)
2. Three students Riya, Tiya and Jiya in a class are using sphericals of power +2D, +4D and −2D. What type of defect in vision they have?

3. How does the focal length of the eye changes when a lens is used to correct the defect of vision in case of (i) short sightedness and (ii) long or for sightedness?

**WHAT YOU HAVE LEARNT**

- Light is a form of energy which makes the objects visible to us.
- When light falls on a smooth and rigid surface and comes back to the same medium, the phenomenon is called reflection.
- In reflection, the angle of incidence is equal to the angle of reflection. Also the incident ray, reflected ray and normal drawn at the point of incidence all lie in the same plane.
- In plane mirror, the virtual image of the size of object and at equal distance from the mirror is formed.
- Spherical mirrors are of two types (i) concave and (ii) convex.
- In spherical mirrors radius of curvature is double of the focal length.
- When object is placed infront of a concave mirror at $F$, between $F$ and $2F$, at $2F$, beyond $2F$, the image will be formed at infinity, beyond $2F$, at $2F$ and between $F$ and $2F$ respectively.
- When an object is placed between $F$ and pole of the concave mirror, the image is formed behind the mirror, virtual and enlarge in size.
- In convex mirror image is always formed between $F$ and pole, smaller in size and virtual nature.
- When light goes from one medium to another its speed changes and the light ray bends. This phenomenon is called refraction of light.
- In refraction, the ratio of sine of angle of incidence to the sine of angle of refraction is constant called refractive index.
- When light goes from rarer to denser medium it bends towards the normal and angle refraction remains less than the angle of incidence.
- When light goes from denser to rarer medium it bends away from the normal and angle of refraction remains greater than the angle of incidence.
- A transparent medium bounded by two well defined surfaces is called lens. There are two types of lens (i) which converges light (convex lens) and (ii) which diverges light (concave lens).
- In convex lens, when object is placed at \( F \), between \( F \) and \( 2F \), at \( 2F \), beyond \( 2F \) in front of convex lens the image is formed at infinity, beyond \( 2F \), at \( 2F \) and between \( F \) and \( 2F \) respectively.

- When object is placed between \( F \) and optical centre of the convex lens, the image formed is virtual and enlarge.

- In concave lens the image is always formed between \( F \) and pole, smaller in size and virtual.

- The focal length of a mirror is given as:
  \[
  \frac{1}{f} = \frac{1}{v} + \frac{1}{u}
  \]

- The focal length of a lens is given as:
  \[
  \frac{1}{f} = \frac{1}{v} - \frac{1}{u}
  \]

- The reciprocal of the focal length is called power of the lens \( P = \frac{1}{f \, (m)} \). Its unit is diopter.

- A person who can see the objects near to him properly but can not see the distant objects has a near sight defect of vision. This defect can be removed by using a concave lens.

- A person who can see the far objects but can not see the near objects has a far sight defect of vision. This defect can be removed by using convex lens.

- When light passes through a prism it splits into its constituent colours and this phenomenon is called dispersion of light.

- Rainbow is the best known example of dispersion in nature.

**TERMINAL EXERCISE**

1. What happens to the speed of light when it goes from (i) denser medium to rarer medium (ii) rarer medium to denser medium?

2. Can angle of incidence be equal to the angle refraction? Justify.


4. Write the nature of the image formed by concave lens.

5. In horizontal and vertical boxes of the letter grid some meaningful words regarding the properties of light are placed in different rows and column in the table below. Find at least three and define them.
6. What will be the nature of the image formed in a convex mirror and in a concave mirror each of focal length 20 cm and object is placed at the distance of 10 cm.

7. Find the position of the image formed in concave mirror of focal length 12 cm when object is placed 20 cm away from the mirror. Also find magnification.

8. In which of the following media, the speed of light is maximum and in which it is minimum.

<table>
<thead>
<tr>
<th>Medium</th>
<th>Refractive index</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.6</td>
</tr>
<tr>
<td>B</td>
<td>1.3</td>
</tr>
<tr>
<td>C</td>
<td>1.5</td>
</tr>
<tr>
<td>D</td>
<td>1.4</td>
</tr>
</tbody>
</table>

9. The image of a candle formed by a convex lens is obtained on a screen. Will full size of the image be obtained if the lower half of the lens is printed black and completely opaque? Illustrate your answer with a ray diagram.

10. Can a single lens ever form a real and erect image?

11. What is dispersion of light? What is the cause of dispersion of light?

12. Why do distant objects appear to be smaller and closer to each other?

13. A person looking at a net of crossed wires is able to see the vertical direction more distinctly than the horizontal wires. What is the defect due to? How is such defect of vision corrected?
14. A person can see the objects placed at a distance of 30 cm clearly but cannot see the objects placed 30 m away. What type of defect of vision he has? How is this defect of vision corrected?

15. Distinguish visible, ultraviolet and infrared light.

16. Which of the following quantities remains constant during reflection of light?
   (i) speed of light
   (ii) frequency of light
   (iii) wavelength of light

17. Write the value of angle of reflection at both the reflecting surfaces $M_1$ and $M_2$ held perpendicular to each other as shown in Fig. 15.34

![Fig. 15.34](image)

18. An object is placed infront of a plane mirror. The mirror is moved away from the object with the speed of 0.25 ms$^{-1}$. What is the speed of the image with respect to the mirror and with respect to the object?

19. Size of the image in a plane mirror of height 12 cm is 20 cm. What is the size of the object?

ANSWERS TO INTEXT QUESTIONS

15.1

1. 1. Luminous 2. Luminous 3. Non-luminous
   4. Luminous 5. Non-luminous

2. (i) Real image can be taken on screen while virtual can not.
   (ii) Real image is formed due to light rays meeting at the screen. While virtual image is formed due to light rays appear to meet at the screen.

3. Real

4. 60°
5.

6. (i) 4 cm  (ii) 8 cm
7. (i) 6.0 ms\(^{-1}\)  (ii) 12.0 ms\(^{-1}\)
8. Real, Erect, Plane, Virtual, Image
9. 

<table>
<thead>
<tr>
<th>Distance of object (A)</th>
<th>Height of object (B)</th>
<th>Distance of image (C)</th>
<th>Height of image (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 cm</td>
<td>5 cm</td>
<td>10 cm</td>
<td>5 cm</td>
</tr>
<tr>
<td>5 cm</td>
<td>10 cm</td>
<td>5 cm</td>
<td>10 cm</td>
</tr>
<tr>
<td>6 cm</td>
<td>8 cm</td>
<td>6 cm</td>
<td>8 cm</td>
</tr>
</tbody>
</table>

15.2
1. Position is equal to \(-8.55\) cm, the image is real of focal length 5 cm
2. When object is between focal point and pole of the mirror.
3. before focus
4. Real, smaller in size and inverted
5. 60 cm infront of mirror
6. Saving mirror, magnifying mirror for dentist
7. Always virtual and smaller in size
8. (i) 4.8 cm  (ii) 6 cm  (iii) 7.2 cm
9. 

<table>
<thead>
<tr>
<th>Position of object</th>
<th>Position of image</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) at (F)</td>
<td>(i) at infinity</td>
</tr>
<tr>
<td>(ii) between (F) and (2F)</td>
<td>(ii) beyond (2F)</td>
</tr>
<tr>
<td>(iii) beyond (2F)</td>
<td>(iii) between (F) and (2F)</td>
</tr>
<tr>
<td>(iv) between (F) and (2F)</td>
<td>(iv) beyond (2F)</td>
</tr>
<tr>
<td>(v) beyond (2F)</td>
<td>(v) between (F) and (2F)</td>
</tr>
</tbody>
</table>

10. (i) in vehicle for rear view (ii) as safety viewers at dangerous corners
11. No, not always
Light Energy

12. Object must be placed either between focal point and pole for virtual image or between $F$ and $2F$ for real image.

15.3
1. Concave lens
2. (i) 
   ![Diagram](image1)
   
   (ii) 
   ![Diagram](image2)
   
   (iii) 
   ![Diagram](image3)
3. 
   ![Diagram](image4)
4. Convex lens, 40 cm
5. –20 cm

15.4
1. \( \frac{5}{3} \)
2. (1) Violet (2) Indigo (3) Blue (4) Green (5) Yellow (6) Orange (7) Red
3. \( r \) and \( \delta \) both will decrease
4. Material of the prism has different value of refractive index for different colours of light.
5. Rainbow in the sky

15.5
1. (A) Shortsightedness, it can be removed by using diverging lens. (B) No defect (C) Longsightedness, it can be removed by using converging lens.
2. Riya and Tiya have longsightedness and Jiya has shortsightedness.
3. (i) increases (ii) decreases
रॉबर्ट नर्सिंग होम में

आप कभी-न-कभी किसी अस्पताल या नर्सिंग होम में अवश्य गए होंगे। वहाँ आपने यह ध्यान दिया होगा कि किस तरह कुछ लोग रोगियों तथा पीड़ितों की सेवा करते हैं। ऐसे दृश्य आप में भी दूसरों के लिए कुछ कर पाने की इच्छा जगाते होंगे। अपनों की सेवा तो सभी करते हैं, पर बड़ी बात तो तब है, जब दूसरों के लिए भी कुछ किया जाए। दूसरों के लिए कुछ करने की भावना से भरे लोग जाति, क्षेत्र, भाषा, धर्म, लिंग व रंग आदि के बंधन को नहीं मानते। वे तो बस यह मानते हैं कि मनुष्य-मनुष्य में भेद कैसा? मनुष्य तो मनुष्य है, वह और कुछ हो ही नहीं सकता। आइए, इस पाठ के माध्यम से ऐसी ही भावना रखने वाले लोगों की विषय में जानने एवं उनसे प्रेरणा लेने का प्रयास करते हैं।

उद्देश्य

इस पाठ को पढ़ने के बाद आप—

- मानव-जीवन में सेवा-भाव और करणा, प्रेम तथा उदारता के महत्त्व का उल्लेख कर सकेंगे;
- क्षेत्र, भाषा, जाति, धर्म एवं रंग-परंपरा आदि के बारे में अपने विचार प्रस्तुत कर सकेंगे;
- विश्व-स्तर पर त्याग व समर्पण के क्षेत्र में महिलाओं के योगदान के विषय में बता सकेंगे;
- पाठ की भाषा-शैली पर टिप्पणी कर सकेंगे;
- रिपोर्ट विधा का वर्णन कर सकेंगे।
कल तक जिनका अतिथि था, आज उनका परिचारक हो गया; क्योंकि मेरी आतिथेया अवांक रोग की लपेट में आ गई और उन्हें इंदीर के रॉब्ट नौसिंग होम में लाया गया।
यह है सितंबर, 1951 !
रोग का आधार पूरे वेष में, परिणाम कांपकंपाता और वातावरण चिंता से घिरा-घिरा कि हम सब सुस्तः। तभी मैंने चौंक कर देखा कि अपने विशिष्ट ध्वाल वेश में आच्छादित नारी कमरे में आ गई है।
देख उनकी कोई पौंतालीस बसंत देखी, वर्ष हिम-श्वेत, पर अरुणोदय की रेखाओं से अनुरूपित, कद लंबा और सुता-समा।
“लंबा गुंह अच्छा नहीं लगता, बीमार के पास लंबा गुंह नहीं,” आते ही उन्होंने कहा।
सफ-सुधारी भाषा, उच्चारण सफ और स्पर्श आदेश का; पर आदेश न अधिनकार का, न अधिकारी का, पूर्णतया माँ का, जिसका आरंभ होता है शिकंजे से और अंत गोद में।
हीं, वे माँ ही थी: होम की अयोश मदर टेरेसा, मातृभूमि जिनकी प्रांत और कर्ममूर्त भारत। उभरती तरणाई से उभय के इस दहाल का रोगियों की सेवा में तत्त्वात, यही कम, यही धाम, यही शांति, यही चाव और बस यही, यही।
उन्होंने रोगी के दोनों म्यान कपोल अपने चौंदमी-चर्चित हाथों से ध्यानपाई तो उसके सुरूप अधरों पर चौंदी का एक रेखा खिच आई और मुझे लगा कि वातावरण का तनाव कुछ कम हो गया।
तभी एक खटक और हमारा डॉक्टर कमरे के भीतर। मदर ने उसे देखते ही कहा—“डॉक्टर, तुम्हारा बीमार हैं रहा है।”
“हीं, मदर ! तुम हैंसी बिखेनटी जो हो,” डॉक्टर ने अपने जाने कितने अनुभव यों एक ही वास्त में गूँध दिए।
मैंने भवना से अभिभूत हो सोचा—जो बिना प्रस्ताव किए ही माँ बन सकती है, वही तीस रूपये मासिक पर बोस वर्ष से दिन और रात सेवा में लग सकती है और वही चीड़ियों के तड़पते जीवन में हैं स्वर खिच सकती है।
रावट नर्सिंग होम में

तीसरे पहर का समय, थर्मोमीटर हाथ में लिए वे आई—मदर देरेसा और उनके साथ एक नवयुवक, उसी विशेष ध्वनि वेश में, गौर और आकर्षक। हाँ, गौर और आकर्षक, पर उसके स्वरूप का विचार करने में वे दोनों ही शायद असफल। वो कहकर उसके आस-पास आ गएंकि शायद चांदनी को दूध में खोलकर ब्रह्मा ने उसका निर्णय किया हो। रूप और स्वरूप का एक देवी साँचा—सी वह लड़की। नाम उसका क्रिस्ट हैल्ड और जन्मभूमि जर्मनी।

फ्रांस की पूरी मदर देरेसा और जर्मनी की दुहिता क्रिस्ट हैल्ड एक साथ—एक रूप, एक ध्येय, एक रस।

“तुझ्या देश महान है, जो युद्ध के देवता हिटलर को भी जन्म दे सकता है और तुझ्या—जैसौ से वाणी अपित को भी।” मैंने उससे कहा, तो दर्पण से दूर हो वह स्टेंड हो गई और अपना दशा बहुत पूर्वी पर वेद में ठूंककर बोली—“यह-यह।”

वह दूसरे कमरे में बाँटी गई।

“आप इस जर्मन लड़की के साथ ध्यान से रहती हैं?”

बोली, “हाँ, वह भी इंसान के लिए काम करती है और मैं भी, फिर याद क्यों न हो?“

मैंने नस्तर चुभाया—“पर फ्रांस को हिटलर ने पददलित किया था, वह आप कैसे भूल सकती हैं?“

नस्तर तेज् था, चुम्बन गहरी; पर मदर का कलेजा उससे अंधूता रहा। बोली—“हिटलर दुरा था, उससे लड़ाई छेड़ी, पर उससे इस लड़की का भी घर बच गया और मेरा भी, हम दोनों एक।“

‘हम दोनों एक’—मदर देरेसा ने इतने गढ़े बूझ कर कहा कि जैसे मैं उनसे उनकी लड़की धीर रहा था और उन्होंने पहले ही दूर्व में मुझे चारों खाने दे मारा। मदर चली गई, मैं सोता रहा। मनुष्य-मनुष्य के बीच मनुष्य ने ही फिक्तनी दीवार में खड़ी की है—ठंडी दीवारें, मजबूत फोलादी दीवारें, भूगोल की दीवारें, जाति-वर्ग की दीवारें। फिक्तनी मनहूस, फिक्तनी नगण्य, पर फिक्तनी अज्ञेय।
## राखर्ट नसिंग होम में

क्रिस्ट हैल्ड के पिता जर्मनी में एक कॉलेज के प्रीसिपल हैं और उसने अभी पाँच वर्षों के लिए ही सेवा का प्रति लिया है।

रोगियों के गर्दन में पाए गए वाल देखकर उसने कहा, “तुम्हारे कारण बाल मेरे पिता के से हैं।” कहा और स्मृतियों में खो-सी गई।

मुझे लगा कि मैं ही क्रिस्ट हैल्ड हूँ। अपने माता-पिता से हजारो मील दूर, एक अजनबी देश में, अकेली, खूबी, छली-सी और मेरे आँखें भर आई।

लड़की मेरे आँखों में जूब-दूब गई और किनारा पाने को उसने जल्दी से उन्हे अपने रूम में धांस की हृदय दिया। उसकी सदा हैंसी आँखें, नरम हो आई, पर जरा भी नम नही। मैंने पुछा, “पर चलते समय रोई थी तुम?” उसका मोहा उत्तर था, “न, मौं बहुत रोई थी।”

फूटी आँखों से कुछ देर उसमें देखता रहा, तब कुछ विस्फोट उसे मेंट किया। बोली, “बन्धनवाद, थूक यू, तांग यू।” वह अक्सर हिंदी, अंग्रेजी, जर्मन भाषाओं के शब्द मिलाकर बोलती है।

हम सब हृंस पड़े और वह हैंसी-हैंसी भाग गई।

मदर टेरेसा बालों के मूढ़ में थी। मैंने उनके इंद्र-मानस में चौर दरवाजे से झोका—‘मदर, घर से आने के बाद फिर आप घर नहीं गई, कभी मिलने-जुलने भी?’ कहना अपना काम कर चुके थे, वाणी की अपना काम करना था, पर मदर ने उसकी राह मोड़ दी और तब मैंने सुनी यह कहानी।

पहली धर्ष हुई। फ्रांस में विश्व-भर के पूजा-पूजों का एक सम्मेलन हुआ। भारत की दो मदर भी प्रतिनिधि होकर उस सम्मेलन में गई। वे फ्रांस की ही थीं, उनके माता-पिता फ्रांस में ही थे। उन्हें पता था कि बरसों बाद हमारी पुत्रियाँ आ रही हैं।

दोनो माताओं अपनी पुत्रियाँ का स्वागत करने जहाज पर आई, पर विश्व भात यह हुई कि वे दोनों अपनी पुत्रियाँ को पहचानने न पाईं और आपस में कहती रही कि तुम्हारी बेटी कौन-सी है। अंत में उनका नाम पूछा और तब गले मिली।

कहानी पूरी हुई, तो कही प्रश्न उठे, पर मदर टेरेसा उनके उत्तर-न-उत्तर भाग गई। निश्चय ही उन दोनों अनपहचानी पुत्रियों में से एक ब्रन्ध थी।

बत इतना ही एक दिन में उनसे और कहाना सका—‘घर से बहुत घिटटी आती हैं, तो मैं यहाँ के किसी दिन फ्रांस का फॉटो मेज देती हूँ।’

रोगी पूरे उपार पर था, रोगी के लिए आसान। मदर टेरेसा ने कहा, “तुम्हारे लिए आज चिट्टी करूँगी।” उनका चेहरा उस समय भक्त की श्रद्धा से आलोकित हो उठा था।

रोगी ने कहा, “कल भी करना मदर।” मदर के स्वर में मिसरी-मिसरी, पर मिसरी कुंजे की थी, जो मिटांगा तो तुरंत ही देती थी, पर मुली तुरंत नहीं और बल का प्रयोग
हो, तो मुंह तक को छील देती है।
बोली, “न, कल उसके लिए करनी, जिसे सबसे अधिक कट होगा।” जैसे हजार वाट का बल मेरी आँखों में कोई गया।
मैंने बुधतों को रूप से पाते देखा था, बुधतों को धन से और गुणों से भी बुधतों को पाते देखा था, पर मानवता के 
आँगन में समर्पण और प्राणित का यह अद्वैत सौंभव स्वरूप आज अपनी ही 
आँखों से देखा कि कोई अपनी पीड़ा से 
किसी को पाए और किसी का उत्साह सदा किसी की पीड़ा के लिए ही सुरक्षित रहे।
ूप के बरसामंदे में खड़े-खड़े मैंने एक जादू की पुड़िया देखी— जीती जागती जादू की 
पुड़िया। आदमियों को महंगी बनाने वाला काम रूप का जादू नहीं, मिलियों को आदमी 
बनाने वाला जीवन का जादू— होम की सबसे बुड़िया मदर मारिट। कद इतना नाटा 
कि उन्हें पुड़िया कहा जा सके, पर उनकी बाल में गजब की बुड़िया, कदम में पुिती और 
व्यवहार में सस्ती, हंसी उनकी यो। कि मोतियों की बौरी खुल पड़ी और क्रां यो। कि 
मरून मात्र माने। भारत में चालूस्व व्यों में सेवा में रसलीन, जैसे और कुछ उन्हें जीवन 
में अब जाना भी तो नही।
ऑपरेशन के लिए एक रोगी आया, ऐसा-आया में पता जीवन। कहने की बेचारे को 
आदत, सहन का उससे क्या निपट? पर कद क्या पात्र की क्षमता देखकर आता है?
“मदर मर जाएगा,” उनसे विश्वास होकर कहा।
वातावरण चीफ का विचारवता से भर गया, पर बुढ़ी मदर की हंसी के दीपक ने झपकी 
तक नहीं खाई। बोली, “कुछ नहीं, कुछ नहीं, आज है ऐवरिथिंग (सब कुछ), कद 
समधिक (कुछ-कुछ) और सब, तब निम्न (कुछ नहीं)” और वे इतने जोर से 
खिलखिलाकर हंसी कि आत-पास कोई होता, तो हो जाता।
एक रोगी उन्होंने देखा-धिमा के गत से उठ-उमरती रोगियो। जोर से बुड़ियों 
बजाकर वे किन्तू— “जी-उत्ती, जी-उत्ती!” अर्थ है— जी-उत्ती, जी-उत्ती।
यह अनुमय कितना चमकतार है कि यहाँ जो जितनी अधिक बुढ़ी है, वह उतनी ही 
अधिक उत्सुक, मुक्तावनी है। यह किस दीपक की जोत है? जागरूक जीवन 
की। लक्ष्यदर्शी जीवन की! सेवा-निर्माता जीवन की! अपने विश्वासों के साथ एकऽ जीवन 
की! माना के बेद रहे हं, रहेंगे मः, पर यह जोत विश्व की सर्वोत्तम जोत है।
सिस्टर क्रिस्ट हैल्ड का तबादला हो गया—अब वह धानी के भील सेव-केंद्र में काम 
करेगी। और, उस जंगली जीवन में यह कपड़ेरिका, पर कपड़ेरिका तो अपने सीमाओं में इतनी 
लीन है कि उसे स्वर्ग के अतिरिक्त और कुछ दिखाता ही नहीं।
रावत्त नरसिंह होम में

वह हम लोगों को मिलने आई—हंसती, खिलती, बिखरती और कुछकुछ। यहाँ से जाने का उसे बिगाड़ नहीं, एक नई जगह देखने का चार उसके रोम-रोम में, पर मुझे उसका जाना कहोट-सा रहा था। वह दूसरे रोगियों से मिलने चली गई।

इसर-उधर आते-जाते वह दो-तीन बार कमरे के बाहर से निकली, पर फिर एक बार भी उसने उघर नहीं झूँका। मैंने अपने से कहा, 'कोई लाख उलझे, उसे किसी में नहीं उलझाना है।' और तब सिस्टर क्रिस्ट हैल्ड का, सच यह है कि सिस्टर-मदर बर्ग का निस्संग, निःश्लेष्य, निदर्शदृश जीवन पूरी तरह मेरे मानस-विचारों में समा गया और फिर मैंने आप ही आप कहा—“सिस्टर क्रिस्ट हैल्ड, हम भारतवासी गीता को कंठ में रखकर धनी हुए, पर तुम उसे जीवन में ले कूलार्ध हुई।”

—कन्हैयालाल मिश्र ‘प्रभाकर’

**वोध प्रश्न**

सर्वांशात्‍क उपयुक्त विकल्प चुनकर पूछे गए प्रश्नों के उत्तर दीजिए:

1. ‘देख उनकी कोई पैलालीस बसंत देखी’ के माध्यम से लेखक क्या बताना चाहता है?
   (क) सांदर्भ
   (ख) मौसम
   (ग) उदार
   (घ) दूसरी-फूर्ति

2. हिटलर को मदर ने बुरा कहा, क्योंकि वह—
   (क) फ्रांस को जीतना चाहता था
   (ख) नफरत पैला रहा था
   (ग) जर्मनी का रहने-वाला था
   (घ) स्त्री-विरोधी था

3. ‘किम यों कि मशीन मात मानना’ का आशय है—
   (क) सभी उपकरण चलाने का कौशल
   (ख) शीघ्रता से काम कर लेना
   (ग) मशीनों को बुरा मानना
   (घ) मशीनों से भी तेज़ काम करना

**आइए समझों**

आइए, अब इस पाठ को तीन अंशों में बॉटकार समझने का प्रयास करते हैं।
5.2.1 अंश-1
कल तक जिनका...पर कितनी अजेय।
पाठ के आरंभ में लेखक ने इंदिरा के रोबर्ट नरसिंह होम का उल्लेख किया है। इस नृत्य होम में लेखक अपने किसी जानकार को बीमार होने पर, इलाज के लिए लेकर जाता है। यहीं पर उसने पहली बार मदर टेरेसा और क्रिस हैंड को देखा। लेखक इन दोनों के रूप-सादर्य तथा रोगियों के प्रति इनकी आत्मीयता और सेवा-भावना से बहुत प्रभावित, प्रेरित हुआ। इसके साथ ही लेखक यह व्यक्त करता है कि मानवता की सेवा करने वालों का इंद्रय एक होता है, वे मनुष्य-मनुष्य के बीच खड़ी की गई दीवारों को ढहा देते हैं।
इस अंश में इन बातों का ऐसा वर्णन किया गया है जो नाभो पाठक के सामने प्रस्तुत घटता हो रहा हो।
मदर टेरेसा का नाम तो हम सब जानते ही हैं। लंबे कद ब गोरे रंग वाली टेरेसा सफेद साड़ी पहनने वाले मान की मूर्ति जैसी दिखती थी। लेखक ने जब इस नृत्य होम में मदर को देखा, उस समय मदर की आयु लगभग 45 वर्ष की होगी। लेखक ने मदर टेरेसा के रोगरास वातावरण में आने और उनकी उम्र और प्रभावशाली व्यक्तित्व के आंदोलन्य देखा वर्णन किया है। निम्नलिखित उद्धरण पर ध्यान दीजिए—“देख उनकी कोई पैंटलीस बसंत देखी, वर्ण हिम-श्वेत, पर अरुणोदय की रंग थी। मैं अनुभवित, कद लबा और सुता—सध।”
इस वर्णन को पहले मदर का चित्र हमारे सामने उपस्थित हो जाता है। वर्ष की तरह सफेद रंग उनके हाथ की फिरण खड़े तो सफेद का रंग लालिमायुक्त हो जाता है—ऐसा ही आकर्षण रूप था मदर का।
मदर नहीं चाहती थी कि रोग, विपत्ति तथा अन्य कष्ट हमारे समाज में बचे रहें। मदर ने इनमें से एक क्षेत्र चुन लिया। वे रोगियों की सेवा करने लगीं। मदर जब किसी को कुछ कहती तो वह किसी तानाशाह के अधिकारी का आदेश न होता, बल्कि सहारों में की ममता उसमें इतःकती थी। जैसे कभी आपकी माँ से आपको डॉक्टरों होंगी, पर उस डॉट में उनका स्थान समाया होता है।
जैसे आप अपनी मां के स्पर्श मात्र से खुश हो जाते हैं, वैसे ही मदर टेरेसा के स्पर्श से रोगी अपनी पीड़ा मूलभूत होती लगती थी। एक स्थान पर मदर के स्पर्श के प्रभाव का उल्लेख किया गया है। कष्ट से ग्रस्त रोगियों को मदर का स्पर्श-मात्र ठंडक पहुँचा देता था। पीड़ितों को खुश देखने के लिए उन्होंने अपना सारा जीवन लगा दिया। स्वयं बच्चों को जन्म दिए बिना भी किसी नारी में इतना ममत्व व इतनी करणा हो सकती है, यह मदर टेरेसा को देखकर पता चलता है। सारा संसार उन्हें मां कहता है, क्योंकि टेरेसा के लिए सभी उनके अपने बच्चे थे। चाहे, उन्होंने किसी संतान को जन्म न दिया हो पर उनके लिए संतान की कमी न थी। और संतान भी तीसी, जिसे मां की ओर से ज्यादा ज्ञात होगा।
रावर्त नरसिंह होम में

इसी नरसिंह होम में लेखक ने मानव-सेवा को समर्पित एक और महिला को देखा। वह भी बहुत आकर्षक थी। ऐसा स्वीकार करता हूँ। जर्मनी में जर्मनी क्रिस्त हैल्ड भी मदर तरेसा के साथ ही रावर्त नरसिंह होम में रोगियों की निपटाव-माफ से सेवा करती थी। क्रिस्त हैल्ड के व्यक्तित्व और सीमांत का भी देश झण्डा हो लेखक ने किया है, जैसा मदर का किया था। जिन शब्दों में यह विचार किया गया है, उन पर आपका अपने आप ही ध्यान गया होगा।

हम सब जानते हैं कि द्वितीय विश्वयुद्ध के समय जर्मनी और फ्रांस एक-दूसरे के घर विरोधी थे। दोनों एक दूसरे के विरुद्ध लड़े भी थे। लेखक को इस बात पर थोड़ा आशर्च होता है कि फ्रांस की मदर तरेसा और जर्मनी की क्रिस्त हैल्ड यहाँ एक साथ, एक कर्म, एक धर्म, एक लोग लिये मानव सेवा में लीन थी। लेकिन हम यह जानते हैं कि द्वितीय-तपस्वी, निपटाव-माफ से काम करने वाले लोग प्राचीन देश में होते हैं। जर्मनी में हिटलर ने ही जन्म नहीं दिया, विवाह का भला करने वाले वैज्ञानिकों, दार्शनिकों, विज्ञानकर्मी आदि ने भी वहाँ जन्म लिया है। मानवता की सेवा करने वाली क्रिस्त हैल्ड भी वहाँ की है। इसीलिए लेखक क्रिस्त हैल्ड से कहता है— "तुम्हारा देश महान है, जो युद्ध के दौरान हिटलर को भी जन्म दे सकता है और तुम्हारे जैसे सेवाशील बालिका को भी।"　

लेखक मदर से थोड़ी चुटकी लेता है। मदर के साथ लेखक की यह बातचीत बहुत रोचक है, साथ ही हम प्रेरणा भी देती है। कभी-कभी हमें यह साधन लगता है कि यदि दो देशों के बीच राजनीतिक संबंध ठीक नहीं होते तो उनकी जनता के बीच के संबंध भी खराब हो जाते हैं। ऐसा नहीं होता। रावर्त नरसिंह होम में फ्रांस की मदर तरेसा और जर्मनी की क्रिस्त हैल्ड एक होकर काम करती हैं। मदर के साथ लेखक के इस संवाद को पढ़िए—

"आप इस जर्मन लड़की के साथ उपाय से रहती हैं?"

बोली, 'हाँ, वह भी इंसकर के लिए काम करती है और मैं भी, फिर प्यार क्यों न हो?" मैंने नस्तर चुमाया—" पर फ्रांस को हिटलर ने पददलित किया था, यह आप कैसे भूल सकती हैं?"

नस्तर तेज़ था, चुभन गहरी, पर मदर का कलेजा उससे अजुबा रहा। बोली— "हिटलर बुरा था, उसने लड़ाई छोड़ी, पर उससे इस लड़की का भी घर बढ़ गया और मेरा भी; हम दोनों एक।'”

जानते हैं न कि युद्ध में किसी का भला नहीं होता। हिटलर ने युद्ध छोड़ा तो उससे मदर के देश का तो नुकसान हुआ ही। स्वयं हिटलर के देश की वासिनी क्रिस्त हैल्ड का भी घर गिया। संकट और दुःख एकता स्थापित करता है। मदर इस सच्चाई को जानती है और वे क्रिस्त हैल्ड के साथ एक होकर दुखियों की सेवा करती हैं।
अब आप ही सोचिए कि क्या किसी व्यक्ति से इस कारण हेश रखना उचित है कि वह किसी अन्य देश व धर्म का है? मनुष्य-मनुष्य के बीच में कैसा? क्या हम किसी को जाति, धर्म, भाषा और रंग को आधार पर दूर कर सकते हैं? न जाने ऐसी कितनी ही दीवारें हमने खड़ी कर रखी हैं जो सारी मनुष्य जाति को एक परिवार नहीं बनाने देतीं। हम केवल मानव हैं, न कि मसूदी-गुजराती या हिंदू-मुस्लिम या ब्राह्मण-अश्विन। बीतने वाली ये दीवारें गिरानी होंगी तभी सबका कल्याण संभव है। वैसे भी भारतीय दर्शन में पूरा विश्व को एक परिवार के रूप में माना गया है।

क्रियाकलाप-5.1

'प्रास', 'हेल्मेज इण्डिया' तथा 'केइर' जैसी अनेक संस्थाएं समाज के लिए अपना योगदान दे रही हैं। आपके आर-पीएस या आपके इलाके में भी कुछ ऐसी संस्थाएं होंगी जो निश्चित भाव से अन्यथा, बूढ़ों व विकलांगों अथवा पशु-पक्षियों की सेवा कर रही हैं। ऐसी कुछ संस्थाओं (कम-से-कम दो) की जानकारी एकत्रित करें। उनमें से आप किसके कार्य में योगदान देना चाहेंगे और क्यों?

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5.2.2 अंश-2

क्रिस्ट हैल्ड के मिता...पीजा के लिए ही सुरक्षित रहे।

पाठ के इस दूसरे अंश में क्रिस्ट हैल्ड और मदर टेरेसा की पारिवारिक पृथ्वीमी का ध्यान-सा परिवार दिया गया है। यह इन दोनों की भरपूर स्नेह मिला पर ये दोनों अपने अपने परिवारों को छोड़कर हजारों मील दूर मनुष्यता की सेवा करने निकल पड़ी। इस अंश में यह भी बताया गया है कि ये दोनों-विशेष रूप से मदर कर्तव्यार्पाणता से सेवा करती हैं और इसे लेकर वे मायुक कभी नहीं होतीं—इससे उनकी सेवा का लाभ उसे मिलता है जिसे उसकी सबसे अधिक जगहा होती है।
राव्य नसिंग होम में

ऐसा हमारे साथ भी होता है कि हमें या हमारे माता-पिता को रोजगार की तलाश में अपने परिवार, अपने गाँव-शहर या देश से दूर जा ना पड़ता है। ऐसी स्थिति में मुख्यतः आजीविका कमाना हमारा उद्देश्य होता है, पर क्रिस्ट हैल्ड का उद्देश्य मानव की सेवा करना था। यहाँ ही जीवन का महान उद्देश्य है। हमें भी स्थायित्व के लिए कुछ करना चाहिए और ऐसा हमें उत्साह से करना चाहिए, जैसा क्रिस्ट ने कहा करती थी। क्रिस्ट ने क्रिस्ट की इस भावना का बहुत ही भावपूर्ण उल्लेख किया है। उसने लिखा है कि क्रिस्ट हैल्ड की आर्थिक नरम हो आई, पर जरा भी नम नहीं हुई, अर्थात् घर की याद ने क्रिस्ट हैल्ड को ठोस-बाहुक तो बना दिया, पर उसने आँखों में पानी नहीं आने दिया।

जर्मनी में जन्म लेने के कारण वे जर्मन भाषा, अंग्रेजी भाषा का अध्ययन करने के कारण अंग्रेजी और भारत में रहने के कारण हिंदी भी ठोसी-बहुत बोल लेती थी। कोई भाषा उसने काम में बाधा नहीं बनती थी। हर किसी की आवश्यकता को समझते हुए उनका अब तक तत्कालीन दिन।

यह तो हुई बात क्रिस्ट हैल्ड की। अब घरों में रहने वाले अपने परिवार को छोड़कर भारत में रहने लगी थी। लेकिन ने उनसे पूछा कि वे अपने परिवार कौनों की दृष्टि से अब नहीं बाल? उन्होंने कहा कि वे कही चर्चा बात के बारे में बाल की उनकी मां उन्हें पहचान ही नहीं पाई। बात यह थी कि मदर की वेशभूषा व सेवा-कर्म ने उन्हें इतना बदल जो दिया था। मदर ने यह भी बताया कि घर से बहुत पत्र आते हैं। पर उसके जवाब में वे कहते थे कि वहाँ कुछ तस्वीरें वाली में फोटो बेग देती हैं।

सोचिए, वे ऐसा क्यों करती होगी। भावम वे बिना कुछ लिखे, बहुत कुछ दिखाते देना चाहती थी। ऐसा माना भी जाता है कि विश्व झूठ को और अधिक प्रभावी डंग से सप्त कर देते हैं। यहाँ किए गए काम को दिखाते वे अपने परिवार को अपनी कृपालता की सूचना पहुँच दिया करती थी। यहाँ के लोगों को उनकी आवश्यकता अधिक थी। चिंता को देखकर परिवार गांव करता होगा।

आप प्रार्थना, दुआ या अदाला तो अर्थात् तो जरूर करते होंगे। इतिहार से कुछ-न-कुछ मांगते भी होंगे। जो कुछ हम मांगते हैं वह अपने और अपने के लिए होता है। कई बार हमारी मनाते पूरी होती हैं, तो कई बार नहीं भी। माना जाता था कि मदर की हर मांग ईश्वर पूरी करते थे। उनकी प्रार्थना का बहुत असर होता था। वह इसलिए कि वे अपने लिए नहीं बल्कि दूसरों के लिए मांगती थे। सभी के पीड़ा को वे अपनी पीड़ा मानती थी। उसके कष्टों को दूर करने के लिए दिन-रात एक कर देती और उसके लिए प्रार्थना करती थीं। हुई न यह बड़ी बात! इसे ही समानुमान कहते हैं। आप भी बहुत से दिन बना लेते होंगे। धर्म के बाद भी बहुत से सेवक रख सकते हैं पर किसी की सेवा कर उसे अपना बना लेना यह तो बड़ी बात। यही तो किया मदर टेरेंस व क्रिस्ट हैल्ड ने। आईए, अंतिम अनुभवों को एक बार फिर से समझो—
पाठगत प्रश्न-5.1

सर्वांशिक उपयुक्त विकल्प चुनकर पूछे गए प्रश्नों के उत्तर दीजिए :

1. मदर टेरेसा का जीवन-उद्देश्य था—
   (क) ईसाई-धर्म का प्रचार करना।
   (ख) महिलाओं को जागरूक बनाना।
   (ग) भारत की संस्कृति को समझना।
   (घ) रोगियों व जरूरतमंडलों की सेवा करना।

2. हिटलर के लिए उपयुक्त विशेषणों का समूह है—
   (क) वीर, विजेता, शासक
   (ख) संवेदनशील, सहहद, शासनाध्यक्ष
   (ग) कृप, निरंकृप, तानाशाह
   (घ) निर्ध्य, साहसी, अधिनायक
3. लेखक ने सबसे अधिक महत्त्व किसे दिया है?

(क) रोगियों को दूर करने को (ख) संविधानांतरण आचरण को
(ग) कठोरतापूर्ण व्यवहार को (घ) मानवता के प्रति समर्पण को

5.2.3 अंश-3

उपर के बनामदे में...जीवन में ले कृतार्थ हुई।

पाठ के अंतिम अंश में मानव-कल्याण में लगी एक और मदर मार्गरिट का चित्रण किया गया है। मदर मार्गरिट बुजुर्ग हैं, लेकिन उनका अभूप्रभाव छोड़ने-वाला जादूई व्यवहार, उनकी बुरी-फुरी और हैंसी का लेखक द्वारा वर्णन अत्यंत पठनीय है। इस अंश के अंत में क्रिस्ट हैल्ड के तबादले का भी उल्लेख है।

आपने जादुगर के करतब तो अवश्य देखे होंगे। पल्लव मे वह बुरी भी करके दिखा सकता है। एक चीज़ को दूसरी चीज़ में बदल सकता है। यह सब तो हमारे भ्रम के कारण होता है। मदर मार्गरिट भी जादू करती है; पर उनका जादू साध्य है। लेखक रॉबर्ट नरसिंग होम में एक ऐसी महिला मदर मार्गरिट से मिला, जो अपने व्यवहार व सेवा से रोगियों को पल्लव में ठीक कर देती। इतनी बुरी होने के बाद भी उनमें गजब की फूरी थी। मार्गरिट के जादू से कष्ट के कारण तड़पता रोगी पल्लव में भला-बंगा हो जाता।

इसीलिए लेखक ने उन्हें जादू की पुड़िया कहा है। आपने कामलुप के जादू की कहानियों सुनी होंगी। कामलुप असम में है। वहाँ के बारे में कहानियों प्रचलित थी कि जो वहाँ बाहर से जाता था, उसे मक्खी, कुंता-बिल्ली आदि भनाकर छोड़ दिया जाता था। ऐसा जादू किस काम का? लेखक के अनुसार जादू तो मदर मार्गरिट करती हैं जो अनुकरण करने लायक है। मदर का जादू मफिख्यां जैसा जीवन बिताने वाले लोगों को वास्तविक मनुष्य बनाने का जादू है। जानते हैं मफिख्यां जैसा जीवन बिताने का आशय क्या है? इसका आशय है— बीमारी से मरता दयनीय जीवन। ऐसे ही लोगों की सेवा करके, उन्हें मनुष्य बनाने का काम मदर मार्गरिट कर रही हैं। रॉबर्ट नरसिंग होम को लेखक ने 'जादू-होम' कहा है, क्योंकि यहाँ मदर टेरेसा हैं, क्रिस्ट हैल्ड हैं और मदर मार्गरिट हैं, जो रोगियों की सेवा करके, उनकी जीवन सुधार रही हैं।
रावण नरसिंह होम में

पाठ में आगे यह पता चलता है कि इसी अस्पताल में एक अमीर रोगी आया जिसने कभी कोई दुख नहीं सहा था। वह बहुत ठहरा रहा था। यहाँ पर लेखक ने थोड़ा व्यंग किया है। यह व्यंग ऐसी अमीरों पर हो जो अपने छोटे से कट्टे को बहुत बड़ा-बड़ा कर देखते दिखाते हैं। दूसरों के मनोकामना कर उन्हें नहीं दिखाई देते। वैसे दुख कभी यह देखकर नहीं आता कि कौन कितना सह सकता है? अगर ऐसा होता तो छोटे मासूम बच्चे और कमजोर तथा वृद्ध कभी दुखी ही नहीं होते। मार्गरेट ने उसे समझाया कि अभी कदम है, फिर धीरे-धीरे कम हो जाएगा और थोड़े दिनों में बिल्कुल खलम हो जाएगा। दुख या कदम अगर आया है तो थोड़ा-बहुत तो उसे सहना ही पड़ता है। हमें भी चोट लगती है तो हम उसका उपचार करते हैं और थोड़े दिनों में ठीक हो जाती है। दुख-दुख तो आते-जाते रहते हैं, हमें कदम के कारण निराश नहीं होना चाहिए। यहाँ पर एक आशय और भी है। आज सब कुछ है, कल थोड़ा कम है और फिर सबकुछ समाप्त। यही जीवन की नियति है, फिर छोटे-मोटे कदमों से क्यों घबराना, हँसकर उनका सामना करना चाहिए।

अच्छा! यह सोचने कि आपके जीवन का लक्ष्य क्या है? अगर अभी तक इस पर विचार नहीं किया तो अब करें, क्योंकि हम अपने जीवन को किस दिशा में आगे बढ़ाना है, यह तो पता होना ही चाहिए। इससे कहीं के प्रति उत्साह हमेशा बना रहता है। मार्गरेट भी इतनी बुरी होने के बावजूद हमेशा खुश और उत्साही रहती थी। आखिर उनमें कौन-सी ऐसी जोत यानी ज्योति थी जो उन्हें इतनी शक्ति व खुशी प्रदान करती थी। यह जोत थी—मानव-सेवा की।

लेखक को जब यह पता चला कि क्रिस्ट हैल्ड का तबाहता धार्मि के भीतर सेवा-केंद्र पर हो गया, तो वह दुखी हो गया। लेकिन लेखक की इस चिंता से अनजान क्रिस्ट नई जगह जाने को लेकर बहुत उत्साहित थी। इस दुख का एक कारण यह था कि धार्मि का जीवन कठिन है और क्रिस्ट हैल्ड का शरीर नाजुक। इसीलिए लेखक ने कहा कि—“ओह, उस जंगली जीवन में यह कपूरिया!” अर्थात उन कठिन परिस्थितियों में यह क्रिस्ट हैल्ड कैसे रह पाएगी। वहाँ लाकर लोगों की सेवा करने का उनमें जोश था।

वस्तुतः सुविधाओं से विभिन्न ऐसी ही जगहों पर काम करने की ज्यादा आवश्यकता है। इस बात को क्रिस्ट समझती हैं। आपके अगर किसी ऐसी जगह से जाने के लिए कहा जाए, जहाँ आप कई वर्षों से रह रहे हैं तो शायद आपको भी अच्छा न लगे। लेकिन जब आपको पता चले कि आपके कार्य का बहुत महत्त्व होगा तो आप बहुत खुश होंगे। क्रिस्ट के लिए सारी जगहें एक-सी थीं और वे हर जगह केवल मानव-सेवा करना चाहती थी। अपने इस महान कार्य को करने के मार्ग में यह किसी स्थान को बाधा नहीं बनाने देती थी। हमारे जीवन में रोज़ नई चुनौतियाँ आती हैं, उन्हें स्वीकार करना चाहिए। सेवा-भाव को आधार बनाकर पूरा जीवन बिता देने की कला को लेखक ने वहाँ सीखा। शायद आप भी निर्भाव भाव से सबके लिए स्वयं को समर्पित करने के महत्त्व को समझ पाएँगे।

आप बहुत-सी अच्छी-अच्छी बातें सुनते हैं। हमारे अनेक धार्मिक ग्रन्थ भी हमें खुब नीति की बातें समझाते हैं। ‘नीता’ में कम को बहुत महत्त्व दिया गया है, हम ये बात जानते
रावट्ट नरिंग होम में

है, परंतु इस पर अमल नहीं करते। नित्य गीता पाठ करना या गीता की चर्चा करना ही उसे कुछ रखना है। हम भारतीयों को इस बात पर गर्व भी है कि गीता एक भारतीय ग्रंथ है। फर जहाँ उसके अनुसार आचरण करने का प्रयास है, वहाँ हम पिछड़ जाते हैं। लेकिन क्रिस्ट हेल्ड सच्चे अर्थों में गीता के अनुसार आचरण कर रही थीं। सारी अच्छी बातें हम सिर्फ सुनते हैं, जीवन में उतारते नहीं हैं। क्रिस्ट ने सबी अर्थों में कर्म के ज्ञान को अपने जीवन में उतारा। जीवन में कर्म के सांदर्भिक का संबंधित महत्व है। यह बात आप एक अन्य पाठ 'सुखी राजकुमार' के आधार से भी जानने चाहेंगे। रावट्ट नरिंग होम में सेवा-भाव का जो रूप दिखा, उसमें जीवन जीने की कला का रहस्य छिपा था। यह सब देखकर लेखक आश्चर्यचकित था। उम्मीद है कि पाठ को पढ़कर आपको भी मानव-सेवा की प्रेरणा प्राप्त हुई होगी।

कियाकलाप-5.2

लेखक ने जरूरतमंड लोगों की सेवा में निर्न्यात-भाव से लगी महिलाओं का आँखों देखा प्रभावशाली चित्रण किया है। आपके जीवन में भी कोई ऐसी घटना घटी होगी जिसे आप आज तक भूल नहीं पाए। ऐसी ही किसी घटना का आँखों देखा चित्रात्मक वर्णन कीजिए।

5.2.4 भाषा-शैली

'रावट्ट नरिंग होम' एक ऐसा पाठ है जिसमें संरचना, रंगाचित्र, रिपोर्टज्ञान आदि विषयों का संयोग हुआ है। इन विषयों में विशेष प्रकाश की भाषा, शैलियों का प्रयोग होता है। इस पाठ में भी इन भाषा-शैलियों को देखा जा सकता है। कहाँ पर ऐसा लगता है मानो लेखक आँखों देखा वर्णन कर रहा है, कहाँ वह शब्दों के माध्यम से व्यक्ति चित्र बनाता है और कहाँ मानव होकर भाषा का व्यवहार करता है।

पाठ के आरंभ में ही आप देखते हैं कि आँखों देखा हाल सुनाया जा रहा है। उदाहरण देखिए:

"यह है सितंबर, 1951!"
रावण नरसिंह होम में

रोग का आधार पूरे वेग में, परिणाम कॉम्पक्टपाता और वातावरण चित्रा से घिरा-घिरा कि हम सब सुसंदर। तभी मैं चाँककर देखा कि अपने विशिष्ट घबरे वेग में आच्छादित नारी कमरे में आ गई है।'

मदर टेरेसा के साथ क्रिस्ट हेल्द आती हैं तो उनका भी ऐसा ही वर्णन किया गया है। कभी-कभी खाँचियों देखी घटना के वर्णन को प्रभावशाली बनाने के लिए छोटे-छोटे ब्यारे भी दिए जाते हैं। ऐसे ही ब्यारे इस पाठ में भी आए हैं। उन स्थलों पर पाठ बहुत प्रभावशाली हो गया है, जहाँ इन ब्यारों के माध्यम से मदर टेरेसा, क्रिस्ट हेल्द और मदर मार्गेट के व्यक्तिविच्छेद खींचे गए हैं।

कही-कही लेखक इन तीनों पाठों की मानव-सेवा से इतना प्रभावित हुआ है कि वह भावुकतापूर्वक अभिव्यक्तियों करता है। एक अभिव्यक्ति देखिए—

"हाँ, माँ ही थी: होम की अध्यक्षा मदर टेरेसा, मातृभूमि जिनकी फ्रांस और कर्मभूमि भारत! उनकी अनुशासनी से उन के इस दलब्र तक रोगियों की सेवा में तल्लीन, यहीं काम, यहीं धाम, यहीं राग, यहीं चाव और बस यहीं, यहीं।"

एक अन्य स्थल पर लेखक कहता है—

"फ्रांस की पुजी मदर टेरेसा और जर्मनी की दुहिता क्रिस्ट हेल्द एक साथ, एक रूप, एक ध्यान, एक रस।"

इन संघर्ष महिलाओं का लेखक के आंतरिक मन पर बहुत गहरा प्रभाव पड़ा। उस प्रभाव को यक्त करके इंग्लिश में कुछ अभिव्यक्तियाँ जिल्ले या लीक से हटकर हो गई हैं। इस पाठ में अधिक बात को बहुत कम शब्दों में कहने का कौशल जगह-जगह मिलता है, जैसे—

"साफ-सुन्धरी भाषा, उच्चारण साफ और स्वर आदेश का; पर आदेश न अधिनायक का, न अधिकारी का, पूर्णतया माँ का, जिसका आरम्भ होता है शिकंजे से और अंत गोद में।"' पाठ में अनेक स्थलों पर लक्षणिक अभिव्यक्तियों हैं, जो लेखक के आशय को पाठक तक पहुँचाने में बहुत सहायक हैं। उदाहरण देखिए—

- चौंदनी-चरित्त हाथ।
- हैंसी बिखेरना।
- चौंदनी को दूध में घोलकर ब्रह्मा ने उसका निर्माण किया हो।
- हजार बाट का बल्ब मेरी ऑखों में चींढ गया।
- हैंसी उनकी थों कि मोहियों की बोरी खुल पड़ी।
- ओह, उस जंगली जीवन में यह कपूर्फ़रिका।
- लेखक ने अवसरानुकूल तस्म, तदभव, देशश और आत्म शब्दों का उपयोग किया है।
रायट नसिंग होम में

पाठगत प्रश्न-5.2

सर्वाधिक उपयुक्त विकल्प चुनकर पूछे गए प्रश्नों के उत्तर दीजिएः

1. “पर कष्ट क्या पात्र की क्षमता देखकर आता है?— कहने का आशय है—
   (क) अभी लोगों पर कष्ट नहीं आना चाहिए। □
   (ख) सहने की क्षमता के अनुसार कष्ट आना चाहिए। □
   (ग) कष्ट किसी भी व्यक्ति पर आ सकता है □
   (घ) प्रत्येक व्यक्ति को कष्ट झेलना चाहिए। □

2. चीखते-तड़पते रोगी को मदर मार्गरिट ने ‘कुछ नहीं, कुछ नहीं’ कहा क्योंकि वे—
   (क) उसके रोग को मामूली समझती थी। □
   (ख) डॉक्टर पर विश्वास करती थी। □
   (ग) रोग से लड़ने की हिम्मत देना (घ) रोग का सही उपचार बाहती थी। □

3. पाठ की भाषा-शैली में कोन-सी विशेषता नहीं मिलती?
   (क) ऑफ़ों देखा वर्णन □
   (ख) छोटी-छोटी बातों की व्याख्या □
   (ग) भाषुकल्पपूर्ण उद्गार □
   (घ) विचारविधता □

आपने क्या सीखा

- सुखी मानवता के लिए महिलाओं का योगदान अविश्वसनीय है। इन महिलाओं ने देश, भाषा, धर्म, संप्रदाय आदि की दीवारों को ढहा दिया।
- अपने मानवीय व्यवहार व आचरण से हम किसी को भी अपना ना सकते हैं।
- मनुष्य के आपसी संबंध मानवीयता के आधार पर होने चाहिए, किसी देश, धर्म, जाति या रंग के आधार पर नहीं।
- मदर टेरेसा, मदर मार्गरिट व सिस्टर क्रिस्ट हैल्ड का समर्पण एवं सेवा-भाव समानूकता का अद्भुत उदाहरण हैं।
- हम विश्व में कहीं भी रहकर रचनात्मक और मानवीय कार्य कर सकते हैं।
रावट नरिंग होम में

- निर्देशार्थ भाव से सदैव कर्मचार रहने की प्रेरणा मिलती है।
- पाठ की भाषा तत्समिक रूप से भी बोधगम्य है। कहीं-कहीं पर अंग्रेजी के शब्दों
  का प्रयोग किया गया है।
- रिपोर्टेज़ किसी सवाली घटना पर आधारित सामान्यत: समाचार पत्र के लिए तिथियों
  जाने वाली विश्वास है।

योग्यता-विस्तार

इस पाठ के लेखक कन्हैयलाल मिश्र 'प्रभाकर' हैं। इनका जन्म रस 1906 में हुआ था।
परिसर में असहाय के कारण उनकी प्रारंभिक शिक्षा सुरक्षा रूप से नहीं हो पाई। उन्होंने
स्वाम्याय से ही हिंदी, संस्कृत, अंग्रेजी आदि भाषाओं का प्रान्त भाषा। भारत के
स्वाध्यात्मक-संबंध में भाग लेने वाले 'प्रभाकर' जी ने पत्रकारिता के क्षेत्र में विशेष प्रतिभा
अभिवाद्य की। उन्होंने हिंदी में लघुकथा, संस्कृत, रेखाचित्र और रिपोर्टेज जैसे अनेक
विधियों में रचना की। अन्य वर्ग के विरुद्ध कोठौं और पीड़ित मानवता के प्रति रहस्यमयी
और कुछ इनकी कामयाब रचनाओं में दिखाई पड़ती है। इनकी प्रमुख कृतियाँ हैं—'मारी
हो गई सोना', 'घरों के पूर्ण', 'आकाश तारे', 'जिवंगी मुसकाए', 'सूरत-बिसरे चेहरे',
'क्षण बोले कथ मुसकाए', 'महक आंगन चहके दवार।'
'प्रभाकर' जी की भाषा में व्यंग्यात्मक सरलता, मामिलता, चुटकिलाप, भावभियोगता की
अद्वैत श्रद्धा है। भाषा और शैली की अद्वितीयता के कारण गद्यकारों में प्रभाकर जी
का विशिष्ट स्थान है।

पाठांत्य प्रश्न

1. रावटनरिंग होम में जाना लेखक के लिए क्यों यादगार बन गया? अपने विचार
  प्रस्तुत कीजिए।
2. रावटनरिंग होम के डॉक्टर ने कहा, 'मदर तुम हैं पूरी बिखरती जो हो।' आसान
  स्पष्ट कीजिए।
3. लेखक मदर टेडेसा के जाने के बाद किस प्रकार की दीवार के बारे में सोचता रहा?
  आपकी दृष्टि में इन दीवारों को गिराना क्यों ज़रूरी है?
4. मदर रायरिट का जादू किस तरह गया गया है? स्पष्ट कीजिए।
5. 'फोटो किसी ताल को अधिक प्रभावी ढंग से प्रस्तुत करती है।' आप इस विचार से
  कहीं तक सहमत हैं? स्पष्ट कीजिए।
राख्तर नरसिंह होम में

6. ‘राख्तर नरसिंह होम’ पाठ से हम अपने जीवन में क्या प्रेरणा ले सकते हैं, उल्लेख कीजिए।

7. निम्नलिखित के आशय स्पष्ट कीजिए:-
   (क) उभरती तरहाँई से उभ्र के इस टलवार तक रोगियों की सेवा में तत्त्वां, यही काम, यही धाम, यही राग, यही वाच और बस यही, यही।
   (ख) फ्रांस की पुजी मदर टेयरसा और जर्मनी की दुहिता क्रिस्ट हैल्ड एक साथ, एक रूप, एक ध्येय, एक रस।
   (ग) कदम क्या पात्र की क्षमता देखकर आता है?
   (घ) भाषा के बदल रहे हैं, रहेंगे भी, पर यह जोत विश्व की समुदाय से जोत है।
   (ड) हम भारतवासी गीता को कठ में रखकर धनी हुए, पर तुम उसे जीवन में ले कृतार्थ हुई।

8. यदि मदर टेयरसा और किस हैल्ड एक होकर कार्य न करती तो किसी हानि होती और क्यों, उल्लेख कीजिए।

9. निम्नलिखित अनुच्छेद को पढ़कर पूछें गए प्रश्नों के उत्तर लिखिए:-
   परोपकार मानव जीवन का धर्म है। परोपकार की भावना के बिना मनुष्य और पशु में किंचित अंतर नहीं है। परोपकार करने से आत्मा को जिस सच्चे आनंद की प्राप्ति होती है, उससे शांत होने में नहीं बाधा जा सकता। स्वयमं भूख-प्यास सुहाग करती है और विश्व की सहायता भी है। परोपकार में ही जीवन की साध्यता है। अपने जीवन को सफल बनाने के लिए हमें अपनी समस्त शक्तियों का प्रयोग परोपकार के लिए करना चाहिए। हमें अपनी धन-संपत्त का प्रयोग दूसरों का हित-संपदान करने के लिए, अपनी शक्ति का प्रयोग अन्यों के लिए, अपना बुद्धि का प्रयोग अन्यों के अधिकारों का दूर करने के लिए करना चाहिए। यदि जीवन में आय सुप्रसिद्धि बनकर सुप्रसिद्धि प्राप्त करने के इसकु छ हैं तो परोपकार कीजिए और यदि पापों का संचय करना चाहते हैं तो दूसरे प्राणियों की पीड़ा दीजिए। अतः हमें परोपकार की पवित्र भावना से प्रेरित होकर जहाँ तक संभव हो सके, दूसरों के कष्टों का संचय करना चाहिए, क्योंकि जीवन में आनंद की प्राप्ति का यह एक सहज मार्ग है।

1. मनुष्य व पशु के बीच अंतर स्पष्ट कीजिए।
2. हम आत्मिक आनंद की प्राप्ति किस प्रकार कर सकते हैं?
3. हमें अपनी शक्ति व धन का प्रयोग कैसे करना चाहिए?
4. इस अनुच्छेद का सार एक तिहाई शब्दों में लिखिए और एक उपयुक्त शीर्षक भी दीजिए।
उत्तरमाला

बोध प्रश्न
1. (घ) 2. (र) 3. (घ)

पाठगत प्रश्न

5.1 1. (घ) 2. (र) 3. (घ)

5.2 1. (र) 2. (र) 3. (ख)
CONSUMER BEWARE! BE AWARE!

SALE UPTO 80%! Buy ONE get ONE FREE! HURRY! Limited period OFFER! SPECIAL DISCOUNT for first 100 customers! FREE television with a refrigerator! How often have you been lured by such clever sale tactics? Or often felt disappointed to find that there is some catch in such sales gimmicks? Some of you may have been cheated by both shopkeepers and manufacturers, who try to blame each other by saying that “you may not have read or followed the instructions!”

In such a case, what do you do? Is there anyone to help you? Yes! There is an agency which not only listens to your grievances patiently but also helps you in getting a compensation for deficiency in performance. This agency may also impose punishment on the offenders. But, for that, you need to become a responsible consumer, shed the indifferent attitude, and exercise your rights. In this lesson, you will learn how to be aware of market malpractices and become an aware consumer.

OBJECTIVES

After completing this lesson, you will be able to:

• describe yourself as a consumer under the Consumer Protection Act 1986;
• critically analyse problems you face as a consumer and find appropriate solutions;
• appreciate the role of consumer education, and effectively use consumer aids to your advantage;
• identify and exercise your rights and responsibilities as a consumer and;
• file a complaint in the appropriate forum when the need arises.
22.1 WHO IS A CONSUMER?

Each one of us is a consumer. To take an example: Guddi buys vegetables for her family. She also pays a maid for her services like cleaning the house and washing clothes. She pays her electricity bill and water charges as well. Each time she makes a payment for some thing that she buys (product) or in lieu of a service rendered, she becomes a consumer. As we have said earlier, all of us are consumers, because we all buy goods from the market and pay for the services rendered by others.

A consumer is a person who buys or uses either goods or services, to satisfy his needs.

The CPA (Consumer Protection Act 1986) clearly identifies two categories of consumers:

(i) “One who buys and uses any goods.”

(ii) “One who hires or avails of any service for personal use.”

**ACTIVITY 22.1**

Can you now list any four products and services for which you have paid for or used as a consumer? A few examples are given below to help you.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Products</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shirt</td>
<td>Tailor</td>
</tr>
<tr>
<td>2.</td>
<td>Umbrella</td>
<td>Electricity</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As a consumer, you may have often encountered many problems. Let us reflect on some of these problems. Based on your own experiences, see if you can add some more.
22.2 PROBLEMS FACED BY YOU AS A CONSUMER

1. Price Variation

Sometimes you may find shopkeepers or vendors charging you more than the price printed on the product. This printed price is the Maximum Retail Price (MRP), which means a shopkeeper cannot charge you more than this amount or MRP.

On being questioned about charging more than the MRP, shopkeepers often make excuses like paying a hefty amount as rent inside the cinema hall or exhibition, or of being charged extra local taxes. You should be aware that the MRP or the printed prices are also inclusive of all taxes!

Similarly in the case of a service, one electrician may charge more than the other for the same kind of work by saying that he provides guarantee for his work.

How can you ensure that you are paying for good quality services? You may:

- get references of people providing good quality services;
- ensure that good quality parts are used;
- supervise personally.

Think of other ways by which you can ensure good services.

Do you know you can actually file a case against such people and they can be fined a hefty sum?

What can you do as a consumer?

You need to find out prices of different brands of products, the two products (i.e. wheat flour and turmeric powder) that your family purchases from different shops. You can compile your data in the following table and then compare the prices, the quantity and the standard marks, like FPO, ISI, Agmark, etc.

For clarification, it may be noted that Standard marks are marks of quality given to products which meet certain standards in terms of material used, method of manufacturing, labelling, packing, sale and performance.

<table>
<thead>
<tr>
<th>Product</th>
<th>Brand name/Company Price</th>
<th>Quantity</th>
<th>Standard</th>
<th>Shop Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat flour</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turmeric powder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>2.</td>
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<td>3.</td>
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<td></td>
<td>4.</td>
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</tr>
</tbody>
</table>
Similarly, you can also find the prices of other commodities and make an informed choice. After the survey, you can conclude and identify the shopkeepers who can give you good quality products at a better price. Now you are in a position to decide from where you should buy your groceries.

But do remember to update yourself periodically, using the same method after determining your needs. You can also negotiate the prices by buying in bulk. Shopkeepers often lower their prices for regular customers. Remember, DO NOT pay more than the MRP (printed on cover of the product). If the shopkeeper still charges you above the MRP, take a receipt as it will help you file a complaint.

2. Lack of Standardized Products

The market is flooded with substandard products. Have you ever wondered why shopkeepers claim that these substandard products are better and are ready to give you a guarantee for them? This is because they get a much higher commission from the manufacturer on substandard products as compared to the standard ones.

What can you do as a consumer?

Visit a shop near your home and request the owner to allow you to survey at least six brands of one product, three of which bear a standard mark and three that do not have the standard mark.

Compare and tabulate them in the following table on the basis of their price, capacity, standard marks, ease of use, after sales service, electricity consumption, warranty/guarantee. After this, select the brand that offers the maximum advantages.

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
<th>Ease of use</th>
<th>Standard mark</th>
<th>After sales service</th>
<th>Electricity used</th>
<th>Warranty/Guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Check out the difference in the quality of the standard and the substandard products that you have compared. For example, ask yourself whether it is worth buying an electronic appliance that might cost less at the time of purchase but.
Consumer Beware! Be Aware!

- uses more electricity
- has no after-sales service
- is difficult to clean and use
- gives electric shocks

And make a wise choice!

3. Imitation

You may have come across products that imitate the packaging of popular brands. Often the brand names are made to rhyme intentionally to fool the customers. For example, the popular brand of ‘Colgate’ toothpaste is imitated as ‘college’ toothpaste, though the colour combination and design of the cover is exactly the same. Similarly, the famous Lal-imli brand of wool is imitated by just a difference in placement of hyphen ‘lali-mali’, you may think this is a misprint on the packaging, which is not so.

Why do you think the manufacturers resort to such practices? Yes, you are absolutely right, they do not have to spend on advertisements. They often imitate popular brands to gain popularity, knowing fully well that most consumers recognize the products by their packaging and do not bother to read the fine print.

Some manufacturers even imitate the standardized marks. Samples of genuine and copied standard marks have been provided below. Can you differentiate the genuine from the fake ones? Yes figure 22.2 (e) is genuine (however IS: and CM/L number can vary) while others are all fake. Do you know that imitating logos and packaging is a serious criminal offence and is punishable under law?

![Fig 22.2: Fake and genuine ISI marks](image)

What can you do as a consumer?

You may try to collect packaged products that have their packing symbols identical to popular brands and products bearing standardised marks or duplicate standard marks. Use both the products, duplicate as well as the original and check the difference in quality. Rate them for the following features and then make an informed decision.
4. Adulteration

In order to earn more profit, manufacturers or shopkeepers intentionally either add inferior substances from a product or subtract a vital element from a product. The element that is added to the main product i.e. food stuff is called **adulterant**. You may have observed that the milk supplied by your milk vendor does not yield much cream. Even rice and pulses contain stones. Stale or padded pulses may even be polished with artificial colour to make them appear fresh. Recently new adulterants such as Iridium and Ruthenium have been found to be mixed in gold articles. Have you also observed adulterants in your food? List them below.

1)  
2)  
3)

**ACTIVITY 22.2**

You can also conduct these simple tests (refer table 22.1) at home to check the purity of your own food samples. Tally your observations with the results given at the end of the lesson.

**Table 22.1: Adulteration Tests**

<table>
<thead>
<tr>
<th>Food stuff</th>
<th>Adulterant</th>
<th>Test</th>
<th>What did you observe?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>Water</td>
<td>(i) Keep milk in a tumbler for 10 minutes and pour it into another tumbler</td>
<td>(i) Does it form a ring on the top?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) Put a drop of milk on a plate and tilt it</td>
<td>(ii) Does it leave a track?</td>
</tr>
<tr>
<td>Black pepper</td>
<td>Papaya seeds</td>
<td>Put a small amount of black pepper in half a glass of water.</td>
<td>How many rise up and how many settle down?</td>
</tr>
<tr>
<td>Asofetida</td>
<td>Resin, gum</td>
<td>Add water in a sample and shake well.</td>
<td>Does it turn milky?</td>
</tr>
</tbody>
</table>
Consumer Beware! Be Aware!

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tea leaves</td>
<td>Coloured exhausted tea leaves</td>
<td>Put a sample of tea on a blotting paper. Sprinkle it with water.</td>
<td>Does it leave colour?</td>
</tr>
<tr>
<td>Coriander powder</td>
<td>Dung powder</td>
<td>Soak in water.</td>
<td>Does it smell of cow dung?</td>
</tr>
<tr>
<td>Spices</td>
<td>Extraneous colour</td>
<td>Take a tumbler of water. Sprinkle small quantity of spice on the surface of water.</td>
<td>Does the water become coloured?</td>
</tr>
<tr>
<td>Tea, semolina</td>
<td>Iron fillings</td>
<td>Pass a magnet over the sample.</td>
<td>Do iron fillings cling to magnet?</td>
</tr>
</tbody>
</table>

For more tests refer to this website if you have access to it:
http://pfa.delhigovt.nic.in

What can you do as a consumer? Consider the following:

- be alert to any change in colour, taste, appearance or smell;
- read labels carefully;
- check for genuine standard marks;
- buy from reputed shops and refuse to buy from unscrupulous shop keepers;
- buy reputed brands;
- buy only packed and sealed foods;
- buy whole grains and spices, and grind them at home;
- do not compromise on quality and price;
- from time to time test food items like milk, spices, sugar and oil at home;
- get doubtful samples of food tested at PFA (Prevention of Food Adulteration) laboratories;
- change the brand/shop, if samples are impure and;
- report to the concerned authorities.

5. Non-Availability, Black-marketing and Hoarding

Before the annual budget, each year the shopkeepers speculate and increase the prices of certain commodities and hoard stocks to earn higher profits.

This is especially true in the case of gas agencies. When the domestic gas price is about to increase, they stop supplying gas to the consumers. But when they know...
that prices of gas cylinders are going to decrease, their rule of delivering the next cylinder only after fifteen days is no more applicable and they immediately supply the gas cylinder.

Many people collect their monthly rations at subsidized rates from government operated ration shops. During the festive season, many groceries go out of stock especially sugar and kerosene. Do you know why? Often greedy shopkeepers of ration shops sell these items in the open market to sweetmeat shopkeepers and make high profits.

In such cases, the consumer faces a lot of difficulty and inconvenience.

**What can you do as a consumer?**

If possible, in such cases, you can:
- shift to a different brand of the same product;
- use an alternative to the product, for example, use jaggery instead of sugar; and
- report to concerned authorities.

**6. Defective weights and measures**

Do you check the weights and the scales that are used to weigh the products you buy? Have you ever checked the measures used for milk or kerosene? These weights have a hollow or a false bottom or may be dented. They measure less than what you have paid for. You may have noticed shopkeepers using stones instead of proper weights. Often magnets are stuck under the balance pans to cheat the consumers.

**What can you do as a consumer?**

While buying unpackaged milk from a milk vendor, be alert on all the ways he may adopt to cheat you. Check-

- Is the milk being measured till the brim?
- Is he emptying the measure completely, before he starts filling it again?
- Does the measure have a false bottom?
- Does the measure have a stamp of the inspector along with the date?

While buying vegetables, refuse to buy if:
- the shopkeeper uses stones instead of weights;
- the balance has iron rings on one side;
Consumer Beware! Be Aware!

- any magnets are stuck under the pan;
- he is putting any rotten or stale vegetables;
- the pointer is missing in the middle of the balance;
- the balance is kept on a tilted surface.

![Image of a balance with a missing pointer and other issues](Fig22.3b)

When you are buying fabric, refuse to buy if:

- the cloth merchant is using a table to measure the cloth.
- the measuring rod is bent.
- the shopkeeper is stretching the fabric while measuring.

![Image of a bent scale](Fig22.3d)

**ACTIVITY 22.3**

Visit a vegetable vendor. Tactfully request him to show you where the weights are stamped. (You may tell him that it is part of your project.)

Politely ask the vendor if he could keep the vegetables where he normally keeps the weights and keep the weights in the pan where he normally keeps the vegetables.

What was the reaction of the vendor?
- Did he happily agree?
- Did he refuse?

If he refused, do you think he is trustworthy? Would you like to buy things from such vendors?
7. Misleading information or lack of information

You may have noticed that most of the products advertised are misleading and exaggerated. The products are not as effective as they are claimed to be.

You may have also faced problems in getting detailed information on the products that you want to buy. Shopkeepers often refuse to give pamphlets of the product on the pretext that they are sealed inside the box of the product. Often, the print on the label is too small or blurred or the matter is written in local language, which is not understood by most of us.

You might have also seen ‘free’ gifts being offered along with the product; for example, a free plastic jar with a particular brand of tea or a free bowl with cooking oil. But these ‘gifts’ are actually ‘free’? Is their price included in the price of the product or is the original price raised to cover the cost of the gift? Quite often, the latter is the case, because the salesman’s motive is only ‘profit’ and not a ‘free gift’ to a consumer.

Similarly, heavy discounts are offered during festivals or at the end of a season. Everywhere you can see banners of ‘sale’. These ‘sales” often offer poor quality/defective articles and thus mislead the consumers. In most of the cases, the actual price is written as discounted price after putting an exorbitant price on the label. As a consumer you can make smarter choices to tackle this issue.

ACTIVITY 22.4

For exaggerated advertisements

Test two or more samples of different detergents. It could be a new one shown on television and the one that you normally use. Conclude whether the new product is as effective as it claims to be. Which one would you like to use and why?

During sale

To decrease the chances of being cheated during sales, find out the quality, prices and weights of products before and after the sales. Try not to get swayed by these sales.

8. Problems related to services

As discussed earlier, most of us are aware about the problems related to products. However, the problems related to services are not given much importance by the consumers, though they get cheated by the service providers also.
Consumer Beware! Be Aware!

Did you know that sometimes gas agencies fill up the commercial gas cylinders from the quota of subsidised domestic gas cylinders, thereby creating a shortage in the domestic supply of gas?

Service providers/financial institutions like banks are at times, rude and refuse to cooperate, or answer the queries of the customers. Often they charge service taxes on facilities that are provided without the consent of the customers. You may have heard of customers complaining about money being pilfered or transferred from their accounts.

Similarly, house builders and school authorities charge large sums as security deposits, for which no interest is paid. You may have observed that often there is no staff present at the railway ticket counters during working hours. Similarly, services such as post, electricity, telephone, water supply, health etc. leave a lot to be desired. Complaints are often ignored or work is not done until you pay tips to the workers.

What can you do as a consumer?

i. Try and recollect the problems you have faced in the market, while purchasing goods. List and compare them with the ones mentioned in the lesson. Note the action you have taken to solve them.

ii. Find out from five of your friends and neighbours whether they have ever faced similar problems with the same shopkeepers and the same service providers. Check the ways they have used to tackle these problems.

iii. If you and your neighbour have faced the same problem with the same shopkeeper see how both of you can unite and tackle him.

INTEXT QUESTIONS 22.1

1. Read the lesson carefully. Find out ‘one word’ used in the lesson to indicate the following:
   a. The person who buys goods and pays for services _____________.
   b. The items that we buy from the market ________________.
   c. Repair of an electric switch for which the consumer pays money ____________.
   d. The term used to indicate duplicate products______________________.
   e. The process of addition or removal of some thing to lower the quantity or quality of food stuffs ____________________.
2. You encounter the following problems in services. Suggest ways to deal with these problems.
   a) Your iron stops working within a week after repairs.
   b) The gas cylinder you have received weighs less than the weight specified.

22.3 ROLE OF CONSUMER EDUCATION

Can you think of ways to equip yourself to tackle these problems? How can you make yourself a wise consumer? Consumer awareness can be brought about by proper education.

Consumer education involves educating the consumer as to what, when, how, from where to buy and how to pay? These have been discussed in table 22.2 as wise buying tips.
<table>
<thead>
<tr>
<th>What to buy?</th>
<th>Ask yourself?</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do I need it?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If your answer is no -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Am I buying it because my friend has it? Or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Am I buying it because they showed it on television?</td>
<td>Don’t buy it !</td>
</tr>
<tr>
<td></td>
<td>If your answer is yes-</td>
<td></td>
</tr>
<tr>
<td>How much to buy?</td>
<td>How much do I buy?</td>
<td>Buy -</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- according to your needs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Non-perishables (in bulk)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Semi-perishables (quantity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>enough for a week)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Perishables (in small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>quantities)</td>
</tr>
<tr>
<td></td>
<td>Do I need to purchase in bulk?</td>
<td>- Buy from a wholesale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>market.</td>
</tr>
<tr>
<td>How to buy?</td>
<td>What do I check</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Survey the market.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>while buying</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Read the labels for:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• date of manufacture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• date of expiry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ingredients</td>
</tr>
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<td></td>
<td></td>
<td>• instructions regarding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• standardized marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Buy goods in sealed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>containers, packets and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bags.</td>
</tr>
<tr>
<td>Where to buy?</td>
<td>Which shop to buy from?</td>
<td>Buy from a licensed or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>co-operative shop only.</td>
</tr>
<tr>
<td></td>
<td>What if there is a defect in the product?</td>
<td>Buy from a shop keeper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>who replaces faulty goods.</td>
</tr>
<tr>
<td>When to buy?</td>
<td>Is this the right time to buy?</td>
<td>Buy when shops are less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>crowded.</td>
</tr>
</tbody>
</table>
### INTEXT QUESTIONS 22.2

1. Match Column A with Column B:

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) A consumer should buy from</td>
<td>(a) when the shops are less crowded.</td>
</tr>
<tr>
<td>(ii) The quantity to be bought</td>
<td>(b) Consumer Protection laws.</td>
</tr>
<tr>
<td>(iii) The best time to buy is</td>
<td>(c) Licensed shops/cooperative Stores only</td>
</tr>
<tr>
<td>(iv) A consumer should know</td>
<td>(d) Depends upon the requirement of the family</td>
</tr>
<tr>
<td>(v) Payment of goods can also be made by</td>
<td>(e) When genuine discounts are offered by shopkeepers</td>
</tr>
<tr>
<td></td>
<td>(f) Cheques</td>
</tr>
</tbody>
</table>

### 22.4 CONSUMER AIDS TO HELP YOU

From where can you get the information about the products? Many of you may seek help from your friends, family or shopkeepers. To know more about a product before purchasing it, whom do you ask?

Yes, advertisements in magazines or on the television, leaflets, labels of products, packages also provide you with necessary information. All such items that provide you with information on products are called consumer aids.

**A Consumer aid is anything written or illustrated that helps and guides a consumer in selecting a product he/she wants to buy.**

<table>
<thead>
<tr>
<th>How to pay?</th>
<th>I need fruits and vegetables</th>
<th>Buy, seasonal fruits and vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>I need to buy cheaper electronics or woolens.</td>
<td>Cash or credit?</td>
<td>Can pay by cash, cheques or credit cards.</td>
</tr>
<tr>
<td>How to pay?</td>
<td></td>
<td>Check interest charged on credit payments beforehand to avoid paying more.</td>
</tr>
</tbody>
</table>
Common aids available to a consumer are labels, leaflets, packages, advertisements, standardisation marks, Legislation and Consumer Associations and Cooperatives.

(i) **Labels**

They are engraved or printed on or attached to the product. Labels are required to give the following information:

(a) Name of the product
(b) Trade and brand name
(c) Manufacturer’s name and address
(d) Contents/ingredients
(e) Purpose/use of the product
(f) Directions to use the product
(g) Warnings and precautions to be kept in mind while using the product
(h) Date of manufacture and date of expiry in the case of medicines/tonics
(i) Dosage (in the case of medicines and tonics)
(j) Guarantee period
(k) Standardisation mark
(l) Product price (MRP)
(m) Net weight
(n) Lot / batch number
(o) Date of manufacture
(p) Date of expiry

**What is the relevance of this information given on the labels to you as a consumer?**

Let’s learn more on it:

- List of ingredients- you may be allergic to some thing or the ingredients may be from animal source;
- check for standard mark (is it genuine?);
- tally rates and net amount and then decide whether the pack is cheaper or more expensive;
- to complain, contact manufacturers with reference to lot number;
- avoid purchasing if it is near the expiry date;
- store and use the products as instructed.
i. Examine any label and evaluate whether it is complete. Choose the product accordingly; good companies usually give complete information on their labels.

ii. Prepare a label for a biscuit, oil and pickle.

(ii) Leaflets

Leaflets inform about the existence of a product. They also provide details of cost of equipment, instructions for installation and maintenance.

(iii) Packages

Most of the products you buy are packed in an attractive package. The package helps you by protecting the product in a number of ways as mentioned below:

(a) It protects the product from damage (e.g., potato) and spoilage (e.g., milk).
(b) It protects the product from breakage (e.g., glasses).
(c) It prevents adulteration (e.g., ghee)
(d) It prevents pilferage (e.g., oil in sealed tins)
(e) It helps in transportation and storage (e.g., wheat flour).

You should check whether materials used in packing are safe and do not affect your health.

(iv) Advertisements

These are used by manufacturers to promote their product. Besides helping you to know what is available in the market, they also provide information about their use and special features of the product. You should not blindly believe in these advertisements.

(v) Standardized marks

These marks ensure the quality of products and indicate whether a product has been produced in accordance with the norms laid down by the standardizing agency. These encourage manufacturers to provide better competition in the market and also upgrade the quality of their products. Specific marks are given to the following products (Table 22.3)
### Table 22.3

<table>
<thead>
<tr>
<th>Standardization mark</th>
<th>Quality assurance of products</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISI</td>
<td>electrical goods, chemicals, toys, pressure cookers, biscuits, coffee, etc.</td>
</tr>
<tr>
<td>FPO</td>
<td>preserved foods such as tinned fruits and vegetables, juices, jams, sauces, pickles, etc.</td>
</tr>
<tr>
<td>Agmark</td>
<td>Agricultural and livestock products like spices, cereals, flour, pulses, egg, oil, butter, etc.</td>
</tr>
<tr>
<td>Woolmark</td>
<td>Wool and woolen garments</td>
</tr>
<tr>
<td>Hall mark</td>
<td>Gold ornaments</td>
</tr>
<tr>
<td>Eco mark</td>
<td>Recyclable, biodegradable and environment friendly products like preservatives, detergents, plastics, paints, etc.</td>
</tr>
</tbody>
</table>

### ACTIVITY 22.6

i. Survey the market for products bearing genuine standardized marks and add to the above list.

ii. Look for advertisements of an ISO 9000 certified company in the categories of products and services.
ISO 9000 is a globally implemented standard given to products which provides assurance about the ability to satisfy quality requirements and to enhance customer satisfaction.

(vi) Legislation

Certain laws have been passed by the government to protect your interests. For example:

Consumer Protection Act, 1986 (CPA) now called Consumer Protection Amendment Act, 2002

The Consumer Protection Act covers all goods and services. Consumer courts are set up at district, state and national levels. You can make your complaint in these courts, according to the price of the product, at a nominal fee. The details of this Act have been given in table 22.4.

(vii) Consumer Organisations

The consumer organizations help you in various ways. They:

- Provide information;
- work for the welfare of the consumers;
- guide the government to formulate consumer related policies;
- educate the consumers on various issues;
- arrange and conduct protests against anti-consumer activities;
- test products for their quality and defects and;
- accept complaints from consumers to represent them in consumer courts.

International Consumer Rights Protection Council (ICRPC) is a registered NGO that helps and guides aggrieved consumers to file their consumer complaints with the consumer court in India.

ACTIVITY 22.7

In your area, there may be a consumer organisation. Go and visit them to find out their activities? How do they work? How can they help you?
22.5 YOUR RIGHTS AS A CONSUMER

Do you know consumers have certain rights?

Knowledge of consumer rights will help you to fight against the various malpractices adopted by salesmen and manufacturers.

What are these rights? Let us find out.

1) **Right to safety**: A consumer has the right to demand safe goods and be protected against all harmful products like adulterated food or unsafe electrical appliances.

   For example, if your oven gives an electrical shock, or your cooker bursts, then under the right to safety, you can file a complaint against the manufacturers.

   **Government safeguards your right to SAFETY by:**
   - ensuring manufacturers and suppliers not to supply goods which are unsafe, unsuitable, defective or of poor quality. Recently milk containing urea was banned.

2) **Right to choose**: A consumer has the right to choose a product from a variety of good quality products. For example, a shopkeeper cannot keep just one brand of a tooth paste. You are entitled to demand more choices of a particular product.

   **Government safeguards your right to CHOOSE by:**
   - establishing procedures for community and consumer education about products.

3) **Right to be informed**: A consumer has the right to demand information regarding a product such as its quality, purity, potency, ingredients, prices, etc. Thus, if the shopkeeper refuses to give you the booklet of the product before you buy the product, you can file a case against him.

   **Government safeguards your right to be INFORMED by:**
   - issuing warnings along with advertisements of toxic products;

![Figure 22.6: Cigarette smoking is injurious to health](image-url)
• prohibiting deceptive packaging; and
• making sure packages clearly identify their price and content.

4) **Right to represent**

The right to be heard and to be assured that consumers’ interests will receive due consideration at appropriate forums.

5) **Right to be heard:** A consumer has the right to express himself in the court if he has been cheated. This means you have the right to make a representation against any malpractice at an appropriate forum. This is discussed in detail later in the chapter.

6) **Right to seek Redressal:** The right to seek redressal against unfair trade practices, or restrictive trade practices, or unscrupulous exploitation of consumers. For example, if a shopkeeper refuses to give you less than one meter of cloth, this is a restricted trade practice and you can file a case against the shopkeeper.

**Government safeguards your right to seek REDRESSAL by:**
• ensuring that consumers are allowed to play an equal role in the resolution of their disputes and
7) **Right to consumer education**: A consumer has the right to make himself aware of consumer ‘evils’ in the society. This means that you should acquire the knowledge and abilities necessary for making wise and intelligent choices.

![Consumer Education](image)

**Figure 22.8: Consumer education**

**Government safeguards your right to CONSUMER EDUCATION by:**

- ensuring that consumer laws are written in a language which can be easily understood and monitors consumer awareness.

8) **Right to basic needs**: Right to basic goods and services guarantees dignified living. It includes adequate food, clothing, health care, drinking water and sanitation, shelter, education, energy and transportation.

**Government safeguards your right to BASIC NEEDS by providing:**

- rations at subsidised rates for low income families
- health care facilities
- safe drinking water
- low cost housing
- free basic and primary education
9) **Right to Healthy Environment**

This right ensures a physical environment that will enhance the quality of life. It includes protection against environmental damage. It acknowledges the need to protect and improve the environment for future generations as well. You must be aware that all vehicles have to obtain a pollution free certificate after every three months. Each one of us has a responsibility towards maintaining a healthy environment. Without our active cooperation, government cannot ensure a healthy environment either.

**Government safeguards your right to a HEALTHY ENVIRONMENT by:**

- promoting use of environmental-friendly products
- encouraging recycling of consumer goods
- ensuring pollution is minimised.

---

*Figure 22.9 (a) Ration shop  Figure 22.9(b): Low cost housing Scheme*

*Figure 22.10 (c) Healthcare facility  Figure 22.10(d) Safe drinking water*
Every year, March 15th is observed as World Consumer Rights Day. It is sad to know that most of us are responsible for the malpractices prevalent in our society. How many of you can proudly call yourselves responsible consumers? Let’s find out!

22.6 YOUR RESPONSIBILITIES AS A CONSUMER

To know how responsible you are as a consumer, answer ‘Yes’ or ‘No’ to the following questions:

1. Do I survey the market before buying anything?
2. Do I insist on taking the bill even if it means paying a bit extra?
3. Do I maintain the bills?
4. Am I ready to buy the groceries at any cost or do I find substitutes?
5. At the time of shortage of any products, do I buy less and share the amount available equally with others and thus do not encourage black-marketing?
6. Do I avoid wastage of anything and discourage excess consumption of those goods which are in short supply?
7. At the time of registering a complaint, do I join hands with ‘fellow-consumers’ against the sellers and not act in an indifferent manner? Do I realize that it could be my turn next?
8. If I find that I am being cheated, do I file a complaint in the appropriate ‘Consumer Forum’?
9. Do I observe any change in colour, texture, taste, label of a product and immediately bring it to the notice of the shopkeeper?
10. Do I buy sealed food products?

Procedure for filing a complaint:

You purchased a product or service that you weren’t happy with? You must remember, no one will help you if you do not want to help yourself! Rather than accepting the situation, take action and file a complaint by following these instructions.

Table 22.4: Procedure for filing a complaint

<table>
<thead>
<tr>
<th>Who can file a complaint?</th>
<th>Anyone (you) can file the complaint.</th>
</tr>
</thead>
<tbody>
<tr>
<td>When to file?</td>
<td>All complaints to be made within 2 years from date of purchase.</td>
</tr>
</tbody>
</table>
## Where to file a complaint?

<table>
<thead>
<tr>
<th>Level</th>
<th>Complaints can be made for</th>
</tr>
</thead>
<tbody>
<tr>
<td>District level</td>
<td>Products which cost up to 20 lakh</td>
</tr>
<tr>
<td>State level</td>
<td>Products which cost more than 20 lakh but less than one crore.</td>
</tr>
<tr>
<td>National level</td>
<td>Products which cost more than one crore.</td>
</tr>
</tbody>
</table>

## What is the fee?

<table>
<thead>
<tr>
<th>Level</th>
<th>Fees</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>Rs.100-500 (Rs.200-4000 at state)</td>
</tr>
<tr>
<td>State</td>
<td>Rs.5000</td>
</tr>
</tbody>
</table>

## How to start?

- Contact the seller. Keep a record of your conversation (person you spoke to? What date and time? And what action promised.
- If you cannot resolve the problem, write a letter to the manufacturer by registered mail (format of letter given on page 24)
- If that does not help, file a complaint in the appropriate forum.

## How to file a complaint?

- Send notice to the opposite party by registered post giving him 15 days to settle your grievance.
- Fill in prescribed form – stating name, address and description of complainant and of opposite party.
- State the facts relating to the complaint – when and where it arose?
- Attach bills along with court fee. Specify compensation desired.
- Submit a notarised affidavit stating facts are true.

## Where to submit the complaint?

Submit the complaint and court fee to the receiving clerk in the consumer court who will give you the date for admission hearing and complaint reference number.

## What next?

- The court will send a notice to the opposite party seeking reply within 30 days, asking him to attend the hearing.
- The court’s final order will be sent to all the parties by registered post.

**Note:** It is important for both the parties to attend /send representatives for all hearings.

## When will the case be settled?

All cases should be settled within 90 days from the date of receipt of complaint (5 months, in case the matter is to be tested). For example, in case of seeds, they need to be grown and then tested for germination.

## What is the relief available?

- Removal of defects from goods, replacement of goods, refund of price paid, compensation for injury/loss suffered, award costs incurred, etc.

You can use the following format of a letter while complaining to the manufacturer.
Name and address of opposite party
(name and address of the company)

Date:
Dear (Contact Person):
On (date), I purchased (or had repaired) a (name of the product with the serial or model number or service performed), I made this purchase at (location, date, and other important details of the transaction).
Unfortunately, your product (or service) has not performed well (or the service was inadequate) because (state the problem).
Therefore, to resolve the problem, I would appreciate your (state the specific action you want). Enclosed are copies (photocopies of originals) of my records (photocopies of receipts, guarantees/warranties, cancelled cheques, contracts, model and serial numbers, and any other documents).
I look forward to your reply and a resolution to my problem and will wait (set a time limit) before seeking legal assistance. Please contact me at the address given below or on telephone.
Sincerely,
Your Name
Address
Telephone no.

If nothing works, you can send a short summary of your complaint to: consumerhelp@mtnl.net.in without any attachments.

INTEXT QUESTIONS 22.3

1. Answer the following questionnaire to rate your self as an alert consumer.

(a) If a vendor on a train, charges you Rs. 5/- more than the MRP, you would ________________.
   (i) give him Rs.5/-
   (ii) refuse to buy
   (iii) complain about him to the concerned authorities
   (iv) bargain with him

(b) If a shopkeeper refuses to give you pamphlets of the appliances, before you decide to buy it, you may______________.
   (i) buy the product and read the pamphlet later
   (ii) buy from another shop where the pamphlet is shown
   (iii) refuse to buy the product.
   (iv) start arguing with the shopkeeper
(c) When you buy medicines worth Rs.34.50p, do you______________.
   (i) insist on taking the bill and keep it safely
   (ii) take the bill and keep it at home.
   (iii) think it is too small an amount to take a bill
   (iv) insist on taking the bill

(d) When onions are available in the market at Rs 50/- kg., do you______________.
   (i) buy them in bulk and hoard them
   (ii) find substitute for onions
   (iii) buy in less quantity and blame the government for rising prices
   (iv) use all your resources to buy onions for personal use

(e) When filing a complaint for products worth over ten lacs, you would
    approach the______________.
    (i) District Court
    (ii) State Consumer Court
    (iii) National consumer court
    (iv) High Court

(f) In case there is a variation in price, you would______________.
   (i) never know as you do not compare the prices
   (ii) buy it from a shop as the shopkeeper is known to you
   (iii) survey the market and buy at a lower rate even if the shop is very far away
   (iv) weigh the pros and cons for after sales service, quality, guarantee, price and standardised mark before buying

(g) To avoid buying adulterated turmeric powder______________.
   (i) buy the turmeric powder bearing Agmark
   (ii) buy reputed brands
   (iii) buy sealed packets
   (iv) buy whole spices and grind at home
2. Study the following situation and find a solution to it.

(a) Rahul is 20 years old. He wants to buy a bicycle. He goes to a nearby shop which has only one brand of bicycle available. He pays the money and does not take a bill as he would have had to pay more money for the taxes. If you were Rahul, what steps would you have taken?

(b) Sita got hurt when her new pressure cooker burst open. If you were Sita what rights would you have exercised? What would be your responsibilities in this context?

**ACTIVITY 22.8**

1. Rohit bought a refrigerator for 20,000/- of Cool Company and found it to be defective. The shopkeeper did not listen to his complaints. If you were Rohit, elaborate the steps you would adopt to file a complaint?

2. Using the given format, write a letter to the opposite party and elaborate the steps of filing the complaint:
   
   (i) Where will you go?
   
   (ii) How much fees will you pay?
   
   (iii) How will you file the complaint?

3. Find out the address of District Consumer Forums in your area for help and guidance.

**WHAT YOU HAVE LEARNT**

<table>
<thead>
<tr>
<th>Responsibilities of Consumers</th>
<th>Problems of Consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer</td>
<td>Hoarding</td>
</tr>
<tr>
<td>Right to Safety</td>
<td>Defective Weights &amp; Measures</td>
</tr>
<tr>
<td>Be informed</td>
<td>Price Variation</td>
</tr>
<tr>
<td>Choose</td>
<td>Lack of Standard</td>
</tr>
<tr>
<td>Represent</td>
<td>Imitation</td>
</tr>
<tr>
<td>Be heard</td>
<td>Adulteration</td>
</tr>
<tr>
<td>Seek Redressal</td>
<td>Misleading Information</td>
</tr>
<tr>
<td>Consumer education</td>
<td></td>
</tr>
<tr>
<td>Basic needs</td>
<td></td>
</tr>
</tbody>
</table>

**HOME SCIENCE**
1. Define the following in your own words.
   (a) Consumer
   (b) Consumer aids

2. (a) Briefly describe any four problems faced by you as a consumer in the following categories:
   (i) Products
   (ii) Services
   (b) Suggest any four ways by which you can overcome these problems.

3. Give four reasons for imparting consumer education to all.

4. You plan to buy a cooler. What are your responsibilities in this context?

5. Why is it important to buy products with standardized marks?

6. List any four ways in which you are likely to get cheated by traders and manufacturers?

7. You have paid for one meter of cloth for your blouse. The tailor tells you it is short by 20 cms. In what ways could the shopkeeper have fooled you?

8. What steps would you adopt to protect yourself from buying adulterated food?

ANSWERS TO INTEXT QUESTIONS

22.1

1. (a) Consumer
   (b) products
   (c) service
   (d) duplicate/fake/imitation
   (e) adulteration
   (f) hoarding/black-marketing
   (g) advertisement
   (h) standardized marks
   (i) MRP
2. (a) (i) tell the shopkeeper
   (ii) write to the manufacturer
   (iii) complain to concerned authorities, if you get no response
   (iv) do not bother/buy another one
   (i)(ii)(iii) - (Satisfactory), (iv) (unsatisfactory)

b) (i) make sure you get it weighed
   (ii) phone up the agency and get it exchanged
   (iii) will tell him next time
   (iv) do nothing/not bother
   (i) - (ii) - (Satisfactory), (iii) needs improvement, (iv) satisfactory)

22.2
i) c  ii) d  iii) a  iv) b  v) f

22.3

1. (a) (iii)
   (b) (ii)
   (c) (i)
   (d) (ii)
   (e) (i)
   (f) (iv)
   (g) (iv)

2. (a)
   (i) Would have surveyed the market.
   (ii) Compared the prices of at least 3-4 brands of cycles.
   (iii) Ensured the bicycle was of a standard company
   (iv) Paid taxes and taken a bill as proof of purchase.

2 (b)

Right to-
(i) safety,
(ii) represent,
(iii) consumer education,
(ii) seek redressal.

Responsibilities- should
(v) take a bill and kept it safely
(vi) have read and followed instructions
(vii) buy standard product
(viii) complain to authorities
(ix) Any other (any four)
CLASSIFICATION OF LIVING ORGANISMS

Do you know that

- earth is the only planet in our solar system of eight planets on which life exists;
- living organisms derive most of their requirements for survival from the non-living sources of earth;
- every organism begins life as a single cell;
- there are plants which eat insects;
- mushrooms that we relish as vegetarian food are fungi. Fungi are the group of organisms which subsist on dead and decaying matter;
- certain bacteria live in oceanic vents at temperatures as high as 80°C to 110°C.

Note the temperature at which you feel uncomfortable on a sunny summer day or an icy cold winter night and it will give you an idea of how high the temperature is at which these bacteria survive.

This lesson deals with the diverse kinds of organisms found on earth and the ways and means of studying this vast biodiversity. It also emphasizes the need for conservation of biodiversity.

OBJECTIVES

After completing this lesson, you will be able to:

- recognize the vast diversity of living organisms in terms of variety of size and complexity;
- explain the meaning of biodiversity;
- describe the levels of biodiversity;
19.1 BIODIVERSITY

19.1.1 What is biodiversity

We find living organisms all around us, even deep under the oceans and in the snow covered Arctic and Antarctica. There are organisms which are single celled and microscopic, as well as animals as large as the elephant, the rhinoceros, the hippopotamus and the whale. Have you seen the movie “Jurassic Park” by Steven Spielberg? From the movie you get an idea of how huge the dinosaurs were which roamed the earth millions of years ago and then became extinct. Also if you were to take a drop of water from the nearby pond and view it under a lens you will be amazed to see the enormous variety of organisms moving about in that drop of water. You might be wondering how many kinds of organisms there would be on earth! It is estimated that about 10 to 15 million different kinds of organisms have been found on earth including the ones that lived in the past. However, scientists have till date identified only over two million of them.

The enormous variety of organisms is termed biodiversity (bios means life and diversity means variety). There is not only diversity in size among organisms but also in complexity. Eg. bacteria are simple single celled organisms and humans are made of a trillion cells and are highly complex.

All organisms have come to exist on earth because of evolution and are related through ancestry. You shall learn about evolution and its mechanism in the next (Lesson 20) entitled ‘History of Life on Earth’. The humans are at the top of the evolutionary ladder. It is sad that lots of different kinds of organisms have been lost due to the impact of human activities. Therefore, we have to be conscious and aware so that damage to the earth on which we live along with other organisms, is avoided.

ACTIVITY 19.1

If you are a stamp collector, make an album or chart of stamps on animals and plants.
**Classification of Living organisms**

**ACTIVITY 19.2**

Some calendars are based on birds or wild animals. Collect the pictures from old calendars and make a scrap book.

Apart from variety of size and complexity, there is diversity in modes of feeding, reproduction and other body functions among organisms.

**ACTIVITY 19.3**

Prepare flow charts by using terms given below in brackets for diversity in reproduction and respiration. Diversity in feeding is given below as a sample:

![Flow Chart](image.png)

Use the words given below to draw flow charts like the one given above depicting variety in reproduction and respiration.

**Reproduction:** Asexual, sexual, single parent, two parents.

**Respiration:** Oxygen from water, oxygen from atmosphere, Carbon dioxide into water, into atmosphere, gills, lungs, anaerobic, aerobic.

You may seek help of your friends and use other innovative ways of presenting the data. Organisms live up to 8 km in air and up to 5 km below sea level. This part of the earth which supports life is the **biosphere**. Biosphere has diverse **ecosystems** such as the...
pond, river, oceans, and mountains, deserts etc. Various kinds of organisms or different species live in these ecosystems. They interact with each other and also interact with the physical components of the ecosystem such as light, temperature etc.

Read the following table and perform the accompanying activities.

**Table 19.1 Biosphere, ecosystem and species**

<table>
<thead>
<tr>
<th>Level of Organisation</th>
<th>Images/ pictures of each level</th>
<th>Diversity of features</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biosphere</strong>&lt;br&gt; the physical part of earth on which organisms can survive</td>
<td><img src="image" alt="Fig. 19.1a Earth as seen from space" /></td>
<td>Oceans, mountains, fresh water bodies, forests, snow clad areas, deserts and grasslands.</td>
<td>Obtain an outline map of the world and mark in different colours, the diverse components mentioned in the adjacent column.</td>
</tr>
<tr>
<td><strong>Ecosystem</strong>&lt;br&gt; Definite geographical region in which various species of organisms live and interact with each other and the physical environment</td>
<td><img src="image" alt="Fig. 19.1b Ecosystem" /></td>
<td>Oceans, mountains, rivers, ponds, forests, snow-clad areas, deserts etc.</td>
<td>Collect pictures or read from your geography book or see a website to record specific features of the ecosystems mentioned in the previous column.</td>
</tr>
<tr>
<td><strong>Species</strong>&lt;br&gt; Group of very similar organisms which can interbreed to produce fertile offspring.</td>
<td><img src="image" alt="Fig. 19.1c Species" /></td>
<td>Different kinds of bacteria, protozoa, fungi, plants and animals</td>
<td>Collect pictures of humans belonging to different parts of the world. They look different. Why are they said to belong to the same species?</td>
</tr>
</tbody>
</table>

**19.1.2 Levels of biodiversity**

All the varieties of living organisms on earth constitute biodiversity. Three levels of biodiversity have been recognized:

1. **Ecological/Ecosystem diversity**

Organisms evolved features which helped them adapt to their surroundings or the ecosystems in which they live. There are different ecosystems and even related organisms living in different ecosystems may differ vastly from each other. For
example tortoises are terrestrial and turtles are aquatic. Both are related but differ much especially in their feet. There is diversity of ecosystems—terrestrial ecosystems include forests, plains, deserts and mountains and aquatic ecosystems are sea, river, pond etc. Organisms living in these have evolved suitable adaptations. India has very diverse terrestrial and aquatic ecosystems.

2. **Species diversity**

*Variety of species living in a certain geographical area constitutes species diversity.* Individual organisms belonging to a particular species are similar and are able to undergo reproduction to produce fertile offspring. They cannot interbreed with another species. There is an enormous number of species of organisms as you have already learnt. It refers to the variety of genes contained within species of plants, animals and microorganisms. Can you say how new variations arise in an individual?

3. **Genetic diversity**

Organisms are made of cells and cells in their nuclei contain chromosomes which bear the genes. Genes control the features of a particular species. Genes of individuals belonging to the same species are similar. Every species has a gene pool. Gene pool means all the different kinds of genes found in a species. The gene pool of a species differs from that of another species.

**ACTIVITY 19.4**

Prepare a chart or flash cards or an album or a power point presentation to depict the three levels of biodiversity. You may use pictures, photocopies of illustrations, photographs, drawings, scanned pictures/photographs etc.

You may even make a model showing various levels of biodiversity.

**19.1.3 Patterns of biodiversity**

**Global Scenario**

The entire world is divided into six *biogeographic* regions (Fig. 19.3). The organisms found in these regions are adapted to the climate of these regions. Certain kinds of
organisms are common to all regions while some are restricted to certain regions only e.g. elephants are found only in Asia and Africa and nowhere else in the world. Grass is found all over the world.

![The six biogeographic regions](image)

**Fig. 19.3 The six biogeographic regions**

### Indian Scene

India has two biodiversity ‘hotspots’—the Western Ghats and North Eastern regions (including Eastern Himalayas). (Fig.19.4) ‘**Hotspots**’ are regions of the world where many different kinds of organisms live. Many of these organisms are not found elsewhere e.g. Many species of frogs live only in the Western Ghats of India.

**The flora and fauna are our heritage. We must conserve our biodiversity.**

![Biodiversity Hotspots of India](image)

**Fig. 19.4 Biodiversity Hotspots of India**

### INTEXT QUESTIONS 19.1

1. What does biodiversity mean?
2. Define (i) species, (ii) biosphere (iii) ecosystem.

________________ ________________ ________________

3. Name the three levels of biodiversity.

________________

4. What is meant by biodiversity hotspots?

________________

19.2 CLASSIFYING AND NAMING ORGANISMS

How may this enormous diversity of living beings be studied and comprehended? This riddle has been solved by categorising diverse kinds of organisms and providing them with scientific names.

19.2.1 Classification of organisms

You have already learnt that about 10-15 million species are supposed to have evolved on the earth till now.

Try and calculate how much 10 million would be by adding zeroes after 10. Till now, approximately 2 million have been identified and named. How do scientists study and identify organisms? They do it by arranging organisms into groups and subgroups. **Grouping of organism according to similarities and differences is termed classification.** When an organism is classified into various categories a hierarchy is maintained. Accordingly, an organism belongs to Kingdom, Phylum, Class, Order, Family, Genus and Species in hierarchical order. These are groups to which an organism belongs and which express its evolutionary relationship with other organisms.

**Thus classification shows evolutionary relationships between organisms and is also termed Systematics. The science of classification or systematics is termed Taxonomy.**

The scientific name of a human being is *Homo sapiens*. Humans are classified as follows:

<table>
<thead>
<tr>
<th>Name of Group</th>
<th>Characteristic features of the groups into which humans are classified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom</td>
<td>All animals (Multicellular, eukaryotic, heterotrophs)</td>
</tr>
<tr>
<td>Animalia</td>
<td></td>
</tr>
<tr>
<td>Phylum</td>
<td>Animals with notochord at some stage of life.</td>
</tr>
<tr>
<td>Chordata</td>
<td></td>
</tr>
</tbody>
</table>
Homo sapiens means the wise hominid.

19.2.2 The Three Domains of Classification

All organisms are now classified into three major domains (Fig. 19.5)

Archaebacteria are thermophilic or heat loving bacteria that live in high temperature vents.

Eubacteria are single celled organisms without well developed nucleus.

Eukarya are all other organisms with a well formed nucleus in their cell/cells. (Eu: true; Karyon : nucleus)

19.2.3 The Five Kingdoms of Life

Earlier there were only 2 kingdoms of plants and animals. Whittaker in 1969 suggested that bacteria should not be in plant kingdom and protozoa not in animal kingdom. He gave the five kingdom classification. Given below are the 5 kingdoms of life and their typical features.
Table 19.2 The five kingdoms of life

<table>
<thead>
<tr>
<th>Kingdoms</th>
<th>Pictures of examples</th>
<th>Name</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom 1</td>
<td>Fig. 19.7a Bacteria</td>
<td>Monera</td>
<td>Single celled, No well formed nucleus (Prokaryotes)</td>
</tr>
<tr>
<td>Kingdom II</td>
<td>Fig. 19.7b Protozoa</td>
<td>Protoctista or Protista</td>
<td>Single celled with well formed nucleus (Eukaryotes)</td>
</tr>
<tr>
<td>Kingdom III</td>
<td>Fig. 19.7c Mushroom</td>
<td>Fungi</td>
<td>Eukaryotes, multi-celled saprotrophs</td>
</tr>
<tr>
<td>Kingdom IV</td>
<td>Fig. 19.7d Fern and Tree</td>
<td>Plantae</td>
<td>Eukaryotes, multicelled, autotrophs</td>
</tr>
<tr>
<td>Kingdom V</td>
<td>Fig. 19.7e Earthworm and cat</td>
<td>Animalia</td>
<td>Eukaryotes, multicelled, heterotrophs</td>
</tr>
</tbody>
</table>

The kingdoms are further divided into divisions (as in bacteria, fungi and plantae) or phyla (as in Protoctista and Animalia). Every phylum includes several classes, classes are divided into orders. Orders include families.

*SCIENCE AND TECHNOLOGY*
A family is made up of many genera (singular: genus). Every genus includes several species. Species are segregated from their related species under the same genus through reproductive barriers. This means that members of one species cannot interbreed with members of another species to produce fertile offspring. See fig. 19.1c

**INTEXT QUESTIONS 19.2**

1. **What is meant by classification?**

2. **How has classification made study of diversity possible?**

3. **Name the three domains into which all the organisms of the world are categorised**

4. **Name the five kingdoms of life and mention the three features on which this classification is based.**

5. **Study the table 19.2 on kingdoms of life and fill in the names of kingdom at A to E in the flow chart given below:**

   **Kingdoms of life**
   
   (A) Primitive nucleus (Prokaryotes)
   
   (B) Single celled
   
   (C) Saprotrophs
   
   (D) Autotrophs
   
   (E) Heterotrophs

   All other Kingdoms

   3 Other Kingdoms

   Multicelled

19.2. 4 **How organisms are named**
Classification of Living organisms

Every organism has a scientific name beside the name by which it is known in a particular language. For example, mango is its name in English, Aam in Hindi and *Mangifera indica*, its scientific name. In scientific naming, genus and species of the organism are mentioned. e.g. *Homo sapiens*.

The Scientific Name

A Scientific name has several advantages and constitutes the specific identity of the specific organism.

- It is understood all over the world.
- It consists of two words, name of the Genus to which it belongs begins with a capital letter and name of the species to which it belongs, begins with a small letter e.g. cat is *Felis domestica* where *Felis* is the genus name and *domestica* the name of the species.
- A scientific name is always written either in italics or underlined.
- Having two names is the Binomial system of nomenclature (naming) introduced by the Swedish naturalist of 18th century, Carolus Linnaeus.

The term binomial nomenclature pertains to the two word naming system (binomial = two names; nomenclature = naming)

19.2.5 Who’s Who in the Living World—Classification of Kingdoms Plantae and Animalia

Every organism belongs to one of the five kingdoms of life.

A. **Kingdom MONERA** includes microscopic, single celled organisms with cell wall, no proper nucleus e.g. All bacteria.

B. **Kingdom PROTOCTISTA(PROTISTA)** includes single celled organisms with well formed nucleus e.g. Amoeba, malarial parasite, *Chlamydomonas*. (Fig. 19.8)

C. **Kingdom FUNGI** includes multicellular or many celled organisms. The body is made of network (mycelium) of fine threads called hyphae. Fungi feed on dead decaying matter (saprotrophs) eg. Mushroom, yeast, bread mould.

D. **Kingdom PLANTAE** includes:
   - Multicellularareukaryotes with
Classification of Living organisms

- cellulose cell wall and chlorophyll present in their cells
- Autotrophs and thus carry out photosynthesis.

E. **Kingdom ANIMALIA** includes organisms with the following characteristics.
- Multicellular, eukaryotes.
- Heterotrophic so feed on plants or other animals
- Possess special organs for locomotion or movement from one place to another.
- Possess nervous system with sense organs.

**Classification of Plants**

Kingdom Plantae is divided into the following divisions.

**Classification of Plants**

Kingdom Plantae is divided into the following divisions.

![Diagram of plant classifications](Fig.19.9a)

**Algae**
(No special roots, stem or leaves)
e.g. The algae

![Diagram of algae](Fig.19.9b)

**Bryophyta**
Root like hyphae but no true roots e.g. Liverworts and mosses

![Diagram of liverworts and mosses](Fig.19.9c)

**Pteridophyta**
True roots, underground stem, spore bearing leaves e.g. Ferns

![Diagram of ferns](Fig.19.9d)

**Gymnosperms**
No flowers, seeds naked and not enclosed in fruit e.g. Pine, Juniper

![Diagram of gymnosperms](Fig.19.9e)

**Angiosperms**
Flowering plants, fruits bear seeds All flowering plants

![Diagram of flowering plants](Fig.19.9f)
Classification of Living organisms

**Classification of Animals**

**Kingdom Animalia**

- **Non Chordata** (No notochord)
  - Phylum Porifera
    - Irregular body
    - With pores or ostia for entry of water containing oxygen and food.
    - Even tiny pieces of sponge can regenerate into full individual
    - E.g. Sycon, Sponge

- Phylum Cnidaria
  - Tentaclae around mouth.
  - Stinging cells present.
  - Reproduction by budding or sexual.
  - E.g. Hydra, Jellyfish, Corals, Anemones
  
- Phylum Platyhelminthes
  - Flat body.
  - Mostly parasitic worms.
  - Some free living.
  - E.g. Tape Worm, Liver Fluke, Planaria

- **Chordata** (Notochord present)
  - Phylum Chordata
    - Echinoidea
      - Flat or globular deep sea animals.
      - Have 5 arms or division of body.
      - Spiny skin.
      - E.g. Star fish,
      
- Phylum Aschelminthes
  - Round
  - Parasitic/free living
  - E.g. Ascaris, (round), Pin worms

- **Annelida**
  - Segmented body
  - Excrete by nephridia
  - Hermaphrodite (male and female organs in the same individual)
  - E.g. Earthworm, Leech, Nereis

- Phylum Arthropoda
  - Jointed legs
  - Body divided into head, thorax, abdomen
  - Body covered with cuticle (layer above skin) made of hard substance called chitin.
  - E.g. Insects, spider, scorpions, prawns, crabs.

- Phylum Mollusca
  - Soft, unsegmented body enclosed in hard shell made of calcium carbonate.
  - Muscular foot.
  - E.g. Oysters, snails, Octopus.

**PHYLUM CHORDATA**

- **Sub Phylum Vertebrata**

- **Class Chondrichthyes**
  - Skeleton made of cartilage
  - Marine fish
  - 7 pairs of gill slits
  - E.g. shark, rays

- **Class Osteichthyes**
  - Bony skeleton
  - Found in both sea and fresh water
  - Gills for breathing covered by operculum
  - E.g. Rohu, Catla

- **Class Amphibia**
  - Live on land but lay eggs in water where life history is completed.
  - Both adapted to both life in water and land.
  - Breach with lungs
  - E.g. Salamander, Frogs

- **Class Reptilia**
  - Land Animals – lay eggs on land
  - Body covered with scales
  - E.g. Lizard, snake, crocodile, turtle

- **Class Aves**
  - Aerial mode of life
  - Light bones
  - Beak for feeding
  - Wings for flying
  - E.g. Birds

- **Class Mammalia**
  - Mammary glands for producing milk for young.
  - Body covered with hair
  - Hair skin
  - E.g. Cow, mouse, man
INTEXT QUESTIONS 19.3

1. Find out the scientific name of the following:
   Frog, cat, China rose, onion.
   You may get them from someone in your neighbourhood who knows Biology or from internet or some Biology book.
   ________________________________________________________________

2. In the following table, fill in plus (+) for present and minus (-) for absent to show the difference between plants and animals.

<table>
<thead>
<tr>
<th>Features</th>
<th>Plant</th>
<th>Animal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorophyll</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Muscles</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Nerves</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Locomotion</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Leaves and Roots</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Mouth and Anus</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

3. See the pictures of the two arthropods shown below. Mark one similarity and one difference

   Spider               Honeybee

4. Which out of ABCD is

   [Diagrams of A, B, C, D]
5.

Write the name of the phylum to which each of the animal shown in the pictures above, belongs.

19.3 CONSERVING BIODIVERSITY

Having got an idea of biodiversity, you must be feeling sad that human activities have put the lives of so many other living beings in jeopardy. Your conscience must be telling you, 'don't all different species have a right to live on earth?' You are right. We must all strive to conserve biodiversity because organisms are interdependent and together maintain a balance in nature. The flora and fauna of our nation is our heritage. We have to conserve our heritage. Let us examine how biodiversity maintains equilibrium and harmony in nature.

19.3.1 Role of biodiversity in maintaining harmony in nature

Biodiversity maintains equilibrium in nature because of which all kinds of organisms are able to survive. The bacteria and fungi recycle organic matter to feed diverse organisms. Algae and plants trap solar energy for photosynthesis and produce food for all living creatures. Insects and bats pollinate flowers. Animals also disperse seeds. Ecosystems such as the forests, deserts, aquatic bodies, wetlands sustain their own typical biodiversity, some of which are part of their unique food chains and food webs.

19.3.2 Conserving Biodiversity

Due to increased land use by humans required for constructing houses and buildings, road and train lines, quarrying and cultivation (agriculture), habitats of plants and animals have been destroyed and biodiversity has been threatened. It is the duty of every human being to protect biodiversity. Conservation keeps ecosystems stable.
Human populations are also making excessive demands upon environmental resources for food and energy and generating a lot of waste. Many plants have become extinct. Some are close to extinction. Endangered species need to be protected. Fish and mollusc stocks have to be conserved and prevented from overexploitation by humans for food. Animals are poached for fur and ivory. Each year about 10 million birds from the wild are traded some of which die even before reaching the destination. Monkeys and tigers have been killed for making traditional medicines. A ban has been imposed on international trading in animals. You might have heard of Veerappan who used to illegally cut sandalwood trees and sell them.

"Operation Tiger" and "Operation elephants" are projects that have helped in preventing decline in their numbers due to habitat destruction.

19.3.3 What Can You Do?

You can spread awareness regarding the dwindling biodiversity and the necessity of conserving their habitats. You can form a group with your friends and organise painting and chart making competitions, essay writing, declamation and slogan writing contests on conservation of biodiversity and also hold debates on issues of biodiversity conservation in your neighbourhood. You may even write and enact street plays to create awareness. You can use the photographs of birds/trees/animals to make greeting cards.

**ACTIVITY 19.5**

Collect pictures of 10 trees and animals found only in the biogeographic region to which India belongs.

**ACTIVITY 19.6**

Take an outline map of India showing different states. Mark the areas where tigers, rhinoceros and elephants are conserved in wild life sanctuaries. If possible, make a trip to a zoo or wild life park or sanctuary or bioreserve park in your neighbourhood. Record what you see.

**ACTIVITY 19.7**

Write a story, poem or a play, imaging yourself to be a bear or monkey who has been captured from the wild for showing pranks to earn money.
ACTIVITY 19.8


ACTIVITY 19.9

Find out the common and scientific names of any two bacteria, two protozoans, two fungi, five plants and five animals. To do this you may seek help of someone who know biology or text books in biology or research by surfing on the internet.

WHAT YOU HAVE LEARNT

- An enormous biodiversity occurs on earth.
- Biodiversity is the term given to the variety of organisms that live on earth.
- Biodiversity exists at three levels:
  i) Ecological diversity,
  ii) Species diversity and
  iii) Genetic diversity.
- Since there is an enormous variety of living beings or organisms, their study requires dividing them into groups. Such grouping, based on similarities and differences between organisms is termed classification or systematics. Such grouping expresses evolutionary relationships between organisms as all organisms have resulted through the process of evolution. Study of classification is Taxonomy.
- All organisms are classified into three domains
  a) Archebacteria includes thermophilic bacteria
  b) Eubacteria includes all other bacteria
  c) Eukarya includes organisms other than bacteria

Further, all organisms are classified into 5 kingdoms which are based on 3 features
  i) Prokaryotes or eukaryotes
  ii) Single celled or multicellded and
  iii) Mode of feeding
Accordingly absence of well formed nucleus or prokaryotes
i) Belong to Kingdom Monera which includes all bacteria.
ii) Presence of well formed nucleus or eukaryote but single celled organisms belong to Kingdom Protoctista
iii) Multicells feeding on dead decaying matter form Kingdom Fungi, while
iv) Photosynthetic organisms that prepare own food constitute Kingdom Plantae and those feeding on others are grouped together into Kingdom Animalia.

Kingdom Plantae has five divisions namely Algae, Bryophyta, Pteridophyta, and Spermatophyta. Spermatophyta further divided into Gymnospermia and Angiospermia or flowering plants.

Kingdom Animalia is grouped into non chordates which are further divided into the phyla Porifera, Cnidaria, Platyheminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, and Echinodermata.

The chordates which have notochord at some stage of life form a single phylum Chordate. Chordate vertebrates are divided into the classes Chondrichthyes (Cartilaginous fish) Osteichthyes (bony fish) Amphibia (Frog, salamander), Reptilia (Lizards, snakes etc.) Aves (Birds) and Mammalia (rats, tigers, horses, humans)

TERMINAL EXERCISES

1. Define biodiversity. Mention its three levels and briefly explain them.

2. What are the global and Indian patterns of biodiversity? What do you mean by a 'hot spot' of diversity?

3. Name the three domains of life and state one distinguishing features of each.

4. Name the five kingdoms of life and state one feature of each of the kingdoms which differs from that of the others.

5. Give an account of the classification of Kingdom Plantae into its divisions. Cite examples.

6. State the difference between chordates and non chordates.

7. Name the phyla to which the following belong: wolf, earthworm, sponge, jelly fish, sparrow, butterfly, starfish, snail, tape worm, round worm

8. To which class of chordates do the following belong? Justify your inclusion into the class by stating any one characteristic feature. Crow, lion, cobra, flying frog, shark, fresh water fish.
9. Write three sentences on why we need to classify and give scientific names to organisms.

10. Why does biodiversity need to be conserved?

11. State three ways by which biodiversity may be conserved?

12. List 10 ways in which organisms help each other survive in nature. What message can you derive from their interdependence?

13. Why have some plants and animals become endangered? State at least five human activities as causes.

14. Write in a paragraph on "what would happen if living beings did not have scientific names and were not grouped." Mention at least five consequences.

15. You find some boys pelting stones at a monkey sitting on a tree. Write five sentences which can dissuade those boys.

**ANSWERS TO INTEXT QUESTIONS**

19.1

1. The various living beings living on earth constitute biodiversity.

2. Species: Group of interbreeding populations
   - Biosphere: Livable part of earth
   - Ecosystem: an area whose inmates interact with each other and also the physical surroundings.

3. Ecological diversity, species diversity, genetic diversity.

4. Hot spots are those areas of a country where some typical plants and animals (organisms) are exclusively present.

19.2

1. Classification: Categorising biodiversity into groups based on similarity and differences of organisms.

2. To make study of the enormous diversity possible.

3. Archaea, Prokarya, Eukarya

4. Monera, Protoctista (Protista), Fungi, Plantae, Animalia

5. A = Monera, B = Protoctista, C = Fungi, D = Plantae, E = Animalia
19.3

1. *Rana trigina, Felis domestica, Hibiscus rosa sinensis, Allium cepa*

2. + –, – +, – +, – +, + –, – +

3. Similarity = jointed legs / Head divided into head, thorax and abdomen.
   Differences = No. of pairs of legs

4. A=Algae, B=Moss, C=Fungus, D=Fern

5. a. Earthworm         Annelida
    b. Pila             Mollusca
    c. Round worm       Aschelminthes
    d. Hydra           Cnidaria
    e. Sponge          Porifera
    f. Starfish        Echinodermata
    g. Fish            Chordata
    h. Humans          Chordata
CONSTITUTIONAL VALUES AND POLITICAL SYSTEM IN INDIA

Mona, who is a student of class X in a school in Shillong asked her teacher a question that had been bothering her for long. She said, “Sir! in newspapers and the television news, I find the reference of the President of United States of America (USA) quite often, but the Prime Minister of USA is never mentioned. Why it is so?” The teacher replied, “You have rightly noticed the differences. It is so because the government of USA is based on its own Constitution, whereas our governmental system is based on our Constitution. It is the Constitution of a country that makes provisions according to which various institutions and offices are created and are made to function. In fact, the Constitution defines all aspects of the political system that a country has and more important than any thing else, the Constitution reflects certain values that form the core of that political system. These values guide not only the government, but also the citizens and the society at large.” Just like Mona, you may also have questions related to the Indian Constitution and its political system such as, what are the values reflected in the Constitution? What is the nature of the Indian political system? Why India is called a federal system? Why is it said to have parliamentary form of government? We shall discuss all these questions in this lesson.

OBJECTIVES

After completing this lesson, you will be able to:

- explain how the Constitution is the basic and fundamental law as well as a living document;
- analyze the Preamble of the Constitution and identify the core values reflected in it;
- appreciate the core constitutional values that permeate the salient features of the Indian Constitution; and
- examine the nature of the Indian federal system and the parliamentary form of government.
15.1 THE CONSTITUTION OF INDIA

Let us begin with a discussion on the Constitution of India. But even before that the question that needs to be answered is: what is the meaning of the term constitution?

15.1.1 Meaning of the Constitution

You may have come across the term constitution quite often. It is used in various contexts such as Constitution of a State or a Nation, Constitution of an Association or Union, Constitution of a Sports Club, Constitution of a non-governmental organization (NGO), Constitution of a company and so on. Does this term mean the same in all these contexts? No, it is not so. As used commonly, constitution is a set of rules, generally written, which defines and regulate the structure and functioning of an organization, institution or a company. But when it is used in the context of a State or a Nation, Constitution means a set of fundamental principles, basic rules and established precedents (means standards/instances).

It identifies, defines and regulates various aspects of the State and the structure, powers and functions of the major institutions under the three organs of the Government – the executive, the legislature and the judiciary. It also provides for rights and freedoms of citizens and spells out the relationships between individual citizen and the State and government.

A Constitution may be written or unwritten, but it contains fundamental laws of the land. It is the supreme and ultimate authority. Any decision or action which is not in accordance with it will be unconstitutional and unlawful. A Constitution also lays down limits on the power of the government to avoid abuse of authority. Moreover, it is not a static but a living document, because it needs to be amended as and when required to keep it updated. Its flexibility enables it to change according to changing aspirations of the people, the needs of the time and the changes taking place in society.

Unlike the Constitutions of most of the democratic countries, the British Constitution is known as unwritten constitution, because it is largely unwritten and uncodified. It was not framed as a complete statement like the Constitution of USA or the Indian Constitution. The Constitution of USA and the Indian Constitution are written constitutions.

15.1.2 The Indian Constitution

Have you seen the document of Indian Constitution? Do you recognize the cover page shown in the illustration? If you have seen or if you get a chance to see it, you will agree that it is a very lengthy document. In fact, Indian Constitution is the longest of all the written constitutions. It was prepared by a representative body, known as
the Constituent Assembly. Most of its members were deeply involved in the freedom struggle. They are respectfully called the founding fathers of the Constitution. The process of constitution-making was greatly influenced by the following factors: (a) aspirations generated during the long-drawn freedom struggle, (b) the constitutional and political changes that took place during the British rule, (c) the ideas and thoughts of Mahatma Gandhi, popularly known as Gandhism, (d) the socio-cultural ethos of the country and (e) the experiences of the functioning of Constitutions in other democratic countries of the world. The Constitution came into effect on 26 January, 1950 and since then we celebrate this day as the Republic Day every year.

Do you know

The Constituent Assembly began to prepare the Constitution on 9 December, 1946. Dr. Rajendra Prasad was elected as its President on 11 December, 1946. Dr. Baba Saheb Bhimrao Ambedkar was the Chairman of the Drafting Committee. The Constituent Assembly met for 166 days, spread over a period of 2 years, 11 months and 18 days. The making of the Constitution was completed on 26 November, 1949 when the Constituent Assembly adopted the Draft Constitution of India.

The Constitution of India defines all aspects of the Indian political system including its basic objectives. It has provisions regarding (a) the territories that India will comprise, (b) citizenship, (c) fundamental rights, (d) directive principles of state policy and fundamental duties, (e) the structure and functioning of governments at union, state and local levels, and (f) several other aspects of the political system. It defines India as a sovereign, democratic, socialist and secular republic. It has provisions for bringing about social change and defining the relationship between individual citizen and the state.

ACTIVITY 15.1

See a copy of the Constitution of India that is available in a Library or see it on the internet. Find out if there is an NGO or a Sports Club or a Students’ Union or Teachers’ Association or any social or cultural organisation nearby, which you may approach. Request any of them to show you the copy of the constitution they have.

Compare any of these constitutions with the Constitution of India. Write briefly what are the differences you find between the two?
INTEXT QUESTIONS 15.1

1. What is the meaning of Constitution?

2. Fill in the blanks:
   (i) The Indian Constitution is the .................................... constitution.
   (ii) The Indian Constitution was prepared by .................................
   (iii) The Constitution of India is a living document, because it needs to be ............................................................
   (iv) The 26 January is celebrated every year as ..............................
       because the Constitution came into effect on ..............................

15.2 CONSTITUTIONAL VALUES

The Constitution of any country serves several purposes. It lays down certain ideals that form the basis of the kind of country that we as citizens aspire to live in. A country is usually made up of different communities of people who share certain beliefs, but may not necessarily agree on all issues. A Constitution helps serve as a set of principles, rules and procedures on which there is a consensus. These form the basis according to which the people want the country to be governed and the society to move on. This includes not only an agreement on the type of government but also on certain ideals that the country should uphold. The Indian Constitution has certain core constitutional values that constitute its spirit and are expressed in various articles and provisions. But do you know what is the meaning of the word, ‘value’? You may immediately say that truth, non-violence, peace, cooperation, honesty, respect and kindness are values, and you may continue to count many such values. In fact, in a layman’s understanding, value is that which is very essential or ‘worth having and observing’ for the existence of human society as an entity. The Indian Constitution contains all such values, the values that are the universal, human and democratic of the modern age.

ACTIVITY 15.2

Read the list of the words stated below. Out of these, choose 6 words that you consider values for yourself and write those in the given box:

<table>
<thead>
<tr>
<th>Freedom</th>
<th>Love</th>
<th>Money</th>
<th>Passion</th>
<th>Creativity</th>
<th>Ambition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>Happiness</td>
<td>Excitement</td>
<td>Knowledge</td>
<td>Success</td>
<td>Fame</td>
</tr>
<tr>
<td>Adventure</td>
<td>Enthusiasm</td>
<td>Peace</td>
<td>Friendship</td>
<td>Sleeping</td>
<td>Beauty</td>
</tr>
</tbody>
</table>
Of the 6 values, select your topmost value and state 2 reasons in the given space below for considering it as your topmost value.

My topmost value ..............................................................
Reasons are:
1. ............................................................................................................
2. ............................................................................................................

Do you think that the topmost value impacts your attitude and behaviour? For example, a person who strongly believes in the value of non-violence, always tries to be non-violent in her/his actions.

15.2.1 Constitutional Values and the Preamble of the Constitution

Have you read the Preamble to the Indian Constitution printed in the beginning of this material? As has been stated above, the constitutional values are reflected in the entire Constitution of India, but its Preamble embodies ‘the fundamental values and the philosophy on which the Constitution is based’. The Preamble to any Constitution is a brief introductory statement that conveys the guiding principles of the document. The Preamble to the Indian Constitution also does so. The values expressed in the Preamble are expressed as objectives of the Constitution. These are: sovereignty, socialism, secularism, democracy, republican character of Indian State, justice, liberty, equality, fraternity, human dignity and the unity and integrity of the Nation. Let us discuss these constitutional values:

1. **Sovereignty**: You may have read the Preamble. It declares India “a sovereign socialist secular democratic republic”. Being sovereign means having complete political freedom and being the supreme authority. It implies that India is internally all powerful and externally free. It is free to determine for itself without any external interference (either by any country or individual) and nobody is there within to challenge its authority. This feature of sovereignty gives us the dignity of existence as a nation in the international community. Though the Constitution does not specify where the sovereign authority lies but a mention of ‘We the People of India’ in the Preamble clearly indicates that sovereignty rests with the people of India. This means that the constitutional authorities and organs of government derive their power only from the people.
2. **Socialism**: You may be aware that social and economic inequalities have been inherent in the Indian traditional society. Which is why, socialism has been made a constitutional value aimed at promoting social change and transformation to end all forms of inequalities. Our Constitution directs the governments and the people to ensure a planned and coordinated social development in all fields. It directs to prevent concentration of wealth and power in a few hands. The Constitution has specific provisions that deal with inequalities in the Chapters on Fundamental Rights and Directive Principles of State Policy.

The following provisions under the Directive Principles of State Policy promote the value of socialism:

“`The State shall, in particular, strive to minimise the inequalities in income, and endeavour to eliminate inequalities in status, facilities and opportunities, not only amongst individuals but also amongst groups of people residing in different areas or engaged in different vocations. “

(Article 38(2))

“`The State shall, in particular, direct its policy towards securing- (a) that the citizens, men and women equally, have the right to an adequate means of livelihood; (b) that the ownership and control of the material resources of the community are so distributed as best to subserve the common good; (c) that the operation of the economic system does not result in the concentration of wealth and means of production to the common detriment; (d) that there is equal pay for equal work for both men and women;…”

(Article 39)

3. **Secularism**: We all are pleased when anyone says that India is a home to almost all major religions in the world. In the context of this plurality (means more than one or two; many), secularism is seen as a great constitutional value. Secularism implies that our country is not guided by any one religion or any religious considerations. However, the Indian state is not against religions. It allows all its citizens to profess, preach and practise any religion they follow. At the same time, it ensures that the state does not have any religion of its own. Constitution strictly prohibits any discrimination on the ground of religion.

4. **Democracy**: The Preamble reflects democracy as a value. As a form of government it derives its authority from the will of the people. The people elect the rulers of the country and the elected representatives remain accountable to the people. The people of India elect them to be part of the government at different levels by a system of universal adult franchise, popularly known as ‘one man one vote’. Democracy contributes to stability, continuous progress in the society and it secures peaceful political change. It allows dissent and encourages...
tolerance. And more importantly, it is based on the principles of rule of law, inalienable rights of citizens, independence of judiciary, free and fair elections and freedom of the press.

5. **Republic**: India is not only a democratic nation but it is also a republic. The most important symbol of being a republic is the office of the Head of the State, i.e. the President who is elected and who is not selected on the basis of heredity, as is found in a system with monarchy. This value strengthens and substantiates democracy where every citizen of India is equally eligible to be elected as the Head of the State. Political equality is the chief message of this provision.

6. **Justice**: At times you may also realise that living in a democratic system alone does not ensure justice to citizens in all its totality. Even now we find a number of cases where not only the social and economic justice but also the political justice is denied. Which is why, the constitution-makers have included social, economic and political justice as constitutional values. By doing so, they have stressed that the political freedom granted to Indian citizens has to be instrumental in the creation of a new social order, based on socio-economic justice. Justice must be availed to every citizen. This ideal of a just and egalitarian society remains as one of the foremost values of the Indian Constitution.

7. **Liberty**: The Preamble prescribes liberty of thought, expression, belief, faith and worship as one of the core values. These have to be assured to every member of all the communities. It has been done so, because the ideals of democracy can not be attained without the presence of certain minimal rights which are essential for a free and civilized existence of individuals.

8. **Equality**: Equality is as significant constitutional value as any other. The Constitution ensures equality of status and opportunity to every citizen for the development of the best in him/her. As a human being everybody has a dignified self and to ensure its full enjoyment, inequality in any form present in our country and society has been prohibited. Equality reflected specifically in the Preamble is therefore held as an important value.

9. **Fraternity**: There is also a commitment made in the Preamble to promote the value of fraternity that stands for the spirit of common brotherhood among all the people of India. In the absence of fraternity, a plural society like India stands divided. Therefore, to give meaning to all the ideals like justice, liberty and equality, the Preamble lays great emphasis on fraternity. In fact, fraternity can be realized not only by abolishing untouchability amongst different sects of the community, but also by abolishing all communal or sectarian or even local discriminatory feelings which stand in the way of unity of India.

10. **Dignity of the individual**: Promotion of fraternity is essential to realize the dignity of the individual. It is essential to secure the dignity of every individual without which democracy can not function. It ensures equal participation of every individual in all the processes of democratic governance.
11. **Unity and integrity of the Nation**: As we have seen above, fraternity also promotes one of the critical values, i.e. unity and integrity of the nation. To maintain the independence of the country intact, the unity and integrity of the nation is very essential. Therefore, the stress has been given on fostering unity amongst all the inhabitants of the country. Our Constitution expects from all the citizens of India to uphold and protect the unity and integrity of India as a matter of duty.

12. **International peace and a just international order**: The value of international peace and a just international order, though not included in the Preamble is reflected in other provisions of the Constitution. The Indian Constitution directs the state (a) to promote international peace and security, (b) maintain just and honourable relations between nations, (c) foster respect for international law and treaty obligations, and (d) encourage settlement of international disputes by arbitration. To uphold and observe these values is in the interest of India. The peace and just international order will definitely contribute to the development of India.

13. **Fundamental Duties**: Our Constitution prescribes some duties to be performed by the citizens. It is true that these duties are not enforceable in the court of law like the fundamental rights are, but these duties are to be performed by citizens. Fundamental duties have still greater importance because these reflect certain basic values like patriotism, nationalism, humanism, environmentalism, harmonious living, gender equality, scientific temper and inquiry, and individual and collective excellence.

### INTEXT QUESTIONS 15.2

1. What do you mean by the term value?

2. State two important constitutional values embodied in the Preamble of Indian Constitution? Why do you consider these two values as very important?

3. Match the values/objectives given below in column ‘A’ with the statements in column ‘B’.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constitutional Values/Objectives</td>
<td>Statements</td>
</tr>
<tr>
<td>(i) Sovereignty</td>
<td>a. promoting social change to end all forms of inequalities.</td>
</tr>
<tr>
<td>(ii) Socialism</td>
<td>b. government of the people, by the people and for the people.</td>
</tr>
<tr>
<td>(iii) Secularism</td>
<td>c. equal treatment without any discrimination.</td>
</tr>
<tr>
<td>(iv) Democracy</td>
<td>d. the Head of the State is an elected person.</td>
</tr>
</tbody>
</table>
Constitutional Values and Political System in India

- (v) Equality: e. freedom to profess, preach and practise any religion.
- (vi) Liberty: f. international peace & security and honourable relations among nations.
- (vii) Fraternity: g. complete political freedom and supreme authority.
- (viii) International peace & just international order: h. freedom of thought, expression and belief.
- (ix) Republic: i. the spirit of common brotherhood.

**ACTIVITY 15.3**

Collect the views of at least five persons on the extent they think the constitutional values have been realized or objectives have been attained. These persons may be your classmates or teachers or members of your family or social workers in your neighborhood or any other. The constitutional values and objectives are stated in one column of the following table. They have to award marks in another column, out of the total marks of 10, based on their rating of the achievement made in respect of each of the values/objectives.

<table>
<thead>
<tr>
<th>Constitutional Values/ Objectives</th>
<th>Extent to which achieved Marks out of 10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Person 1</td>
</tr>
<tr>
<td>Social &amp; Economic justice</td>
<td></td>
</tr>
<tr>
<td>Liberty of thought &amp; expression</td>
<td></td>
</tr>
<tr>
<td>Equality of status and opportunity</td>
<td></td>
</tr>
<tr>
<td>Unity and integrity of the nation</td>
<td></td>
</tr>
<tr>
<td>Abolition of untouchability</td>
<td></td>
</tr>
<tr>
<td>International peace &amp; security</td>
<td></td>
</tr>
<tr>
<td>Universal adult franchise</td>
<td></td>
</tr>
<tr>
<td>Sovereignty with the people of India</td>
<td></td>
</tr>
<tr>
<td>Independence of judiciary</td>
<td></td>
</tr>
</tbody>
</table>

Based on the analysis of the responses, identify which value/objective has been realized to the maximum extent and which to the minimum extent. Try to find out the reasons.
15.2.2 Values and the Salient Features of the Constitution

The discussion on the Preamble embodying constitutional values clearly demonstrates that these are important for the successful functioning of Indian democracy. Your understanding of these values will be further reinforced, when you will find in the following discussion that constitutional values permeate all the salient features of Indian Constitution. The main features of the Constitution as shown in the illustration are as follows:

1. **Written Constitution:** As has been stated earlier, the Constitution of India is the longest written constitution. It contains a Preamble, 395 Articles in 22 Parts, 12 Schedules and 5 Appendices. It is a document of fundamental laws that define the nature of the political system and the structure and functioning of organs of the government. It expresses the vision of India as a democratic nation. It also identifies the fundamental rights and fundamental duties of citizens. While doing so, it also reflects core constitutional values.

2. **A Unique Blend of Rigidity and Flexibility:** In our day-to-day life, we find that it is not easy to bring about changes in a written document. As regards Constitutions, generally written constitutions are rigid. It is not easy to bring about changes in them frequently. The Constitution lays down special procedure for constitutional amendments. In the unwritten constitution like the British Constitution, amendments are made through ordinary law-making procedure. The British Constitution is a flexible constitution. In the written constitution like the US Constitution, it is very difficult to make amendments. The US Constitution, therefore, is a rigid constitution. However, the Indian Constitution is neither as flexible as the British Constitution nor as rigid as the US Constitution. It reflects the value of continuity and change. There are three ways of amending the Constitution of India. Some of its provisions can be amended by the simple majority in the Parliament, and some by special majority, while some amendments require special majority in the parliament and approval of States as well.

3. **Fundamental Rights and Duties:** You must be familiar with the term fundamental rights. We quite often find it in newspapers or while watching television. The Constitution of India includes these rights in a separate Chapter which has often been referred to as the ‘conscience’ of the Constitution. Fundamental Rights protect citizens against the arbitrary and absolute exercise of power by the State. The Constitution guarantees the rights to individuals against the State as well as against other individuals. The Constitution also guarantees the rights of minorities against the majority. Besides these rights, the Constitution has provisions identifying fundamental duties, though these are not enforceable as the fundamental rights are. These duties reflect some of the basic values embodied in the Constitution.

4. **Directive Principles of State Policy:** In addition to Fundamental Rights, the Constitution also has a section called Directive Principles of State Policy. It is a unique feature of the Constitution. It is aimed at ensuring greater social and
economic reforms and serving as a guide to the State to institute laws and policies that help reduce the poverty of the masses and eliminate social discrimination. In fact, as you will study in the lesson on “India-A Welfare State”, these provisions are directed towards establishment of a welfare state.

5. Integrated Judicial System: Unlike the judicial systems of federal countries like the United States of America, the Indian Constitution has established an integrated judicial system. Although the Supreme Court is at the national level, High Courts at the state level and Subordinate Courts at the district and lower level, there is a single hierarchy of Courts. At the top of the hierarchy is the Supreme Court. This unified judicial system is aimed at promoting and ensuring justice to all the citizens in uniform manner. Moreover, the constitutional provisions ensure the independence of Indian judiciary which is free from the influence of the executive and the legislature.

6. Single Citizenship: Indian Constitution has provision for single citizenship. Do you know what does it mean? It means that every Indian is a citizen of India, irrespective of the place of his/her residence or birth in the country. This is unlike the United States of America where there is the system of double citizenship. A person is a citizen of a State where he/she lives as well as he/she is a citizen of U.S.A. This provision in the Indian Constitution definitely reinforces the values of equality, unity and integrity.

7. Universal Adult Franchise: The values of equality and justice are reflected in yet another salient feature of the Constitution. Every Indian after attaining certain age (at present 18 years) has a right to vote. No discrimination can be made on the basis of religion, race, caste, sex, descent, and place of birth or residence. This right is known as universal adult franchise.

8. Federal System and Parliamentary Form of Government: Another salient feature of the Indian Constitution is that it provides for a federal system of state and parliamentary form of government. We shall discuss these below in detail. But it is necessary to note here that the federal system reflects the constitutional value of unity and integrity of the nation, and more importantly the value of decentralization of power. The parliamentary form of government reflects the values of responsibility and sovereignty vested in the people. The core principle of a parliamentary government is the responsibility of the executive to the legislature consisting of the representatives of the people.

INTEXT QUESTIONS 15.3

1. What are the main features of the Indian Constitution?

2. What are the constitutional values reflected in the Directive Principles of State Policy?
Why Indian judiciary is called an integrated judiciary?

What is the meaning of single citizenship?

15.3 FEDERAL SYSTEM IN INDIA

As you may have found, whenever there is a discussion on the nature, structure and processes of political system in India, it is said that India is a federal state. There are generally two types of states in the world. The state that has only one government for the entire country, which is known as unitary state. The United Kingdom has a unitary system. But there are states like United States of America and Canada which have governments at two levels: one at the central level and the other at the state level. Besides having two sets of government, a federal system must have three other features: (i) a written constitution, (ii) division of powers between the central government and the state governments, and (iii) supremacy of judiciary to interpret the constitution. India also has a federal system having all these features, but with a difference. Let us examine the nature of the Indian federation.

15.3.1 Characteristics of the Indian Federal System

1. Two-tier Government: You must have heard that there are two sets of government created by the Indian Constitution: one for the entire nation called the union government (central government) and another for each unit or State, called the State government. Sometimes, you may also find the reference of a three-tier government in India, because besides the Union and State governments, local governments—both rural and urban—are also said to constitute another tier. But constitutionally India has a two-tier government. The Constitution does not allocate separate set of powers to the local governments as these continues to be under their respective State governments.

2. Division of Powers: Like other federations, both the Union and the State governments have a constitutional status and clearly identified area of activity. The Constitution clearly divides the powers between the two sets of governments, so that the Centre and the States exercise their powers within their respective spheres of activity. None violates its limits and tries to encroach upon the functions of the other. The division has been specified in the Constitution through three Lists: the Union List, the State List and the Concurrent List. The Union List consists of 97 subjects of national importance such as Defence, Railways, Post and Telegraph, etc. The State List consists of 66 subjects of local interest such as Public Health, Police, Local Self Government, etc. The Concurrent List has 47 subjects such as Education, Electricity, Trade Union, Economic and Social Planning, etc. On this List both the Union government and State governments have concurrent jurisdiction. However, the Constitution assigns those powers on the subjects that are not enumerated under Union List, State List and Concurrent
List to the Union government. Such powers are known as Residuary Powers. If there is any dispute about the division of powers, it can be resolved by the Judiciary on the basis of the constitutional provisions.

3. Written Constitution: As we have earlier seen, India has a written Constitution which is supreme. It is also the source of power for both the sets of governments, the Union and the State. These governments are independent in their spheres of governance. Another feature of a federation is the rigid constitution. Although the Indian Constitution is not as rigid as the US Constitution, it is not a flexible constitution. As mentioned earlier, it has unique blend of rigidity and flexibility.

Whereas there have been only 27 Amendments in the Constitution of the United States of America since it was ratified on 21 June, 1788, there have been 95 Amendments to the Indian Constitution between 26 January, 1950 and 25 January, 2010.

4. Independence of Judiciary: Another very important feature of a federation is an independent judiciary to interpret the Constitution and to maintain its sanctity. The Supreme Court of India has the original jurisdiction to settle disputes between the Union and the States. It can declare a law as unconstitutional, if it contravenes any provision of the Constitution. The judiciary also has the powers to resolve disputes between the Union government and the State governments on the constitutional and legal matters related to the division of powers.

15.3.2 Indian Federal System with a Strong Centre

In view of the above provisions, the Indian system appears to have all the features of a federal system. But have you gone through a statement which says that, “India is federal in form but unitary in spirit”? In fact, Indian federal system has a strong Union government. This was deliberately done in the context of the prevailing situation on the eve of independence and in view of the socio-political situations. Apart from India being a vast country of continental dimensions, it has diversities and social pluralities. The framers of the Constitution believed that we required a federal constitution that would accommodate diversities and pluralities. But when India attained independence, it was faced with challenges like maintaining unity and integrity and bringing about social, economic and political change. It was necessary for the Centre to have such powers because India at the time of independence was not only divided into Provinces created by the British but it also had more than 500 Princely States which had to be integrated into existing States or new States had to be created.

In fact, the Central government has been made strong deliberately. Besides the concern for unity, the makers of the Constitution also believed that the socio-economic problems of the country needed to be handled by a strong central
government in cooperation with the States. Poverty, illiteracy, social inequalities and inequalities of wealth were some of the problems that required unified planning and coordination. Thus, the concerns for unity and development prompted the makers of the Constitution to create a strong central government. Let us look at the important provisions that have created a strong central government:

1. The First Article of the Constitution itself hints at Indian federal system being different. It states that India shall be “a Union of States”. Nowhere does the Constitution describe India as a federal state. The Central government has sole power on the territory of India. The very existence of a State, including its territorial integrity is in the hands of the Parliament. The Parliament is empowered to ‘form a new State by separation of territory from any State or by uniting two or more States. It can also alter the boundary of any State or even its name. However, the Constitution provides for some safeguards. The Central government must secure the view of the concerned State legislature on such decisions.

2. Secondly, the division of powers is in favour of the Union government. The Union List contains all the key subjects. Besides, even in relation to the Concurrent List the Constitution has assigned precedence to the Centre over States. In the situation of a conflict between laws made on any subject of the Concurrent List by a State and also by the Parliament, the law made by the Parliament would be effective. The Parliament may legislate even on a subject in the State List, if the situation demands that the Central government needs to legislate. This may happen, if the move is ratified by the Rajya Sabha.

3. Thirdly, the federal principle envisages a dual system of Courts. But, in India we have unified or integrated judiciary with the Supreme Court at the apex.

4. Fourthly, the Union government becomes very powerful when any of the three kinds of emergencies are proclaimed. The emergency can turn our federal polity into a highly centralised system. The Parliament also assumes the power to make laws on subjects within the jurisdiction of the States. In yet another situation, if there are disturbances in any State or part thereof, the Union Government is empowered to depute Central Force in the State or to the disturbed part of the State.

5. As you will study in the lesson on “Governance at the State Level, the Governor of the State is appointed by the President of India, i.e. the Union government.
He/She has powers to report to the President, if there is a constitutional breakdown in the State and to recommend the imposition of President’s Rule. When the President’s Rule is imposed on the State, the State Council of Ministers is dismissed and the Governor rules over the State as a representative of the Central government. The State legislature also may be dissolved or kept in suspended animation. Even in normal circumstances, the Governor has the power to reserve any bill passed by the State legislature for the assent of the President. This gives the Central government an opportunity to delay the State legislation and also to examine such bills and veto them completely.

6. The Central government has very effective financial powers and responsibilities. In the first place, items generating revenue are under the control of the Centre. The States are mostly dependent on the grants and financial assistance from the Central government. Moreover, India has adopted planning as the instrument of rapid economic progress and development after independence. This also has led to considerable centralisation of decision making.

7. Finally, according to the constitutional provisions, the executive powers of the Centre are superior to those of the States. The Central government may choose to give instructions to the State government. Moreover, we have an integrated administrative system. The All-India Services are common for the entire territory of India and officers chosen for these services serve in the administration of the States. Thus, an IAS officer who becomes the collector or an IPS officer who serves as the Commissioner of Police, are under the control of the Central government. States cannot take disciplinary action nor can they remove these officers from service.

From the above discussion, it is clear, that there is a tilt in favour of the Centre at the cost of the States. The States have to work in close co-operation with the Centre. This has lent support to the contention that the Indian Constitution is federal in form but unitary in spirit. Constitutional experts have called it a ‘semi-federal’ or a ‘quasi federal’ system.

**ACTIVITY 15.4**

Consult books or surf the internet and make a list of the States of India and find out the year in which each of the States was created.

**15.3.3 Demand for Greater Autonomy to States**

The working of the Indian federation over the last six decades clearly shows that primarily because of the centralized federal system, the relations between the Centre and the States have not always been cordial. It is quite natural that the States would expect a greater role and powers in the governance of the State and the country.
as a whole. Which is why, from time to time, States have demanded that they should be given more powers and more autonomy. With a view to seek solution, the Administrative Reforms Commission, Sarkaria Commission and several other Commissions were appointed by the Government of India, the latest being the Commission on Centre-State Relations in March, 2010.

The core of important recommendations of various Commissions has accepted that there is no need to bring about changes in the fundamental fabric of the Constitution. However, the need to have a permanent Inter-State Council has been felt. In addition, it is desired that both the Centre and the States should have the concern for the development of backward territories or areas. If economic development of these backward regions is undertaken in a planned manner, the separatist tendencies will be automatically controlled. Differences between the Union and the States should be resolved by mutual consultation. The view on the demand of the States to provide more financial resources at their disposal has found favour. In order to improve Centre-State relations in the country, recommendations have been made for economic liberalization and suitable amendments to the Constitution.

ACTIVITY 15.5

For the last five years an intensified agitation is going on to create a separate State out of a region of the present State. Identify that State, enumerate the reasons for such a demand and point out a major step that the political leaders of that region have taken during May-September, 2011

INTEXT QUESTIONS 15.4

1. What are the main features of a federal system?
2. State two important reasons why it said that “India is federal in form, but unitary in spirit”?
3. The States of Chhattisgarh, Jharkhand and Uttarakhand were created during 2000 and 2001. Find out from which States they were separated? State also the reasons why were they created?

15.4 PARLIAMENTARY FORM OF GOVERNMENT IN INDIA

Another important feature of the Indian political system is its parliamentary form of government both at the union and state levels. There are two forms of government:
presidential and parliamentary. In presidential system, the three organs of government are independent of one another. There is absence of close relationship between the executive and the legislature. The United States of America has a presidential form of government. But, in a parliamentary form of government, there is a very close relationship between the executive and the legislature. United Kingdom has a parliamentary form of government. In fact, the Constitution makers of India adopted the British model, as the system of government that operated in India before 1947 was to a great extent quite similar to the British parliamentary government. In India, we have parliamentary form of government both at the central and state level. The Indian system reflects all the main features of a parliamentary government: (i) close relationship between the legislature and the executive, (ii) responsibility of the executive to the legislature, (iii) the executive having a Head of the State as the nominal executive, and a Council of Ministers headed by the Prime Minister as the real executive.

![Parliament of India](image)

**Figure 15.2 Parliament of India**

1. **Close Relationship between the Legislature and the Executive:** In India, there is a close relationship between the executive, i.e. the Council of Ministers with the Prime Minister at the head and the legislature, i.e. the Parliament. Only the leader of the majority party or coalition of parties can be appointed as the Prime Minister. All the members of the Council of Ministers must be the Members of Parliament. It is only on the advice of the Council of Ministers that the President can summon and prorogue the sessions of both Houses of Parliament and even dissolve the Lok Sabha. All the elected Members of the Parliament participate...
in the election of the President and he/she can be removed from office only when an impeachment motion against him/her is passed by both the Houses of Parliament.

2. **Responsibility of the Executive to the Legislature:** The Council of Ministers is collectively responsible to Lok Sabha. It means that the responsibility of every Minister is the responsibility of the entire Council of Ministers. It is responsible to Rajya Sabha also. In fact, both the Houses have powers to control the Council of Ministers. They do it by asking questions and supplementary questions on the policies, programmes and functioning of the government. They debate on the proposals of the government and also subject its functioning to intensive criticism. They can move adjournment motion and calling attention notices. No bill tabled by the Council of Ministers can become law unless it is approved by the Parliament. The annual budget also is to be passed by the Parliament. In real terms, the tenure of the Council of Ministers depends on the Lok Sabha. The Council of Ministers has to resign if it loses the confidence of Lok Sabha, which means the support of the majority in that House. The Council of Ministers can also be removed from office by the Lok Sabha through a vote of no-confidence.

3. **Nominal and Real Executive:** There are two parts of the executive in India, nominal executive and real executive. The President who is the Head of the State is the nominal and formal executive. Theoretically, all the executive powers are vested by the Constitution in the President of India. But, in practice these are not exercised by him/her. These are actually used by the Prime Minister and the Council of Ministers. The Council of Ministers with the Prime Minister at the head is the real executive. The President cannot act without the advice of the Council of Ministers.

4. **Prime Minister as the real executive:** It is the Prime Minister who is the pivot of the parliamentary executive. All the members of the Council of Ministers are appointed by the President on the recommendations of the Prime Minister. The allocation of portfolios among the Ministers is the prerogative of the Prime Minister. He/She presides over the meetings of the Cabinet and is the only link between the Council of Ministers and the President. Any Minister can be removed from office if the Prime Minister decides. When the Prime Minister resigns, the entire Council of Ministers has to go.

The parliamentary system in India has been functioning quite satisfactorily. The parliamentary governments in States also are structured on the pattern of the Central government. The executive consists of the Governor and the Council of Ministers with Chief Minister at the head. Whereas, the Governor functions as the Head of the State, the Chief Minister and the Council of Ministers act as the real executive. State legislatures are bicameral (State Assembly and Legislative Council) in only a few States; in most of the States these are unicameral (Legislative Assembly).
INTEXT QUESTIONS 15.5

1. In a parliamentary system, what kind of relation is between the executive and the legislature?

2. Why is the President of India only the nominal executive?

3. What is the meaning of collective responsibility?

4. How do both the Houses of Parliament have control over the Council of Ministers?

WHAT YOU HAVE LEARNT

- Constitution means a set of fundamental principles, basic rules and established precedents, which identifies, defines and regulates the major institutions of the State, the executive, the legislature and the judiciary. It also specifies the powers and functions of institutions, provides for rights and freedoms of citizens and spells out the relationship between individual citizen and the State and government.

- The Constitution of India defines the basic objectives of the system it has established. It has established in India a sovereign, democratic, socialist and secular republic. It has provisions for bringing about social change and defining the relationship between individual citizen and the state.

- The Constitution of any country serves several purposes. It lays out certain ideals that form the basis of the kind of country that we as a citizens aspire to live in. A Constitution helps serve as a set of principles, rules and procedures that all persons in a country can agree upon as the basis of the way in which they want the country to be governed and the society to move on. This includes not only an agreement on the type of government but also on certain ideals that they all believe the country should uphold. The Indian Constitution also has certain core constitutional values that constitute its spirit and are expressed in various articles and provisions.

- The constitutional values are reflected in the entire Constitution of India, but its Preamble embodies ‘the fundamental values and the philosophy on which the Constitution is based’. These are: sovereignty, socialism, secularism, democracy, republican character, justice, liberty, equality, fraternity, human dignity and the unity and integrity of the Nation.

- The constitutional values also permeate all the salient features of Indian Constitution such as written constitution, the constitution having a unique blend of rigidity and flexibility, fundamental rights, directive principles, fundamental duties, integrated judicial system, single citizenship, universal adult franchise, federalism and parliamentary form of government.
India is a federal state, as it has a written constitution, two tiers of government - at the union level and the state level. There is a division of powers between the Union government and State government, and there is also the independent judiciary. But it is a federation with a strong Centre. The Constitution itself has made the Union government more powerful than the State governments.

India has a parliamentary form of government at both the central and state levels. The President is the Head of the State and a nominal executive, whereas the Prime Minister as head of the Council of Ministers is the real head of the executive. There is a close relationship between the executive and legislature and the Council of Ministers is collectively responsible to the Parliament.

TERMINAL EXERCISES

1. Answer the following questions in brief:
   (i) Define Preamble
   (ii) What is a Constitution?
   (iii) Who framed the Constitution of India?
   (iv) What is meant by 'Universal Adult Franchise'?

2. Answer the following questions:
   (i) Describe the importance of the Constitution.
   (ii) What are the major constitutional values embodied in the Preamble? How are these being practised in our daily lives?
   (iii) What are the salient features of the Constitution of India?
   (iv) Explain any three federal features of the Indian Constitution.
   (v) How can you say that the Constitution of India is rigid as well as flexible?
   (vi) Why is India called a federal state in form but unitary in spirit?
   (vii) Examine the nature of the parliamentary form of government in India.
   (viii) Have you ever been part of the Republic Day celebration in your own area/region as a participant or a spectator? If so, mention the highlights of that function.
   (ix) Given below is the recorded conversation between a Saudi Arabian Citizen and an Indian. The points made by the Saudi Arabian are given below, whereas the replies by the Indian could not be recorded and hence are left blank. On the basis of what you have read in this lesson and your general knowledge, complete the conversation with relevant replies (‘SA’ stands for the Saudi Arabian and I stands for the Indian).

...
Constitutional Values and Political System in India

(a) SA Our country is ruled by a hereditary King. We cannot change him. So, we have a monarchial form of government.

I ..............................................................................................................................

(b) SA We, in Saudi Arabia do not have any such system as yours, because we have no political parties. There are no elections and the people do not have any say in the formation of the government. So much so that even media cannot report anything that the King does not like.

I ..............................................................................................................................

(c) SA In our country, there is only one religion. Hence, there is no freedom of religion. Every citizen is required to be Muslim.

I ..............................................................................................................................

(d) SA Yes, Non-Muslims are allowed to follow their own religion but only privately and not in public.

I ..............................................................................................................................

(e) SA In my country, there is discrimination on the basis of sex. Women are not considered equal to men. They are subjected to many public restrictions. So much so that testimony of one man is considered equal to that of two women.

I ..............................................................................................................................

VIEWS EXPRESSED BY THE INDIAN

1. After independence no king rules in India. Instead, we have a President who is elected by the people indirectly. So, India is a republic with a parliamentary form of government wherein political parties play a major role as representatives of the people.

2. In this regard, we are very lucky. We have the freedom to form associations, unions as well as political parties. Every Indian citizen has the right to vote and contest elections. Besides, the media in India is also free to express its views on any issue in spite of the fact that India is a multi-cultural, multi-lingual and multi-religious country.

3. But we are a secular nation. The state does not have any religion of its own. Every citizen has a fundamental right as freedom of religion guaranteed by the Constitution. Hindus, Muslims, Sikhs, Christians, and others have freedom to practise his/her religion.

4. Strange enough! In our country the Constitution guarantees right to profess, preach and practise any religion publically.
5. In India the Constitution provides for gender equality, though in practice we also have to go a long way. But women have equal rights in every sphere of life. They are engaged in all kinds of job and business. They have also been made the beneficiary of reservations.

15.1
1. When used in the context of a State or a Nation, Constitution means a set of fundamental principles, basic rules and established precedents. It identifies, defines and regulates various aspects of the State and the structure, powers and functions of the major institutions under the three organs of the Government, the executive, the legislature and the judiciary. It also provides for rights and freedoms of citizens and spells out the relationship between individual citizen and the State and government.

2. (i) longest (ii) the Constituent Assembly (iii) needs to be amended as and when required to keep it updated (iv) Republic Day, 26 January 1950

15.2
1. Value is that which is very essential or ‘worth having and observing’ for the existence of human society as an entity.

2. The values expressed in the Preamble are expressed as objectives of the Constitution. These are: sovereignty, socialism, secularism, democracy, republican character of Indian State, justice, liberty, equality, fraternity, human dignity and the unity and integrity of the Nation.

3.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>(i)</td>
<td>(g)</td>
</tr>
<tr>
<td>(ii)</td>
<td>(a)</td>
</tr>
<tr>
<td>(iii)</td>
<td>(e)</td>
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<td>(iv)</td>
<td>(b)</td>
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<td>(v)</td>
<td>(c)</td>
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<td>(vi)</td>
<td>(h)</td>
</tr>
<tr>
<td>(vii)</td>
<td>(i)</td>
</tr>
<tr>
<td>(viii)</td>
<td>(f)</td>
</tr>
<tr>
<td>(ix)</td>
<td>(d)</td>
</tr>
</tbody>
</table>
15.3


2. social and economic equality, elimination of social discrimination, international peace

3. Although the Supreme Court is at the national level, High Courts at the state level and Subordinate Courts at the district and lower level, there is a single hierarchy of Courts. At the top of the hierarchy is the Supreme Court.

4. It means that every Indian is a citizen of India, irrespective of the place of his/her residence.

15.4

1. (i) Two-tier government at the Centre and at the state level; (ii) Division of Powers between the Centre and the States; (iii) Written Constitution; (iv) Supremacy of Judiciary

2. (i) The Central government has sole power on the territory of India. The very existence of a State including its territorial integrity is in the hands of the Parliament; (ii) The division of powers between the Centre and the States is in favour of the Union government. The Union List contains all the key subjects; (iii) India has a unified or integrated judiciary with the Supreme Court at the apex; (iv) Union government becomes very powerful when any of the three kinds of emergencies are proclaimed; (v) During all the three types of Emergencies, The Union government becomes all powerful, and India becomes almost a unitary state; (vi) According to the constitutional provisions, the executive powers of the Centre are superior to those of the States.

3. Gather relevant information from books, magazines or by surfing internet to answer

15.5

1. There is a close relationship between the executive, i.e. the Council of Ministers with the Prime Minister at the head and the legislature, i.e. the Parliament. The Council of Ministers is collectively responsible to the Parliament. If the Lok Sabha passes a no-confidence motion against the Council of Ministers, it has to resign.

2. The President who is the Head of the State is the nominal and formal executive. Theoretically, all the executive powers are vested by the Constitution in the President of India. But in practice these are not exercised by him/her. These are actually used by the Prime Minister and the Council of Ministers. The Council
of Ministers with the Prime Minister at the head is the real executive. The President cannot act without the advice of the Council of Ministers. The President is elected by an Electoral College that consists of the Members of Parliament. If the Parliament passes an impeachment against the President, he/she leaves the office.

3. It means that the responsibility of every Minister is the responsibility of the entire Council of Ministers. Even one ministry is criticized, the entire Council of Ministers is considered responsible for that.

4. They do it by asking questions and supplementary questions on the policies, programmes and functioning of the government. They can move adjournment motion and calling attention notices. No bill tabled by the Council of Ministers can become a law unless it is approved by the Parliament. The annual budget also is to be passed by the Parliament.
Adolescence Education Programme

Learning Together
Learning Better

Episode 4
Methodology used: Maps, Charts, Graphs, Tables, Case Study, Quiz, Street Play, Inferential Learning
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Developed under MHRD-UNFPA Supported: Adolescence Education Programme
Greetings from NIOS!

National Institute of Open Schooling (NIOS) is an autonomous organization under Ministry of Human Resource Development (MHRD) Government of India and caters to the educational requirements of out of school children and youth of India. With over two million learners on rolls, NIOS has emerged as the largest open schooling organization in the world.

The NIOS in collaboration with MHRD-UNFPA has been engaged in addressing issues and concerns of adolescent learners and empowering them with life skills through ‘Adolescence Education Programme’. Cognizant of the delivery model, NIOS followed a curricular approach and integrated critical adolescent issues and concerns within the self-learning material.

Integration was carried out with the rationale to equip the learners with skills that would make them better humans and more productive for the society while studying for their secondary course. Through a series of capacity building workshops for the lesson writers and providing them continuous support, NIOS was able to realize the aim that seemed daunting initially.

Life Skills have been seamlessly woven into the course content so that the learners, while studying the main syllabus get empowered to apply the core content in real life situations. This teaching material will help you transact not only the subject specific content but it will also help you empower the learners with important skills such as communication skills, critical and creative thinking etc.

It gives me great pleasure to share with you the this teacher-training package of Life Skills enriched lessons from five subjects- Hindi, English, Science, Home Science and Social Science at secondary level along with a set of CDs Learning Together Learning Better. I hope you will find them useful.

Yours sincerely,

Dr. S.S. Jena
Dear Teachers,

The Academic Department at the National Institute of Open Schooling has revised the curriculum in all the subjects at the secondary level. The National Curriculum Framework 2005 developed by the National Council for Educational Research and Training was kept as a reference point. After making a comprehensive comparative study of various state boards, we developed the curriculum that was functional, related to life situations and simple. Leading educationists of the country were involved in developing this material.

Hindi, English, Science and Technology, Home Science and Social Science at secondary level were enriched with life skills under the MHRD UNFPA supported Adolescence Education Programme. The integration of life skills is aimed at instilling an adaptive and positive thinking, feeling and behaviour in the learners.

I sincerely hope that you will find the selected lessons interesting, exciting and useful. Any suggestions for further improvement are welcome.

Let me wish you all a happy and successful future.

(Dr. Kuldeep Agarwal)
Director (Academic)
diracad@nios.ac.in
Dear Teacher,

Welcome to NIOS!

You have just taken your first step towards realizing your goal of empowering students to become global citizens. Globally, the education system is undergoing a change in terms of approach as well as objective. NIOS has initiated a unique process of developing life skills enriched materials and methodologies for the student’s benefit. We have a vision to guide you to enhance your teaching skills such that the student not only does well academically but also enhances his personal and social competencies. Along with subject knowledge, the student should be able to deal with the stress and strain of life. They should have the ability to discriminate between right and wrong, good and bad, and take the correct decisions regarding their life and career. The methodology adopted by NIOS is to integrate these life skills seamlessly with the content of the subject.

While going through these study materials, you will find a number of activities, including intext questions, in between the lessons. These activities have been carefully designed to provide an opportunity to learn and practice. The intext questions are devices to help assess the extent of learning and enhance it. Life skills are abilities that each of us possesses, and yet conscious efforts need to be made to enhance these abilities. Attempting these exercises will help in developing life skills without an extra effort.

I hope you will find these life skills-enriched study materials and methodologies rewarding and helpful for empowering the students.

Asheema Singh
Project Coordinator
(Adolescence Education Project)
asheemasingh@nios.ac.in
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PERIODIC CLASSIFICATION OF ELEMENTS

In the last lesson, you have studied about the structure of atoms and their electronic configurations. You have also learnt that the elements with similar electronic configurations show similar chemical properties. By the middle of the nineteenth century quite a large number of elements (nearly 60) were known. In order to study these elements systematically, it was considered necessary to classify them. In this lesson, you will undertake the journey through the development of classification of elements from ancient to modern. You will also study how some properties of elements vary in the modern periodic table.

OBJECTIVES

After studying this lesson you will be able to:

- describe briefly the development of classification of elements;
- state main features of Mendeleev's periodic table;
- explain the defects of Mendeleev's periodic table;
- state modern periodic law;
- describe the features of the long form of periodic table;
- explain modern periodic classification and
- describe the trends in variation of atomic size and metallic character in the periodic table.

6.1 CLASSIFICATION OF ELEMENTS

6.1.1 Need for Classification of Elements

You must have visited a chemist’s shop. Several hundred medicines are stored in it. In spite of this, when you ask for a particular medicine, the chemist is able to locate it easily. How is it possible? It is because the medicines have been classified into various categories and sub categories and arranged accordingly. This makes their location an easy task.
Before the beginning of the eighteenth century, only a few elements were known, so it was quite easy to study and remember the properties of those elements and their compounds individually. However, by the middle of the nineteenth century, more than sixty elements had been discovered. The number of compounds formed by them was also enormous. With the increasing number of elements, it was becoming more and more difficult to study their properties individually. Therefore, the need for their classification was felt. This led to the classifications of various elements into groups which helped in the systematic study of elements.

6.1.2 Development of Classification

Scientists after many attempts were successful in arranging various elements into groups. They realised that even though every element is different from others, yet there are a few similarities among some elements. Accordingly, similar elements were arranged into groups which led to classification. Various types of classification were proposed by different scientists. The first classification of elements was into 2 groups—metals and non-metals. This classification served only limited purpose mainly because some elements like germanium and antimony showed the properties of both— metals and non-metals. They could not be placed in any of the two classes.

Scientists were in search of such characteristics of an element which would never change. After the work of William Prout in 1815, it was found that the atomic mass of an element remains constant, so it could form the basis for a satisfactory classification. Now, you will learn about the four major attempts made for classification of elements. They are as follows:

1. Dobereiner’s Triads
2. Newlands’ Law of Octaves
3. Mendeleev’s Periodic Law & Periodic Tables
4. Modern Periodic Table

6.1.3 Dobereiner’s Triads

In 1829, J.W. Dobereiner, a German chemist made groups of three elements each and called them triads (Table 6.1). All three elements of a triad were similar in their physical and chemical properties. He proposed a law known as Dobereiner’s law of triads. According to this law, when elements are arranged in order of increasing atomic mass, the atomic mass of the middle element was nearly equal to the arithmetic mean of the other two and its properties were intermediate between those of the other two.
Table 6.1: Dobereiner’s triads of elements

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Element</th>
<th>Atomic Mass</th>
<th>Mean of I and III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I. Lithium</td>
<td>7</td>
<td>(\frac{7 + 39}{2} = 23)</td>
</tr>
<tr>
<td></td>
<td>II. Sodium</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III. Potassium</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I. Calcium</td>
<td>40</td>
<td>(\frac{40 + 137}{2} = 88.5)</td>
</tr>
<tr>
<td></td>
<td>II. Strontium</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III. Barium</td>
<td>137</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I. Chlorine</td>
<td>35.5</td>
<td>(\frac{35.5 + 127}{2} = 81.25)</td>
</tr>
<tr>
<td></td>
<td>II. Bromine</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III. Iodine</td>
<td>127</td>
<td></td>
</tr>
</tbody>
</table>

This classification did not receive wide acceptance since only a few elements could be arranged into triads.

6.1.4 Newlands’ Law of Octaves

In 1864, an English chemist John Alexander Newlands arranged the elements in the increasing order of their atomic masses (then called atomic weight). He observed that every eighth element had properties similar to the first element. Newlands called it the Law of Octaves. It was due to its similarity with musical notes where every eighth note is the repetition of the first one as shown below:

1 2 3 4 5 6 7 8
सा रे गा मा ला भा नी सा

The arrangement of elements given by Newlands is given in Table 6.2.

Starting from lithium (Li), the eighth element is sodium (Na) and its properties are similar to those of the lithium. Similarly, beryllium (Be), magnesium (Mg) and calcium (Ca) show similar properties. Fluorine (F) and chlorine (Cl) are also similar chemically.

Table 6.2: Arrangement of some elements with their atomic masses according to the Law of Octaves.

<table>
<thead>
<tr>
<th>Li</th>
<th>Be</th>
<th>B</th>
<th>C</th>
<th>N</th>
<th>O</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>(7)</td>
<td>(9)</td>
<td>(11)</td>
<td>(12)</td>
<td>(14)</td>
<td>(16)</td>
<td>(19)</td>
</tr>
<tr>
<td>Na</td>
<td>Mg</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
</tr>
<tr>
<td>(23)</td>
<td>(24)</td>
<td>(27)</td>
<td>(28)</td>
<td>(31)</td>
<td>(32)</td>
<td>(35.5)</td>
</tr>
<tr>
<td>K</td>
<td>Ca</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(39)</td>
<td>(40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The merits of Newlands’ Law of Octaves classification are:

(i) Atomic mass was made the basis of classification.
Module - 2

Notes

Periodic Classification of Elements

(ii) Periodicity of properties (the repetition of properties after a certain interval) was recognised for the first time.

The demerits of Newlands’ law of Octaves are:

(i) It was not applicable to elements of atomic masses higher than 40 u. Hence, all the 60 elements known at that time, could not be classified according to this criterion.

(ii) With the discovery of noble gases, it was found that it was the ninth element which had the properties similar to the first one and not the eighth element. This resulted in the rejection of the very idea of octaves.

The basic idea of Newlands for using the atomic mass as the fundamental property for classification of elements was pursued further by two scientists Lother Meyer and D. Mendeleev. Their main achievement was that they both included almost all the known elements in their work. We shall, however, discuss the classification proposed by Mendeleev which was accepted more widely and is the basis of the modern classification.

6.1.5 Mendeleev’s Periodic Law and Periodic Table

Dmitri Mendeleev (also spelled as Mendeleef or Mandeleyev), a Russian chemist studied the properties of all the 63 elements known at that time and their compounds. On arranging the elements in the increasing order of atomic masses, he observed that the elements with similar properties occur periodically. In 1869, he stated this observation in the form of the following statement which is known as the Mendeleev’s Periodic Law.

The chemical and physical properties of elements are a periodic function of their atomic masses.

A periodic function is the one which repeats itself after a certain interval. Mendeleev arranged the elements in the form of a table which is known as the Mendeleev’s Periodic Table.

Mendeleev’s Periodic Table

Mendeleev arranged the elements in the increasing order of their atomic masses in horizontal rows till he came across an element whose properties were similar to those of the first element. Then he placed this element below the first element and thus started the second row of elements.

The success of Mendeleev’s classification was due to the fact that he laid more emphasis on the properties of elements rather than on atomic masses. Occasionally, he could not find an element that would fit in a particular position. He left such positions vacant for the elements that were yet to be discovered. He even predicted the properties of such elements and of some of their compounds fairly accurately. In some cases, he even reversed the order of some elements, if it better
matched their properties. Proceeding in this manner, he could arrange all the known elements in his periodic table.

When more elements were discovered, this periodic table was modified and updated to include them. One more group (zero group) had to be added when noble gases were discovered.

**Table 6.3: Mendeleev’s updated periodic table**

<table>
<thead>
<tr>
<th>Groups</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxides Hydrides</td>
<td>ROH</td>
<td>ROH₂</td>
<td>RO₂</td>
<td>RO₃</td>
<td>RO₄</td>
<td>RO₅</td>
<td>RO₆</td>
<td>RO₇</td>
</tr>
<tr>
<td>Periods</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>H</td>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>F</td>
</tr>
<tr>
<td>2</td>
<td>Na</td>
<td>Mg</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
</tr>
<tr>
<td>3</td>
<td>K</td>
<td>Ca</td>
<td>Zn</td>
<td>Ge</td>
<td>As</td>
<td>Se</td>
<td>Br</td>
<td>Kr</td>
</tr>
<tr>
<td>4 First series</td>
<td>Ag</td>
<td>Sr</td>
<td>Ba</td>
<td>Lu</td>
<td>Hf</td>
<td>Ta</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>5 First series</td>
<td>Au</td>
<td>Au</td>
<td>Os</td>
<td>Ir</td>
<td>Pt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 First series</td>
<td>U</td>
<td>Pu</td>
<td>Np</td>
<td>Am</td>
<td>Cm</td>
<td>Bk</td>
<td>Cn</td>
<td></td>
</tr>
</tbody>
</table>

**Main Features of Mendeleev’s Periodic Table**

The following are the main features of this periodic table:

1. The elements are arranged in **rows** and **columns** in the periodic table.
2. The horizontal rows are called periods. There are six periods in the periodic table. These are numbered from 1 to 6 (Arabic numerals). Each one of the 4th, 5th and 6th periods have two series of elements.
3. Properties of elements in a given period show regular gradation (**i.e.** increase or decrease) from left to right.
4. The vertical columns present in it are called **groups**. There are eight groups numbered from I to **VIII** (Roman numerals).
5. Groups I to VII are further divided into A and B **subgroups**. However, group VIII contains three elements in each of the three periods.
6. All the elements present in a particular group are chemically similar in nature. They also show a regular gradation in their physical and chemical properties from top to bottom.

**Merits of Mendeleev’s Periodic Classification**

1. **Classification of all elements**

Mendeleev’s classification included *all the 63 elements known* at that time on the basis of their atomic mass and facilitated systematic study of elements.
2. Correction of atomic masses

Atomic masses of some elements like Be (beryllium), Au (gold), In (indium) were corrected based on their positions in the table. (See box 1)

3. Prediction of new elements

Mendeleev arranged the elements in the periodic table in increasing order of atomic mass but whenever he could not find out an element with expected properties, he left a blank space. He left this space blank for an element yet to be discovered. He even predicted the properties of such elements and also of some of their compounds. For example, he predicted the existence of unknown element for the vacant space below silicon and thus belonging to the same group IV B, of the periodic table. He called it eka-silicon (meaning, one position below silicon). Later, in 1886, C.A. Winkler of Germany discovered this element and named it as germanium. The predicted and the actual properties of this element were remarkably similar (see Box 2). Ekaboron (scandium) and eka-aluminium (gallium) are two more examples of unknown elements predicted by Mendeleev.

4. Valency of elements

Mendeleev’s classification helped in understanding the valency of elements. The valency of elements is given by the group number. For example, all the elements in group 1 i.e. lithium, hydrogen, sodium, potassium, rubidium, caesium have valency 1.
Defects of Mendeleev’s Periodic Table

Mendeleev’s periodic table was a great success, yet it had the following defects:

1. **Position of Hydrogen**
   
   The position of hydrogen which is placed in group IA along with alkali metals is ambiguous as it resembles alkali metals as well as halogens (group VII A).

2. **Position of Isotopes**
   
   All the isotopes of an element have different atomic masses therefore, each one of them should have been assigned a separate position. On the other hand, they are all chemically similar; hence they should all be placed at the same position. In fact, Mendeleev’s periodic table did not provide any space for different isotopes. For example, two isotopes of carbon are represented as $^{12}$C, $^{14}$C but placed at the same position.

3. **Anomalous Pairs of Elements**
   
   At some places, an element with greater atomic mass had been placed before an element with lower atomic mass due to their properties. For example, cobalt with higher atomic mass (58.9) was placed before nickel with lower atomic mass (58.7). Other such pairs are:
   
   (i) Tellurium (127.6) is placed before iodine (126.9) and
   (ii) Argon (39.9) is placed before potassium (39.1).

4. **Grouping of chemically dissimilar elements**
   
   Elements such as copper and silver have no resemblance with alkali metals (lithium, sodium etc.), but have been grouped together in the first group.

5. **Separation of chemically similar elements**
   
   Elements which are chemically similar such as gold and platinum have been placed in separate groups.

**INTEXT QUESTIONS 6.1**

1. Elements A, B and C constitute a Dobereiner’s triad. The atomic mass of A is 20 and that of C is 40. Predict the atomic mass of B.
2. Which property of atoms was used by Mendeleev to classify the elements?
3. In Mendeleev’s periodic classification, whether chemically similar elements are placed in a group or in a period?

*Anomaly means deviation from common rule, irregularity, abnormal, exception*
6.2 MODERN PERIODIC LAW

Though Mendeleev’s periodic table included all the elements, yet at many places a heavier element had to be placed before a lighter one. Such pairs of elements (*called anomalous pairs*) violated the periodic law. Also, there was no place for different isotopes of an element in the periodic table. Due to these reasons, it was felt that the arrangement of elements in the periodic table should be based on some other property which is more fundamental than the atomic mass.

In 1913, Henry Moseley, an English physicist discovered that the *atomic number* and not the atomic mass is the most fundamental property of an element.

**Atomic number** (*Z*) of an element is the number of protons in the nucleus of its atom.

Since atom is as electrically neutral entity, the number of electrons is also equal to its atomic number i.e. the number of protons. After this development, it was felt necessary to change the periodic law and modify the periodic table.

### 6.2.1 Modern Periodic Law

The *Modern Periodic Law* states that the chemical and physical properties of elements are periodic functions of their atomic numbers *i.e. if elements are arranged in the order of their increasing atomic number, the elements with similar properties are repeated after certain regular intervals.*

Fortunately, even with the revised periodic law, the Mendeleev’s classification did not require any major revision as it was based on properties of the elements. In fact, taking atomic number as the basis for classification, removed major defects from it such as *anomalous pairs* and *position of isotopes*.

After changes in the periodic law, many modifications were suggested in the periodic table. Now, we shall learn about the modern periodic table in its final shape that is being used now.

**Cause of Periodicity**

Let us now understand the cause of periodicity in the properties of elements. Consider the electronic configuration of alkali metals *i.e.,* the first group elements with atomic numbers 3, 11, 19, 37, 55 and 87 (*i.e.,* lithium, sodium, potassium, rubidium, caesium and francium) in the table given below:
Periodic Classification of Elements

Table 6.4 : Electronic configuration of group 1 elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Electronic configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>^{3}_{1}Li</td>
<td>2, 1</td>
</tr>
<tr>
<td>^{11}_{1}Na</td>
<td>2, 8, 1</td>
</tr>
<tr>
<td>^{19}_{1}K</td>
<td>2, 8, 8, 1</td>
</tr>
<tr>
<td>^{37}_{1}Rb</td>
<td>2, 8, 18, 8, 1</td>
</tr>
<tr>
<td>^{55}_{1}Cs</td>
<td>2, 8, 18, 18, 8, 1</td>
</tr>
<tr>
<td>^{87}_{1}Fr</td>
<td>2, 8, 18, 32, 18, 8, 1</td>
</tr>
</tbody>
</table>

All these elements have one electron in the outer most shell and so they have similar properties which are as follows:

(i) They are good reducing agents.
(ii) They form monovalent cations.
(iii) They are soft metals.
(iv) They are very reactive and, therefore, found in nature in combined state.
(v) They impart colour to the flame.
(vi) They form hydrides with hydrogen.
(vii) They form basic oxides with oxygen.
(viii) They react with water to form metal hydroxides and liberate hydrogen.

It is noticed that all the elements having similar electronic configuration have similar properties. Thus, the re-occurrence of similar electronic configuration is the cause of periodicity in properties of elements.

6.3 MODERN PERIODIC TABLE

The periodic table based on the modern periodic law is called the Modern Periodic Table. Presently, the accepted modern periodic table is the Long Form of Periodic Table.

It may be regarded as an extended form of Mendeleev’s table in which the subgroups A and B have been separated.

Now, you will learn the main features of the long form of periodic table which is shown in Table 6.5.
### Table 6.5: Modern Periodic Table

<table>
<thead>
<tr>
<th>Group</th>
<th>Period</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>H</td>
<td>He</td>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>F</td>
<td>Ne</td>
<td>Na</td>
<td>Mg</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5</td>
<td>3.6</td>
<td>3.7</td>
<td>3.8</td>
<td>3.9</td>
<td>4</td>
<td>4.1</td>
<td>4.2</td>
<td>4.3</td>
<td>4.4</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>F</td>
<td>Ne</td>
<td>Na</td>
<td>Mg</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
<td>K</td>
<td>Ca</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5</td>
<td>3.6</td>
<td>3.7</td>
<td>3.8</td>
<td>3.9</td>
<td>4</td>
<td>4.1</td>
<td>4.2</td>
<td>4.3</td>
<td>4.4</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
<td>Kr</td>
<td>Xe</td>
<td>Cs</td>
<td>Ba</td>
<td>Ra</td>
<td>Ac</td>
<td>Th</td>
<td>Pa</td>
<td>U</td>
<td>Pu</td>
<td>Am</td>
<td>Cm</td>
<td>Bk</td>
<td>Cf</td>
<td>Es</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5</td>
<td>3.6</td>
<td>3.7</td>
<td>3.8</td>
<td>3.9</td>
<td>4</td>
<td>4.1</td>
<td>4.2</td>
<td>4.3</td>
<td>4.4</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td></td>
<td></td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5</td>
<td>3.6</td>
<td>3.7</td>
<td>3.8</td>
<td>3.9</td>
<td>4</td>
<td>4.1</td>
<td>4.2</td>
<td>4.3</td>
<td>4.4</td>
<td>4.5</td>
<td>4.6</td>
</tr>
</tbody>
</table>

### 6.3.1 Features of Long Form of Periodic Table

The long form of periodic table helps us to understand the reason why certain elements resemble one another and why they differ from other elements in their properties. The arrangement of elements in this table is also in keeping with their electronic structures (configuration). In table 6.5, you must have noticed that it is divided into columns and rows. The columns represent the **groups** or family and the rows represent the **periods**.
1. **Groups:** There are 18 vertical columns in the periodic table. Each vertical column is called a group. The groups have been numbered from 1 to 18 (in Arabic numerals).

   All elements present in a group have similar electronic configurations and have same number of valence electrons. You can see in case of group 1 (alkali metals) and group 17 elements (halogens) that as one moves down a group, more and more shells are added as shown in Table 6.6.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 17</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element</strong></td>
<td><strong>Electronic configuration</strong></td>
</tr>
<tr>
<td>Li</td>
<td>2,1</td>
</tr>
<tr>
<td>Na</td>
<td>2,8,1</td>
</tr>
<tr>
<td>K</td>
<td>2,8,8,1</td>
</tr>
<tr>
<td>Rb</td>
<td>2,8,18,8,1</td>
</tr>
</tbody>
</table>

Table 6.6

All elements of group 1 have only one valence electron. Li has electrons in two shells, Na in three, K in four and Rb has electrons in five shells. Similarly all the elements of group 17 have seven valence electrons however the number of shells is increasing from two in fluorine to five in iodine.

2. **Periods:** There are seven horizontal rows in the periodic table. Each row is called a period. The elements in a period have consecutive atomic numbers. The periods have been numbered from 1 to 7 (in Arabic numerals).

   In each period a new shell starts filling up. The period number is also the number of the shell which starts filling up as we move from left to right across that particular period. For example, in elements of 3rd period (N = 3), the third shell (M shell) starts filling up as we move from left to right*. The first element of this period, sodium (Na 2,8,1) has only one electron in its valence shell (third shell) while the last element of this period, argon (Ar 2,8,8) has eight electrons in its valence shell. The gradual filling of the third shell can be seen below.

<table>
<thead>
<tr>
<th>Period →</th>
<th>Na</th>
<th>Mg</th>
<th>Al</th>
<th>Si</th>
<th>P</th>
<th>S</th>
<th>Cl</th>
<th>Ar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electronic configuration</strong></td>
<td>2,8,1</td>
<td>2,8,2</td>
<td>2,8,3</td>
<td>2,8,4</td>
<td>2,8,5</td>
<td>2,8,6</td>
<td>2,8,7</td>
<td>2,8,8</td>
</tr>
</tbody>
</table>

* However, it should be noted here that more and more electrons are added to valence shell only in case of normal elements. In transition elements, the electrons are added to incomplete inner shells.
(a) The first period is the shortest period of all. It contains only two elements; H and He.
(b) The second and third periods are called short periods containing 8 elements each.
(c) The fourth and fifth periods are long periods containing 18 elements each.
(d) The sixth and seventh periods are very long periods containing 32 elements each.

6.3.2 Types of Elements

1. **Main Group Elements:** The elements present in groups 1 and 2 on left side and groups 13 to 17 on the right side of the periodic table are called representative or main group elements. Their outermost shells are incomplete, which means their outermost shell has less than eight electrons.

2. **Noble Gases:** Group 18 on the extreme right side of the periodic table contains noble gases. Their outermost shells contain 8 electrons except He which contains only 2 electrons.

   Their main characteristics are:
   (a) They have 8 electrons in their outermost shell (except He which has 2 electrons).
   (b) Their combining capacity or valency is zero.
   (c) They do not react and so are almost inert.
   (d) All the members are gases.

3. **Transition Elements:** The middle block of periodic table (groups 3 to 12) contains transition elements. Their two outermost shells are incomplete.

   Since these elements represent a transition (change) from the most electropositive element to the most electronegative element, they are named as transition elements.

   Their important characteristics are as follows:
   (a) All these elements are metals and have high melting and boiling points.
   (b) They are good conductors of heat and electricity.
   (c) Some of these elements get attracted towards magnet.
   (d) Most of these elements are used as catalyst.
   (e) They exhibit variable valencies.

4. **Inner Transition Elements:** These elements, also called rare-earth elements, are shown separately below the main periodic table. These are two series of
14 elements each. The first series called **lanthanoids** consists of elements 58 to 71 (Ce to Lu). They all are placed along with the element 57, *lanthanum* (La) in the same position (group 3, period 6) because of very close resemblance between them. It is only for the sake of convenience that they are shown separately below the main periodic table.

The second series of 14 rare-earth elements is called **actinoids**. It consists of elements 90 to 103 (Th to Lr) and they are all placed along with the element 89, *actinium* (Ac) in the same position (group 3, period 7) but for convenience they are shown below the main periodic table.

In all rare-earths (lanthanoids and actinoids), *three outermost* shells are incomplete. They are therefore called **inner transition elements**.

It is interesting to note that the element lanthanum *is not* a lanthanoid and the element actinium *is not* an actinoid.

5. **Metals**: Metals are present in the left hand portion of the periodic table. The strong metallic elements; *alkali metals* (Li, Na, K, Rb, Cs, Fr) and *alkaline earth metals* (Be, Mg, Ca, Sr, Ba, Ra) occupy groups 1 and 2 respectively.

6. **Non-metals**: Non-metals occupy the right hand portion of the periodic table. Strong non-metallic elements *i.e.*, halogens (F, Cl, Br, I, At) and chalkogens (O, S, Se, Te, Po) occupy groups 17 and 16 respectively.

7. **Metalloids**: Metalloids are the elements that show mixed properties of both metals and non-metals. They are present along the diagonal line starting from group 13 (Boron) and going down to group 16 (Polonium).

**ACTIVITY 6.1**

Rearrange the alphabets to get the correct name of the element in the space provided and mention its position in the modern periodic table

(a) RGANO ..................... is a noble gas which is placed in group ..................... and third period of the modern periodic table.

(b) HULIMIT ..................... is an alkali metal which is placed in group 1 and ..................... period of the modern periodic table.

(c) MILCUAC ..................... is an alkaline earth metal which is placed in group ..................... and fourth period of the modern periodic table.

(d) POHSROSUHP ..................... is a metalloid which is placed in group 15 and ..................... period of the modern periodic table.
6.3.3 Merits of the Modern Periodic Table

The following points overcame the defects of Mendeleev’s periodic table, that is why, it was accepted by scientists across the world.

1. **Position of isotopes:** All isotopes of an element have the same atomic number and therefore, occupy the same position in the modern periodic table.

2. **Anomalous pairs:** The anomaly regarding all these pairs disappears when *atomic number* is taken as the basis for classification. For example, cobalt (at. no. 27) would naturally come before nickel (at. no. 28) even though its atomic mass is little more than that of nickel.

3. **Electronic configuration:** This classification is according to the electronic configuration of elements, *i.e.*, the elements having a certain pattern of electronic configuration are placed in the same group of the periodic table. It relates the properties of elements to their electronic configurations. This point will be further elaborated in the next section.

4. **Separation of metals and non-metals:** The position of metals, non-metals and metalloids are clearly established in the modern periodic table.

5. **Position of transition metals:** It makes the position of the transition elements quite clear.

6. **Properties of elements:** It reflects the differences, the trends and the variations in the properties of the elements in the periodic table.

7. This table is simple, systematic and easy way of remembering the properties of different metals.

**INTEXT QUESTIONS 6.2**

1. Give any two defects of Mendeleev’s periodic table which has been removed in modern periodic table. How were they removed?

2. Metalloids are present along the diagonal line starting from group 13 and going down to group 16. Do they justify their position in the modern periodic table?

### 6.4 PERIODIC TRENDS IN PROPERTIES

You have learnt about the main features of the long form of the periodic table in the previous section and you know that it consists of groups and periods. Let us recall their two important features:

1. In a given group, the number of filled shells increases. The number of valence electrons is the same in all the elements of a given group. However, these valence
Periodic Classification of Elements

electrons but they are present in higher shells which are farther away from the nucleus. In view of this, decreases the force of attraction between the outermost shell and the nucleus as we move downwards in a group.

2. In a given period, the nuclear charge and the number of valence electrons in a particular shell increase from left to right. This increases the force of attraction between the valence electron and nucleus as we move across a period from left to right.

The above given changes affect various properties which show gradual variations in groups and periods, and they repeat themselves after certain intervals of atomic number. They are called periodic properties. Now you are going to learn the variations of two of such properties in the periodic table.

A. Atomic Size

Atomic size is the distance between the centre of nucleus and the outermost shell of an isolated atom. It is also known as atomic radius. It is measured in picometre, pm (1 pm = 10^{-12} m). Atomic size is a very important property of atoms because it is related to many other properties.

Variation of atomic size in periodic table.

The size of atoms decreases from left to right in a period but increases from top to bottom in a group. For example, the atomic radii of the elements of the second period and of group 1 are given below in the tables 6.7 and 6.8 respectively.

<table>
<thead>
<tr>
<th>Atomic Number</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elements : (in second period)</td>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>F</td>
</tr>
<tr>
<td>Atom radius/pm :</td>
<td>134</td>
<td>90</td>
<td>82</td>
<td>77</td>
<td>75</td>
<td>73</td>
<td>72</td>
</tr>
<tr>
<td>Atomic Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In a period the atomic number and therefore the positive charge on the nucleus increases gradually. As a result, the electrons are attracted more strongly and they come closer to the nucleus. This decreases the atomic size in a period from left to right.

In a group as one goes down, a new shell is added to the atom which is farther away from the nucleus. Hence electrons move away from the nucleus. This increases the atomic size in a group from top to bottom.
B. Metallic and Non-metallic Character

The tendency of an element to lose electrons to form cations is called *electropositive* or *metallic character* of an element. Alkali metals are most electropositive. The tendency of an element to accept electrons to form anions is called *electronegative* or *non-metallic character* of an element.

(a) Variation of Metallic Character in a Group

*Metallic character increases from top to bottom in a group as tendency to lose electrons increases.* This increases the electropositive character and metallic nature. The variation can best be seen in group 14 as shown below.

**Table 6.9: Metallic character of groups 14 elements**

<table>
<thead>
<tr>
<th>Element</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Non-metal</td>
</tr>
<tr>
<td>Si</td>
<td>Metalloid</td>
</tr>
<tr>
<td>Ge</td>
<td>Metalloid</td>
</tr>
<tr>
<td>Sn</td>
<td>Metal</td>
</tr>
<tr>
<td>Pb</td>
<td>Metal</td>
</tr>
</tbody>
</table>

(b) Variation of Metallic Character in a Period

*Metallic character decreases in a period from left to right.* It is because the ionization energy increases in a period. This decreases the electropositive character and metallic nature. The variation of metallic character in the elements of 3rd period is shown below.
**Table 6.10 : Metallic character of 3rd period elements**

<table>
<thead>
<tr>
<th>Element</th>
<th>Na</th>
<th>Mg</th>
<th>Al</th>
<th>Si</th>
<th>P</th>
<th>S</th>
<th>Cl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
<td>Metal</td>
<td>Metal</td>
<td>Metal</td>
<td>Metalloid</td>
<td>Non-Metal</td>
<td>Non-Metal</td>
<td>Non-Metal</td>
</tr>
</tbody>
</table>

In this section, you have learnt about variation of some properties in periodic table. Some important trends in periodic table may be summarized in a general way as given below:

**Table 6.11 : Variation of various periodic properties in periods and groups**

<table>
<thead>
<tr>
<th>Property</th>
<th>In a Period (From left to right)</th>
<th>In a Group (From top to Bottom)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic number</td>
<td>increases</td>
<td>increases</td>
</tr>
<tr>
<td>Atomic size</td>
<td>decreases</td>
<td>increases</td>
</tr>
<tr>
<td>Metallic character</td>
<td>decreases</td>
<td>increases</td>
</tr>
<tr>
<td>Non-metallic character</td>
<td>increases</td>
<td>decreases</td>
</tr>
</tbody>
</table>

**INTEXT QUESTIONS 6.3**

1. Fill in the blanks with appropriate words

   (a) The force of attraction between nucleus and valence electrons ................ in a period from left to right.

   (b) Atomic radii of elements ................. in a period from left to right.

   (c) Atomic radii of elements ................. in a group from top to bottom.

   (d) Metallic character of elements ................. from top to bottom in a group.

2. In the following crossword puzzle, elements are present horizontally, vertically downwards and diagonally downwards. Let us find out how many elements you are able to get within 5 minutes.
**What you have learnt**

- The first classification of elements was as metals and non-metals.
- After the discovery of atomic mass (old term, atomic weight) it was thought to be the fundamental property of elements and attempts were made to correlate it to their other properties.
- John Dobereiner grouped elements into triads. The atomic mass and properties of the middle element were mean of the other two. He could group only a few elements into triads. For example (i) Li, Na and K (ii) Ca, Sr and Ba (iii) Cl, Br and I.

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Please check in the intext answers to find if you missed out any.

3. Let us find how many riddles you can solve.
   
   (i) I am the only noble gas whose outermost shell has 2 electrons. Who am I?
   
   (ii) I am placed in group 16 of the modern periodic table and essential for your respiration. Who am I?
   
   (iii) I combine with chlorine to form your table salt. Who am I?

   **(Hint: Answers are present in the grid)**
Newlands tried to see the periodicity of properties and stated his law of octaves as “When elements are arranged in the increasing order of their atomic weights every eighth element has properties similar to the first”. He could arrange elements up to calcium only out of more than sixty elements then known.

Mendeleev observed the correlation between atomic weight and other properties and stated his periodic law as, “The chemical and physical properties of elements are a periodic function of their atomic weights”.

Mendeleev gave the first periodic table which is named after him which included all the known elements. It consists of seven horizontal rows called periods and numbered them from 1 to 7. It has eight vertical columns called groups and numbered them from I to VIII.

Main achievements of Mendeleev’s periodic table were (i) inclusion of all the known elements and (ii) prediction of new elements.

Main defects of Mendeleev’s periodic table were (i) position of isotopes, (ii) anomalous pairs of elements like Ar and K and (iii) grouping of dissimilar elements and separation of similar elements.

Moseley discovered that atomic number and not atomic mass is the fundamental property of elements. In the light of this the periodic law was modified to “The chemical and physical properties of elements are periodic functions of their atomic numbers”. This is the Modern Periodic Law.

Modern Periodic Table is based upon atomic number. Its long form has been accepted by IUPAC. It has seven periods (1 to 7) and 18 groups (1 to 18). It is free of main defects of Mendeleev’s periodic table. Elements belonging to same group have same number of valence electrons and thus show same valency and similar chemical properties.

Arrangement of elements in the periodic table shows periodicity. Atomic radii and metallic character increase in a group from top to bottom and in a period decrease from left to right.

### TERMINAL EXERCISE

**A. Objective questions**

**I. Mark the correct choice:**

1. Which one of the following was the earliest attempt of classification of elements?
   
   (a) Classification of elements into metals and non-metals
   
   (b) Newlands’ Law of Octaves
2. **The ‘law of octaves’ was given by**
   (a) Mendeleev        (b) Newlands
   (c) Lother Meyer     (d) Dobereiner

3. **According to the periodic law given by Mendeleev, the properties of an element are a periodic function of its**
   (i) atomic volume   (ii) atomic size
   (iii) atomic number (iv) atomic mass

4. **The particle which is universally present in the nuclei of all elements is**
   (a) neutron         (b) proton
   (c) electron        (d) $\alpha$-particle

5. Potassium is more metallic than sodium because
   (a) both have 1 electron in their outermost shell.
   (b) both are highly electropositive.
   (c) sodium is larger in size than potassium.
   (d) potassium is larger in size than sodium.

7. Which one of the following elements in its chloride does not show the valence equal to its valence electrons?
   (a) NaCl           (b) MgCl$_2$
   (c) AlCl$_3$       (d) PCl$_3$

8. Which one of the following elements has the least tendency to form cation?
   (a) Na             (b) Ca
   (c) B              (d) Al

9. Which one of the following does not belong to the family of the alkali metals?
   (a) Li             (b) Na
   (c) Be             (d) K

10. The number of elements in the 5$^{th}$ period of the periodic table is
    (a) 2              (b) 8
     (c) 32            (d) 18

11. The elements with atomic number 9 resembles with the element having atomic number
    (a) 35             (b) 27
     (c) 17             (d) 8
12. In which period of the periodic table, an element with atomic number 20 is placed?
   (a) 4      (b) 3
   (c) 2      (d) 1

II. Mark the following statements True (T) or False (F):
1. The properties of the middle element in a Dobereiner’s triads are intermediate between those of the other two.
2. The vertical columns in the periodic table are called periods.
3. Mendeleev depended only on the atomic mass of elements for his classification.
4. All elements present in a group are chemically similar.
5. The modern periodic law is based upon atomic mass.
6. The importance of atomic number as the fundamental property was realised by Henry Mosely.
7. There are 18 groups in the modern periodic table.
8. Non-metals are present in the middle portion of the periodic table.

III. Fill in the blanks:
1. According to the modern periodic law, the properties of elements are periodic function of their .................
2. The ................. number is same as the number of shell which in gradually filled up in the elements of this period.
3. In normal elements of a particular period the electrons are gradually filled in ................. shell.
4. All elements of a particular group have ................... electronic configurations.
5. In the modern periodic table, groups are numbered from ................... to ...................
6. The second and third periods of the periodic table are called ................... periods.
7. The main group elements are present in group 1 and 2 on the left side and ................... to ................... on the right side of the periodic table.
8. All the group eighteen elements (except the first one) contain ................. valence electrons.
9. All transition elements are metals with ...................... melting and boiling points.
10. The group of 14 rare-earth elements belonging to the group 3 and 7th period are called ......................
11. All elements present in a given ....................... have the same valency.
12. Atomic size ...................... in a period from left to right.
13. Magnesium is ...................... metallic than calcium.
14. Carbon belongs to group ...................... of the Periodic table.
15. All the elements of group 15 have ...................... valence electrons.

B. Subjective Questions

I. Very short Answer Questions (Answer in one word or one sentence).
1. What was the earliest classification of elements?
2. State Newlands’ law of octaves.
3. Which classification of elements failed after the discovery of noble gases?
4. State Mendeleev’s Periodic Law.
5. How were the groups numbered in the Mendeleev’s periodic table?
6. Name the fundamental properties of element on which the modern periodic law is based.
7. How many groups are there in the modern periodic table?
8. How have groups been numbered in the modern periodic table?
9. What are normal elements?
10. What are the elements present in the middle portion of the modern periodic table called?
11. What is atomic size?
12. How does atomic size vary in a period and in a group?
13. Where would the element with largest atomic size be placed in any group?
14. Give the number of a group in which metallic, metalloid and non-metallic, all three types of elements, are present.

II. Short Answer Questions (Answer in 30-40 words).
1. State Dobereiner’s law of triads.
2. Show that chlorine, bromine and iodine (atomic masses 35.5, 80 and 127 respectively) constitute a triad.
3. What were the reasons for the failure of Newlands’ law of octaves?
4. Describe Mendeleev’s periodic table briefly in terms of rows and columns and their raw being.
5. Give any two achievements of the Mendeleev’s Periodic classification.
6. What were the defects in Mendeleev’s periodic classification.
7. State modern periodic law.
8. Briefly describe the modern periodic table in term of groups and period.
9. Give names of four classes into which the elements have been classified and mention to which groups of the modern period table they belong.
10. List the merits of the long form of the modern periodic table and explain any two of them.
11. How are the electronic configurations of all the elements belonging to a particular group related? Explain with the help of group 17 elements.
12. How does the electronic configuration of elements belonging to a particular period vary? Explain with the example of second period elements.
13. Define atomic radius.
14. How and why does metallic character vary in a group from top to bottom?

III. Long Answer Questions (Answer in 60–70 words).
1. State Mendeleev’s Periodic Law and describe the periodic table constructed on this basis.
2. What are the merits and demerits of the Mendeleev’s Periodic classification?
3. Describe the modern periodic table in terms of groups and periods.
4. What are the following types of elements and where are they located in the periodic table?
   (a) Main group elements (b) Noble gases  
   (c) Transition elements (d) Inner transition elements.
5. Discuss the merits of the modern periodic table.
6. What is the relationship between the electronic configuration and the modern periodic table?
8. Explain the variation of atomic size in a group and in a period.
9. How is metallic character related to ionization energy? Explain the variation of metallic character in the periodic table.
6.1
1. Atomic mass of B = \( \frac{20 + 40}{2} = 30 \)

2. Atomic mass

3. Group

4. These were the positions of elements which were yet to be discovered.

5. Any three of the following: (i) position of hydrogen (ii) position of isotopes (iii) anomalous pairs of elements (iv) grouping of chemically dissimilar element (v) separation of chemically similar element (vi) no explanation for electronic configuration

6.2
1. Anomalous pairs when elements are arranged in the order of their increasing atomic numbers, these anomalies are automatically removed, since the atomic number of the first element is less than that of the second although their atomic masses show reverse trends.

2. Position of isotopes. Since all the isotopes of an element have the same atomic number, they all will occupy the same position in the periodic table.

6.3
1. (a) increases (b) decreases (c) increases (d) increases


3. (i) Helium (ii) Oxygen (iii) Sodium

Activity 6.1
(a) Argon (b) Lithium (c) Calcium (d) Phosphorous
POPULATION: OUR GREATEST RESOURCE

All of us hear many people saying that the population of India is a great problem. You also may be feeling the same. You may be aware that the population of India is more than a billion and it is still growing. It may overtake the population of China within the next couple of decades, eventually making India the most populous nation of the world. It is in this way the population is quite often seen as a liability, a major hindrance to development and quality of life of the people. But is it true? Let’s think and understand. Has population not been an asset, a resource for the country? Today, India is considered as a leading nation in the world in terms of human power. One of the major contributory factors for this global standing has been the young, educated and productive people of our country. They are contributing to the development of not only our country, but many of the foreign countries also. In this context, population is an asset for the economy, the greatest resource of the country rather than a liability. In this lesson, you shall know how population of our country can be viewed as the greatest resource.

OBJECTIVES

After completing this lesson, you will be able to:

- analyze population not in terms of simple numbers and a problem, but as the greatest resource of the country;
- explain factors that make population a human resource;
- identify areas of high, moderate and low density of population and locate the same on the outline map of India;
- analyze the factors affecting the distribution and density of population;
- examine the implications of the population change and population composition, rural-urban composition, age composition, sex composition and literacy;
appreciate needs of adolescents as a critical population group and the growing potential human resource;
recognize the need for empowerment of women in India; and
evaluate population policies adopted by the Government of India, especially in the context of human resource development.

14.1 POPULATION AS A RESOURCE

Generally, we understand that population means a collection of people. Let us go through the meanings of population stated in the box below. This term has been defined differently in different contexts. You may find that the meaning of population stated in a science or biology textbook is different from how it has been used in a social science, geography, economics or sociology textbooks. You will learn later on that in statistics this term has yet another meaning. Will you like to find out what it is? You may do it by consulting books on Statistics. However, in the present lesson we will be using population to mean the collection of people living in a given geographic area or territory. This is how it is used in the census. The collection of people is seen and understood primarily in terms of number. But population is also considered as a resource, a human resource.

What does population mean?
- Total number of people inhabiting a specified area or territory (e.g. population of a village, city, state, country, world).
- Total number of people of a particular group, race, class or category (e.g. population of Scheduled Castes, Scheduled Tribes, or religious groups like Hindus, Muslims, Christians, Sikhs)
- In biology, collection of inter-breeding organisms of a particular species (e.g. population of tigers, deer, etc.)

What is resource? It is something that can be used and reused. Let us look around the room. We find things like furniture, books, notebooks, pen, cups and others. We consider them as our resources and use and reuse them in our daily life.

Now, let us try to trace their origin. These are made out of the resources which we get from nature. The furniture is made from timber that we obtain from the forest. Books and notebooks are made from the wood pulp which comes from the forest. The pen is made up of plastic which is the by-product of petroleum. The cup is made of clay found in the soil. These and many more things which are part of our daily life are extracted, processed or manufactured from the natural resources. It is the people who with their physical and mental efforts convert the natural resources into various goods of utility.
The Government of India created a Ministry of Human Resource Development in 1985, in place of its earlier Ministry of Education and Culture. Some of the States also have done so. This suggests that the idea of people being a human resource has gained acceptance.

If resources are things that are used and reused, how can population be considered a resource? We all know that the grains which are cultivated in the fields, the minerals that are mined, and the goods which are manufactured in factories are all produced by people. People of the country produce and develop various facilities and services to make their lives comfortable. The facilities, whether these are means of transport and communication, schools, colleges, hospitals, electricity producing units, infrastructure for irrigation and others, play a significant role in the development of a country.

For producing and developing all such facilities and converting them into useful resources, human beings play the role of the best resource. Without human beings, other resources cannot be developed and utilized properly. Therefore, the number as well as the quality of people, collectively, is the real and ultimate resource of a country.

In view of the above, the sheer number of people, which is determined by census conducted at periodic intervals, may be a liability, but the qualitative population becomes the human capital of a country. For converting the number into capital, the country has to invest a lot in the form of improving the health and nutritional status of the people, their education and specialized training and their overall quality of life. The investments for improving the quality of the people made by the state as well as the society matter a lot. It is essential that every individual develops to the fullest capability and is engaged in the development process of the country. It is therefore important to understand that people as human resource are both an object of development and also a participant in development. As we discussed earlier the number of people may not be called resource, but there are certain factors which convert these numbers into a useful resource.

Human capital: Over the years, the terms used to describe staff and employees in businesses have changed. We have moved from ‘personnel’ to ‘human resources’ to ‘human capital’. Human capital represents attributes of a person that are productive in the economic context. It refers to the stock of productive skills and technical knowledge embodied in labour.
Census: The procedure of systematically acquiring and recording information about the members of a given population. The term is used mostly in connection with ‘national population and door to door censuses’ to be taken every 10 years. The Government of India, with the assistance of States, has been conducting census to collect data about various demographic and socio-economic aspects of our population.

Factors making population a Human Resource

What are the factors that influence the role of population as the human resource? You may infer from the above discussion that the education, health and nutritional status of the people, and their specialized training determine the quality of population as a human resource. But besides these, there are key socio-demographic factors that have significant impact on the role of population as a resource. These are: (i) Distribution of Population; (ii) Population Change; and (iii) Population Composition. We shall try to understand these three factors. Let us begin with Distribution of Population.

INTEXT QUESTIONS 14.1

1. What is meant by resource?
2. Enumerate qualities that are essential for making human beings a resource.

14.2 DISTRIBUTION OF POPULATION

You may be knowing that resources, whether natural or any other, are not equally distributed. For example, natural resources like forests or iron ore or coal are not found equally in the world and also within our own country. The same is the case with human resources. They are not evenly spread everywhere in the world and their numbers keep on changing. The spread of population over an area, may be in a state or the entire country, is known as the distribution of population.

You will find it very interesting when you look at the following map of India (Figure 14.1). It shows how the population of India is spread across various States and Union Territories (UTs). This has been shown through dots. Each dot represents five lakh persons. As you see, in some States, the number of dots is less, even if the area is substantially large. It means that the population in these States is either widely spread or moderately spread. But in some other States, the dots are very close to one another, so close that those parts in the map look almost painted. In them, the spread of population is very dense. Let us prepare a list of sparsely populated, moderately populated and densely populated States and Union Territories (UTs) of India.
Figure 14.1: Distribution of Population in India

14.3 DENSITY OF POPULATION

Based on the above figure, a comparison of population distribution in any two States will be quite interesting. Let us look at the States of Maharashtra and West Bengal in the map (Figure 14.1). The patterns of the spread of population in them are different. From the simple look at the map, it appears that West Bengal has more population than Maharashtra. But it is not true. Maharashtra has more population than West Bengal, but Maharashtra is thinly populated because its land area is larger than that of West Bengal. Hence, we can not compare the population situation of two States in terms of only the number without considering their areas. That is why, the comparison of population of regions and countries is done through density of population.
Density of Population: The density of population is the number of persons living per unit of an area. It is usually expressed as number of people per square kilometre (sq km). The formula for its computation is:

\[
\text{Density of population} = \frac{\text{Number of people in a defined area unit}}{\text{Total area in square km of that particular area}}
\]

For determining the density, the number of people living in a specific territory is divided by the total area of that territory. This provides an average number of persons living per sq km in the territory. For example, let us assume that the population of a district is 250,000 and its area is 1000 square km. The density of population of this district can be calculated as follows:

\[
\text{Density of Population} = \frac{250000 \text{ persons}}{1000 \text{ sq km area}} = 250 \text{ persons per sq km.}
\]
The map (Fig. 14.2) shows that the density of population in India is uneven. It varies from one state to another.

**ACTIVITY 14.1**

Look at the Figure 14.2. Identify and name the States having high (more than 500 persons per sq km), moderate (100-500 persons per sq km) and low (less than 100 persons per sq km) density.

**States having high density**

**States having moderate density**

**States having low density**

Can you state the reasons for such a variation in density among States?

**Hints:** Unfavorable/harsh climatic conditions, rugged terrain and poor soil fertility are mainly responsible for the low density. Rich soil, abundance of rainfall, developed irrigational facilities, moderate climate and urbanization support high density of population. The areas of average fertility, modest rainfall, less developed irrigational facilities and, to some extent, stony/sandy surface sustain moderate density of population.

It also keeps on changing. As you may find in figure 1.3 the density of population in India was as low as 77 persons per sq km in 1901. It has steadily increased from 90 persons per sq km in 1931 to 325 persons per sq km in 2001. You would be interested to know, which is the most densely populated State/UTs of India. For that you may have to see the Census Reports. According to Census 2001, the NCT of Delhi has the highest density of population (9340 person per square km) followed by UT of Chandigarh (7900 persons per sq km). Arunachal Pradesh has the lowest density, 13 persons per sq km. Among the States, West Bengal has the highest density of population, i.e., 903 persons per sq km.
Factors affecting distribution and density of population

Why is the distribution of population uneven? It is human nature that people like to live in the areas where resources are easily available. These resources may be fresh water, fertile soil, food and shelter, opportunities of work and others. The availability of these resources is influenced by geographical features which cause uneven distribution. And therefore, density and distribution of population are also uneven. We can divide the factors which affect distribution and density of population into two broad categories: Physical and Socio-economic.

A. Physical Factors

Three important physical factors influence the distribution and density of population, namely relief, climate and soil.

(i) Relief: you may have visited a mountainous area or a valley and also a plain area and observed that the mountains are less populated than the plains. Relief which represents the differences in elevation and slope between the higher and lower parts of the land surface of a given area, directly affects the accessibility of the area. The areas, which are easily accessible, are most likely to be inhabited by people. that is why, we find that the plains are densely populated and areas of rugged relief like mountains and plateaus are not. If you compare the density and distribution of population in northern plain and those in Himalayan areas, you can find the effects of relief.
Population: Our Greatest Resource

**Relief:** Elevations of land; the variations in height of a land surface and its being shaped into hills and valleys.

(ii) **Climate:** Climatic condition is one of the most important factors which affects density and distribution of population. Favourable climate provides convenient living conditions for human beings. The higher density of population is found in the areas where the climate is favorable. But areas with harsh climate, i.e., areas that are too hot, too cold, too dry or too wet have lower density of population. In India, the area having dry climate such as Rajasthan and the areas with extreme cold climate such as the Valley in Jammu and Kashmir, or Himachal Pradesh and Uttarakhand have low density of population.

(iii) **Soil:** Human beings depend upon the quality of soil for agriculture. Areas of fertile soil can, therefore, support larger population. That is why, the regions of fertile soil such as the alluvial plains of North India and coastal plains have higher density of population. On the other hand, the areas with less fertile soils like parts of Madhya Pradesh, Rajasthan and Chhattisgarh have lower density of population.

B. **Socio-economic Factors**

The density and distribution of population also depend on the following socio-economic conditions of the area:

(i) **Industrialization and Urbanization:** As you always find, large number of people reside in the area having industries. They also prefer to live in the urban areas, towns and cities. The areas which are rich in mineral resources also attract large population. The mining areas in Jharkhand are very densely populated. This is so because these areas support several economic activities and offer lots of employment opportunities. Moreover, the education and health facilities are better in these areas. We are aware that all large cities of India like Delhi, Mumbai, Bangalore, Hyderabad, Chennai, Kolkata and many more have high density of population.

(ii) **Transport and Communication:** Some parts of the country have better transport and communication facilities and other public utility services than the other parts. Areas of northern plain are very well connected, whereas north eastern areas have comparatively poor connectivity. All such areas where the public facilities are well developed have a comparatively higher density of population. Sometimes we find that the places of cultural and religious significance are also densely populated.

All the above mentioned factors operate in combination. We can take the example of the high density population in the Ganga plain. It is caused by a combination of factors: level land, fertile soils, a favorable climate, industrialisation and urbanisation,
and comparatively well developed means of transport and communication. On the other hand, factors like rugged hilly terrain, unfavorable climate, poor means of transport and communication together cause low density of population in areas like those in Arunachal Pradesh.

**ACTIVITY 14.2**

Study the maps of physiographic divisions of India, the great northern mountains and the peninsular plateau of India in lesson 11. The smiling face of our Mother Land. Read these maps along with the data given in the figure numbers 14.1, 14.2 and 14.4 showing the distribution and density of population, respectively.

Co-relate and analyze the maps and identify the areas where physical conditions are favourable for people.

**INTEXT QUESTIONS 14.2**

1. Which one of the following States has the highest density of population according to 2001?
   A. West Bengal  
   B. Kerala  
   C. Tamil Nadu  
   D. Uttar Pradesh

2. The population of a district is 3,00,000 and its area is 1000 square km. What would be the density of population?
   A. 150 persons/sq. km  
   B. 200 persons/sq. km  
   C. 250 persons/sq. km  
   D. 300 persons/sq. km

3. Mention four important factors that are responsible for high density of population in big cities like Delhi, Mumbai, Kolkata and Chennai.


**14.4 POPULATION CHANGE**

The quality of population as a human resource in any country is greatly influenced by the pattern of population change. The change can be in terms of population growth or population decline. Although the population of the world is still growing, there are countries where it is declining. Both the situations of population change have their impact on the quality of human resources. If population grows at a faster rate, it results into an imbalance between population growth and resources of a country. This situation has an adverse impact on the quality of human resources.
The Indian population has been growing since long. From a population of 238 millions in the year 1901, it increased to 1028 millions in 2001 and is still growing. This increase in population is more than four times within a span of a century. On the other hand, there are countries in Western Europe where population is declining. Why it is so? Let us identify those factors which are responsible for population change.

**Factors of Population Change**

Population of any country increases or decreases because of three main demographic factors: (a) birth rate, (b) death rate, and (c) migration. A number of socio-economic factors also influence birth rate and death rate which ultimately affect population change. However, you may find in figure 14.5 that in our country the main reason for rapid increase in population is high birth rate and low death rate. The migration as a factor has rather negligible influence on population growth at the national level.

![Birth, Death and Growth rate of population](image)

*Figure 14.5: Growth of Population*

If you study figure 14.5 carefully, you will find that death rate has been declining since 1921. The birth rate also started declining during the same period. However, the decline in death rate has been faster than that of the birth rate. That is why, the gap between birth rate and death rate has been widening, leading to increase in population.
The population growth is also visible when you look at the decadal growth given in figure 14.6. The decadal growth rate have declined marginally between 1981 and 1991 and again between 1991-2001. It is a happy sign. But you may be surprised to know that in spite of decreasing growth rates, the absolute population has been increasing continuously over the successive years. Based on the outcome of birth rate and death rate, the entire period since 1901 to 2001 has been divided into four groups – stagnant, steady, rapid and slowing down stages of population growth.

**Do you know**

**Birth Rate:** The number of births per thousand of population in a given year under a particular territory is called Crude Birth Rate (popularly known as birth rate). Thus,

\[
\text{Birth Rate} = \frac{\text{No. of live births in a year under an area}}{\text{Mid-year population of that area}} \times 1000
\]

Suppose in a district, the total live births are 800 in a year and its mid-year population is 25000. So,

\[
\text{Birth Rate} = \frac{800}{25,000} \times 1000 = 32 \text{ per thousand of population}
\]

**Death Rate:** The number of deaths per thousand of population in a given year under a particular territory is called Crude Death Rate (popularly known as death rate). Thus,

\[
\text{Death Rate} = \frac{\text{No. of deaths in a year under an area}}{\text{Mid-year population of that area}} \times 1000
\]

Suppose in a district, the total deaths are 600 in a year and its mid-year population is 25000. So,

\[
\text{Death Rate} = \frac{600}{25,000} \times 1000 = 24 \text{ per thousand of population}
\]

**Natural Growth Rate:** Natural growth rate is the difference between birth rate and death rate. Therefore, natural growth rate = birth rate - death rate.

Suppose the birth rate of a particular year within an area is 32 and death rate is 24. Therefore, natural growth rate is 32 – 24 = 8 per thousand of population.
As we find right from the beginning of the 20th century, the population of India has been increasing in absolute numbers except during 1921 when there was a decline in absolute number. After 1921, there has been a continuous rising trend. That is why, the census year of 1921 is called the year of “The great divide” in the demographic history of India.

Let us try to understand the reasons for the fast rate of population growth in India. The most significant factors are illiteracy and low level of education, unsatisfactory health and nutritional status and poverty. There are some other crucial socio-cultural factors like preference for male child, early marriage, religious beliefs and low status of women.

**INTEXT QUESTIONS 14.3**

1. If in an area, birth rate is 45 per thousand and death rate is 25 per thousand, what would be the natural growth rate?
   - A. 15 per thousand
   - B. 18 per thousand
   - C. 20 per thousand
   - D. 25 per thousand

2. Which one of the following is the main reason for rapid increase in population of India?
   - A. High birth rate and high death rate
   - B. Low birth rate and low death rate
   - C. High birth rate and low death rate
   - D. Low birth rate and high death rate

3. Why is 1921 called the year of “The great demographic divide”? 
14.5 Population Composition

We have studied the distribution, density and growth of population so far. You would have been able to understand that the net effect of the difference between birth rate and death rate determines the pace and trend of population change. This net effect also demonstrates the composition of population which is an important factor influencing not only the pace of population growth but also the quality of population as a human resource. What is population composition? Population composition is the description of population defined by characteristics such as age, sex, rural-urban or literacy status. We shall, therefore, try to understand the following aspects of the population composition in India:

(i) Age composition,
(ii) Sex composition,
(iii) Rural-urban composition, and
(iv) Literacy

(i) Age Composition

The age composition of population has significant implications for the current and future development of a country. Population has been traditionally divided into three broad age groups: children (0-14 years), adults (15-60 years) and old (more than 60 years). Figure 14.7 shows age composition of Indian population in the above mentioned groups. If we compare the data from 1971, it is obvious that the child
population is declining and the population of adults has been increasing. However, population of the old is also increasing. In this way, the share of dependent population is increasing. Population of the old and children put together constitutes the dependent population. When the number of dependent population increases, the dependency ratio goes up. As a result, the country has to invest more on the growth and development of children and welfare of the old people; otherwise the same resources can be used for other productive purposes.

**Dependency Ratio**

Dependency Ratio = \( \frac{\text{Dependent population (0-14 yrs. plus more than 60 yrs. old)} \times 100}{\text{Working population (15-59 years)}} \)

Suppose in a district, dependent population (0-14 years plus more than 60 years) is 7000 and working population (15-59 years) is 18000. Thus,

\[ \text{Dependency Ratio} = \frac{7000}{18000} \times 100 = 38.89 \]

That means out of every 100 persons, 38.89 persons are dependent and 61.11 persons are working persons.

**Think and Ponder**

Your grandparents, being in the age-group of 60 years and above, belong to the dependent population group. Do you think they are a burden? Are they not contributing towards the welfare of the family and society? If ‘yes’, how are they contributing? If ‘no’ why are they not contributing?

**Adolescents as a Distinct Population Group**

The latest approach to understand the age composition emphasises the need to treat adolescents as a distinct population group. Traditionally, we have been dividing population in three phases: childhood, adulthood and old age. But as we observe, there are many individuals who are neither children nor adults. If you yourself are in that phase of life, you must have experienced your parents or other adults telling you, “Why are you doing this? You are no longer a child”. On another occasion the same adults would be telling, “How can you do this? You are not an adult”. In fact, the phase of life between childhood and adulthood, say between 10 years and 19 or a few more years, is known as adolescence and the persons in this age group are identified as adolescents. You may go through the text in the Box to understand meaning of adolescent better.
What does Adolescent Mean?

United Nations definitions are based on number of years as follows:
- Adolescents: 10-19 years olds
- Youth: 15-24 years olds
- Young People: 10-24 years olds

But adolescents as a population group may not be seen only in association with the precise number of years, as its periodicity varies from person to person. Adolescents belong to “a developmental period which extends from the end of childhood to the beginning of adulthood”.

Adolescence is defined as the period of physical, psychological and social maturation from childhood to adulthood, the period extending from puberty to the attainment of full reproductive maturity.

As shown in Table 1.1, adolescents as a distinct population group constitute almost 22.0 per cent of total population of India. This was their share in 2001. Their number is still growing and currently (in 2009) their percentage share has increased. The National Population Policy 2000 identifies them as an “under-served population group”, because their needs have not been specifically addressed so far. The Policy describes various strategies to address different needs of adolescents. These are: (i) provide accurate information about physical, physiological, psychological and social changes and developments that take place during adolescence; (ii) develop the needed life skills to empower them to avoid risky situations and to attain sound physical, mental and social health; (iii) provide food supplements and nutritional...
services; and (iv) make available the needed health and counselling services available to them.

Table 1.1: Adolescents (10-19 Years) by Sex (in thousands) in India, 1991 and 2001

<table>
<thead>
<tr>
<th>Census Year</th>
<th>Total No. of Adolescents</th>
<th>% of Total Population</th>
<th>Male</th>
<th>% of Total Male</th>
<th>Female</th>
<th>% of Total Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>181,419</td>
<td>21.4</td>
<td>95,969</td>
<td>21.9</td>
<td>85,450</td>
<td>21.0</td>
</tr>
<tr>
<td>2001</td>
<td>225,061</td>
<td>21.9</td>
<td>119,571</td>
<td>22.4</td>
<td>105,490</td>
<td>21.2</td>
</tr>
</tbody>
</table>

**ACTIVITY 14.3**

Look into the data given in Table 1.1 and search answers for the following:

1. Why is the number of adolescent girls less than adolescent boys, though biologically the number of girls should have been more?
2. What is the trend in terms of percentage of male and female adolescents during 1991 and 2001?
3. Why are the adolescents considered as under-served population group?
4. Can you prepare a list of the needs of adolescents that must be addressed by the society?

(ii) Sex Composition

Sex composition is a very significant indicator of the quality of population of a country as a human resource. In fact, primarily it is understood on the basis of sex ratio. Sex ratio is defined as the number of females per 1000 males. It is an important

![Figure 14.8 (b): Trends in Sex Ratio in India](image-url)
social indicator to measure the extent of prevailing equity between males and females at a given point of time. Sex ratio should be favourable. But in our country, sex ratio has always remained unfavorable to females, and the matter of concern is that it has been declining. In the year 1901, there were 972 females per 1000 males. In 2001, it has come down to 933 only. This trend is shown in figure 14.8 (a) and (b).

Let us think why sex ratio is unfavorable in our country? It is primarily because of the prevailing discrimination against the females in our society. The favourable sex ratio is available only in one State and one Union Territory. It is 1058 in the State of Kerala and 1001 in the Union Territory of Puducherry, now known as Puducherry.

**Child Sex Ratio**

The trend of decline in child sex ratio in the country is a matter of great concern. The sex ratio in 0-6 year population (child population) is continuously decreasing. Whereas the 1991 and 2001 Census Reports showed some improvement in overall sex ratio, the sex ratio of 0-6 year population has decreased sharply. Out of 28 States and 7 Union Territories, only in four States, namely Kerala, Mizoram, Sikkim, Tripura and Union Territory of Lakshadweep the child sex ratio is in tune with the overall sex ratio. The worst affected States are Haryana, Himachal Pradesh, Gujarat, Punjab, and Uttarakhand, and the Union Territory of Chandigarh and National Capital Region of Delhi. This decline in child sex ratio suggests the prevalence of the practices of female foeticide and female infanticide in these States. These practices are against the norms of a civil society.

(iii) **Rural-urban Composition**

India has been a land of farmers and a country of villages. At the beginning of the twentieth century nine out of ten persons used to live in villages. More than three-
fourths of our population still lives in rural areas. The urban area in India is defined as one, in which three-fourth of the population depends directly or indirectly on non-agricultural pursuits, with a minimum of 5000 population and the density being not less than 400 persons per sq. km.

It seems, (see figure 14.9) we are moving rather fast towards urbanization along with its consequences such as shortage of housing, water, electricity, and encroachment on environment.

![Rural and Urban population](image)

**Figure 14.9: Rural - Urban Change**

### (iv) Literacy

Literacy is an indicator of development of any society. As defined in the Census Report, ‘a person aged seven and above, who can both read and write with understanding in any language is treated as literate’. Literacy rate in our country was 18.83 percent in 1951. It has increased to 65.38 percent in 2001. Among various States of our country, Kerala has the highest literacy (90.86 percent) followed by Mizoram (88.49 percent) and Lakshdweep (87.52 percent). But the literacy rate, in general, is lower among females as compared to males (figure 14.10)

![Literacy rate in India](image)

**Figure 14.10: Literacy**
ACTIVITY 14.4

Collect the following information from your vicinity for about 10-15 households:

1. Name of the person interviewed .......................
2. Age ....................... Years .......................
3. Academic Qualification .......................
4. Number of persons earning in the family .......................
5. Total no. of members M ....................... F .......................
6. Members of family in the age groups
   (a) Up to 14 years .......................
   (b) 15 years to 60 years .......................
   (c) More than 60 years .......................
7. Based on the data collected above, compute and analyze:
   (a) Sex-ratio
   (b) Dependency ratio .......................
      (i) Below 14 years ....................... and its percentage .......................
      (ii) More than 60 years ....................... and its percentage .......................

We have been thus able to understand that the population of any country cannot become its greatest resource only by virtue of its number. The country has to invest to improve the quality of demographic characteristics and convert the number into a resource. For converting the number into human resource, India like many other countries of the world has been adopting and implementing policies and programmes. In the next section, therefore, we shall try to understand policies of Government of India in respect of population and empowerment of women.

INTEXT QUESTIONS 14.4

1. According to 2001 census, the sex ratio of India is:
   A. 920  B. 927  C. 933  D. 943
2. The percentage of urban population, according to 2001 census is:
   A. 27.8  B. 26.7  C. 25.7  D. 24.0
3. What would be the result if the dependency ratio is more?
4. State any two reasons responsible for unfavourable sex ratio in India.
14.6 POPULATION POLICIES IN INDIA

Do you know that discussions on population growth and the need to adopt a population policy had begun in India even before Independence? A Sub-Committee on population was set up by the National Planning Committee appointed in 1938 by the Interim Government. This Committee, in its resolution in 1940 said, “in the interest of social economy, family happiness and national planning, family planning and a limitation of children are essential”.

In 1952, India was the first country in the world to launch a national population programme emphasizing family planning. The aim of the programme was to reduce birth rates “to stabilize the population at a level consistent with the requirement of national economy”. Since then India has been reformulating its population policy from time to time, the details of which you can get from relevant books or when you study in higher classes. At present we shall try to understand the latest population policy which was adopted by Government of India in 2000.

National Population Policy (NPP) 2000

The National Population Policy 2000 has made a qualitative departure in its approach to population issues. It does not directly lay emphasis on population control. It states that the objective of economic and social development is to improve the quality of lives that people lead, to enhance their well-being, and to provide the opportunities and choices to become productive assets (resources) in the society. Stabilizing population is an essential requirement for promoting sustainable development. The immediate objective of the NPP 2000 is to address the unmet needs for contraception, health care infrastructure, and health personnel, and to provide integrated service delivery for basic reproductive and child health care. The medium-term objective is to bring the total fertility rate (TFR) to replacement levels by 2010 through vigorous implementation of inter-sectoral operational strategies. The long-term objective is to achieve a stable population by 2045 with sustainable economic growth, social development, and environmental protection.

Do you know

Total Fertility Rate at Replacement Level: It is the total fertility rate at which newborn girls would have an average of exactly one daughter over their lifetimes. In more familiar terms, every woman has as many babies as needed to replace her. It results into zero population growth.

Stable Population: A population where fertility and mortality are constant over a period of time. This type of population will show an unvarying age distribution and will grow at a constant rate. Where fertility and mortality are equal, the stable population is stationary.
Women Empowerment in India

The empowerment of women is very crucial for improving the quality of population as a human resource. Women, in India, although making up almost 50% of the total population, have been looked down upon and subjected to discrimination. By simple logic, this has deprived the nation of the contribution of half of its population as human resources. This is quite opposite of what is seen and observed in the developed world. The role of women in our country has been limited to looking after their families, also being mute spectators to all kinds of discrimination, ill treatments and crimes against them.

If you go through the Indian Constitution, you will find that in its Articles 14, 15, 16, 19, 39, 42, 51e provisions have been made to ensure justice and equality to all. Many laws have been passed like Special Marriage Act 1954, Medical Termination of Pregnancy Act 1971 and Child Marriage Restraint Act (Amendment) 1978. Yet the status of women continues to be a matter of great concern.

Some steps have been taken and it is hoped that there will be qualitative change in the status of women. The empowerment of women received a major boost when the 73rd and 74th Constitutional Amendments providing 33 percent reservation of seats for Women in Panchayati Raj institutions and Urban Local Bodies were passed by the Parliament. Another Constitution Amendment Bill has been introduced, which aims at providing 33 percent reservation for women in the House of the People and State Legislative Assemblies. A National Commission for Women came into existence in 1992, through an Act passed in 1990. Wide ranging functions have been assigned to the Commission to look into and investigate into any ill treatment brought to their notice against women and to safeguard their interest.

The ultimate objective is to facilitate the advancement, development and empowerment of women and to eliminate all forms of discrimination. These steps will also ensure their active participation in all spheres of life and activities. You can read, learn and understand about the need of women empowerment and its efforts made more in detail in the lesson ‘Socio –Economic Development and Empowerment of Disadvantaged Groups’.

INTEXT QUESTIONS 14.5

1. Suppose a particular district has an area of 200 square Km. The same district records the total number of persons as 17400, 26200, 36200, 47200, 59800, 75200 according to 1951, 1961, 1971, 1981, 1991 and 2001 census, respectively.
   A. Calculate the density of population for all six censuses.
   B. Find out the decadal change in density.
   C. Can you find any trend from your calculation of population density?
Population: Our Greatest Resource

WHAT YOU HAVE LEARNT

- Population is the total number of people living in a country at a given time. The data regarding various socio-economic and demographic aspects of our population is collected by the Government of India at the beginning of each decade and it is called census.

- The total population of India according to the 2001 census is 1028.7 millions which is more than four times to that of 1901 (238.3 millions). The difference between the birth rate and death rate is called natural growth rate.

- Density of population is defined as the number of persons per square kilometer. Its distribution in India is highly uneven. NCT of Delhi has the highest density of 9294 persons/sq. km. and Arunachal Pradesh has the lowest 14 persons/sq. km.

- Sex ratio is defined as the number of females per 1000 male in the total population. Sex ratio is unfavorable in India. It is 933 according to the census of 2001. The sex ratio can be improved by empowering women.

- Population of India is divided mainly into three age-group; (i) children (0-14 years), (ii) adults (15-60 years) and (iii) old (60+years). Children and old form the dependent population and their percentage in the total population is about 43.

- For an awakened society, literacy is an important indicator. As per the census ‘a person aged seven and above should be able to read and write with understanding’. Literacy rate in our country has improved a lot. It was only 18.33 in 1951 which has gone up to 65.37% in 2001. Kerala has the highest literacy rate 90.86 percent.

- The main objective of the National Population Policy is to improve the quality of life of the people by reducing birth and death rates, family welfare, stabilizing population, economic growth, social development and environmental protection. By making appropriate investment in improving the quality of life, our large population can be transformed into a productive resource of our country.

TERMINAL EXERCISES

1. Define sex-ratio. Why is the sex-ratio in India unfavorable?
2. Define population growth rate and explain how it is arrived at.
3. What inferences can we draw from the age composition data of India?
4. How can we turn our huge population into a resource?
5 Define the following terms
   (i) Density of population
   (ii) Birth rate, Death rate and Growth rate.
   (iii) Literacy
6 Explain the National Population Policy?
7 What is meant by women empowerment? How does women empowerment empower the whole society/community?

ANSWER TO INTEXT QUESTIONS

14.1
1. Something that can be used or reused by us.
2. Education, health and nutrition, specialized training.

14.2
1. A. West Bengal
2. D. 300 persons/square km
3. Industrialization; (ii) Urbanization; (iii) Employment opportunities; (iv) Means of transport and communication.
4. (i) Rugged topography
   (ii) Harsh climatic condition

14.3
1. C. 20 per thousand
2. C. High birth rate and low death rate
3. The year 1921 shows decline in population but after that it has been increasing continuously.

14.4
1. C. 933
2. A. 27.8
3. Government has to invest more for the welfare of dependent population and hence less available fund for greater developmental works in country.
4. (i) Discrimination against females.
   (ii) Female foeticide and infanticide.
### 14.5 Population: Our Greatest Resource

#### Year A Density Year B Decade change in density Year C

<table>
<thead>
<tr>
<th>Year</th>
<th>Density</th>
<th>Decade change in density</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>87</td>
<td>—</td>
<td>Continuously increasing trend in the density of population</td>
</tr>
<tr>
<td>1961</td>
<td>131</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>1971</td>
<td>181</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>236</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>299</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>376</td>
<td>77</td>
<td></td>
</tr>
</tbody>
</table>
You must have seen variety of grass, plants, bushes, trees, insects, birds, animals or beautiful landscape around you. We rely on this diversity of plants and animals to provide us food, fuel, medicine and other essentials without which we cannot live. These species are the product of more than four billion years of evolution. Yet, this rich bio diversity is being lost at an alarming rate largely because of human activities. However, there are many things that each one of us can contribute in preserving these species, plants, animals and other living organisms. There are lots of things which you can do to help in saving these precious diversities of life. It is very important for us to know about this variety in terms of plants, animals and micro-organisms. In this lesson, we will learn about some of these plants, animals, their importance, their distribution in India and need for their conservation.

**OBJECTIVES**

After studying this lesson, you will be able to:

- explain the concept of bio-diversity;
- explain the status of bio-diversity in India;
- establish the significance of biodiversity;
- describe natural vegetation and wildlife in India;
- locate forests, wildlife sanctuaries, national parks, biosphere reserves and wetlands in an outline map of India; and
- recognise our role in conserving natural vegetation and wildlife in our region.

**11.1 BIO-DIVERSITY**

Biodiversity is a short form of biological diversity. **Biological diversity or biodiversity is a term; we use to describe the variety of life on Earth which includes**
different components of physical environment such as temperature, soil and water. In simple terms biodiversity is the total number of genes, species and ecosystems of a region. It includes (i) genetic diversity, (ii) species diversity and (iii) ecosystem diversity. Plants and animals constitute only a small component of biodiversity. Do you know that the invisible micro-organisms constitute a large component of bio-diversity.

**Figure 11.1 Biodiversity**

**Genes:** The basic biological unit of heredity. Genes of an individual belonging to the same species are similar and genes control the characteristics of particular species.

**Species:** A group of very similar having some common characteristics or qualities and capable of interbreeding.

**Ecosystem**—Any segment of the landscape that includes biotic (living) and abiotic (non-living) components is known as ecosystem.

### 11.1.1 Status of biodiversity in India

Biodiversity increases as we move from the poles towards the equator. India is located between 8°4′ North and 37°6′ North latitudes and 68°7′ East and 97°25′ East longitude. It is due to this unique position that India has such rich biodiversity. Although India has only 2.4% of the world’s land area but its contribution to the
World’s biodiversity is approximately 8% of the total number of species which is estimated to be 1.75 million (As per Global Biodiversity Assessment of UNEP of 1995). 6% of the world species are found in India. 45000 plants species comprising about 12% of world’s flora are found in Indian forests. Two of the twelve biodiversity hotspots in the world are in India. They are the North-Eastern region and the Western Ghats.

- A biodiversity hotspot is a region with a high level of endemic species. Endemic species are those species that are found in a certain limited area.

- **Mega biodiversity**: A unique combination of different plants and animal species which is not available anywhere else.

### 11.2 SIGNIFICANCE OF BIODIVERSITY

Biodiversity is fundamental to the existence of life on the earth. Its significance cannot be underestimated. There are varieties of living things that exist in a given physical environment. These are interdependent and interrelated in the form of an ecosystem. Do you know that plants occur in distinct groups of communities in areas having similar climatic conditions? The nature of vegetation in any area determines the animal life. When the vegetation of a place is altered, animal life also changes and simultaneously it affects mankind. Loss of any component in the system adversely affects other components of the system. We are an integral part of the ecosystem. By cutting trees and killing animals, human beings lead to ecological imbalance. How does the ecosystem get influenced by human beings? Collect some articles from the newspaper and magazines which will help you in understanding human impact on ecosystem. We must understand that all plants and animals in an area are interdependent and interrelated in their physical environment? This ecosystem is extremely valuable in different facets of human life which includes the following:

- Providing of food, water, fiber, fuel etc.
- Regulating of climate and disease (For example: people are suffering from cold and cough in winters and stomach infections in monsoon etc.

### 11.2.1 Causes of Loss of Biodiversity

Increasing population and changing lifestyle leads to commercial exploitation of the natural resources. This results in loss of biodiversity. Consequently it is adversely affecting the ability of the nature to continue delivering the goods and services for human existence. The loss of biodiversity affects not only the physical environment but also the social, cultural, religious and spiritual well being of human life.
United Nations had proclaimed the year 2010, the International Year of Biodiversity.

According to IUCN (International Union for Conservation of Nature), by 2010 around 18,788 species out of 52,017 so far assessed are threatened with extinction. Of the world’s 5,490 mammals, 78 are extinct, 188 critically endangered, 540 endangered and 492 vulnerable. Amphibians are also in danger of extinction, 1,895 of the planet’s 6,285, are the most threatened group of species.

Extinction of individual species, destruction of natural habitats, land-use conversions, climate change, pollution and degradation is continuing at an alarming rate. Do you think this has anything to do with the extinction of various species.

ACTIVITY 11.1
Can you mention the names of three species of plants and animals/birds found in your locality and their importance for the residents of your locality? One example has been done for you.


<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Plants</th>
<th>Importance</th>
<th>Sr. No.</th>
<th>Animals/Birds</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Neem</td>
<td>Give us medicine, wood, oxygen and shade</td>
<td>1.</td>
<td>Vulture</td>
<td>Keeps environment free of carcasses and waste, restrict spread of diseases, help control a number of pest like rats</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td>4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INTEXT QUESTIONS 11.1**

1. “Bio-diversity is fundamental to the existence of life on the earth” Justify the statement by giving any two reasons.

2. Explain **hotspots** in 30 words.

**11.3 NATURAL VEGETATION AND WILDLIFE**

In our ecosystem, vegetation and wildlife are valuable resources. We all know that plants provide us with timber, give shelter to man and animals, produce the oxygen we breathe, prevent soil erosion and natural calamities such as floods, high speed winds and help in storage of underground water, give us fruits, nuts, latex, turpentine oil, gum, medicinal plants and also the paper that is so essential for our studies. These are some of the innumerable uses of plants. Wildlife includes animals, birds, insects, reptiles as well as the aquatic life forms. They provide us milk, meat, hides and wool. Insects like bees provide us honey, help in pollination of flowers and have an important role to play as decomposers in the ecosystem. The birds feed on insects and act as a decomposers as well. Vulture due to its ability to feed on dead livestock is a scavenger and considered a vital cleanser of the environment. So life forms, big or small, all are integral in maintaining a balance in the ecosystem.

**11.3.1 Natural Vegetation in India**

As in any other part of the world, natural vegetation of India is also determined by climate, physiographic and soil factors. If we look at the figure 11.3, we find that based on factors of temperature, rainfall and topographic conditions, India has diverse vegetation patterns as summarized below. Dense natural vegetation found in North-Eastern region, Western Ghats and Andaman Nicobar. The Northern plain and North-Western Region supports very scanty vegetation and is under cultivation. The
Deccan region is full of scrubs and mixed deciduous forests. Natural vegetation of India can broadly be divided into the following groups:

(i) Tropical Evergreen Forests
(ii) Tropical Deciduous Forests
(iii) Thorn Forests
(iv) Tidal Forests
(v) Himalayan Forests

Forests can also be man-made, it can be created in urban areas. However, in this lesson, only natural forests have been discussed under natural vegetation.

(i) Tropical Evergreen Forests
Trees in these forests remain green all the year round as the climate of the region is warm and wet throughout the year. The leaves of these trees do not fall in any particular season. Hence, they are evergreen. These forests are found in the areas having more than 200 cm of rainfall with a short dry season. The trees reach a height up to 60 meters or even more. It has a dense and mixed vegetation of all kinds including trees, shrubs, climbers, creepers, epiphytes and ferns giving it a multilayered structure. Hence, their economic exploitation is not viable. The number of species of trees is very large in a small area. Rosewood, ebony, mahogany, rubber, jack wood and bamboo are the important species of trees found in Tropical Evergreen Forests. In India, this type of vegetation is found in the areas of heavy rainfall in Western Ghats, upper parts of Assam and islands of Lakshadweep, Andaman and Nicobar. Hardwood from these forests is used for furniture, handicraft etc. The prevent landslides and soil erosion.

ii) Tropical Deciduous Forests
Vegetation in these forests shed their leaves once in a year. That is why they are called tropical deciduous forests. These are most widespread forests of India. These forests are found in the areas receiving annual rainfall between 75 to 200 cms. As far as the physical distribution of this type of forests is concerned they are found in the entire country excluding some parts of Deccan Plateau, North-Eastern Region, Western Ghats and Eastern coast. These forests have been subject to extensive clearance by man for the purpose of cultivation. Still some patches of natural vegetation are found along the foothills of Himalayas, hilly regions of peninsular and central part of the country. On the basis of the availability of rainfall these forests are further divided into moist deciduous and dry deciduous.

(a) The moist deciduous forests are found in the areas of rainfall between 100 to 200 cm. These are distributed mainly in the eastern parts of the country,
Northeastern states along the foothills of Himalayas, Jharkhand, Odisha and Chhattisgarh, and eastern slopes of Western Ghats. Teak, Bamboo, Sal, Shisham, Sandalwood, Khair, Kusum, Arjun, Mahua, Jamun and Mulberry are the important species of trees found in these forests.

(b) The dry deciduous forests are spread in the areas receiving rainfall between 75 to 100 cms annually. These forests are found in the interior parts of the Peninsular plateau and the plains of Uttar Pradesh, Madhya Pradesh and Bihar. Tree species grow in this vegetation are Teak, Sal, Peepal, and Neem.

(iii) Thorn Forests

The areas with less than 75 cm of annual rainfall are characterized by the natural vegetation of thorny trees and bushes. Climate of this part is mainly dry with occasional wet period, so it does not support dense vegetation. They are mainly found in North-Western India, interior parts of the Peninsular India including semi-
arid areas of Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Haryana, Karnataka, Andhra Pradesh and Maharashtra. Vegetation of these forests is widely distributed in the form of small trees and bushes with deep roots. The stems are succulent to conserve water. Leaves are mostly thick and small to minimize evaporation. Acacia, euphorbias, babul, cacti, khair, date and palms are common variety of trees in this type of vegetation.

(iv) Tidal Forests

As suggested by the name, these forests are found in tidal creeks and swamps influenced by the tides and wetland topography. These areas are characterized by mud, silt and water accumulated on the surface. Roots and branches of the trees are submerged under water for specific period of time. They are also called mangrove forests. Mangroves are practically evergreen with thick leathery leaves. Such types of forests are found in the deltas of Sundarban, Mahanadi, the Godavari, Krishna, Kaveri rivers and in the Andaman and Nicobar Islands. Mangrove or Sundari is the common tree in Sunderbans while palm, coconut, keora, and agar are other important species of tidal forest. It is interesting to know that this type of forests have remained away from the large scale commercial exploitation. These forests are located along the coasts. They provide protection against cyclones.

(v) Himalayan Vegetation

As is evident by the name that these forests are mainly found in the mountainous region of the Himalayas. The decreasing in temperature and increasing in altitude lead to varied types of vegetation depending upon the factors like slope of the mountain and sunrays receiving side. The ecosystem is highly fragile. Himalayan forests have been exploited in many ways in recent decades. Areas with relatively low altitude up to 1000 meters, warm climate and good amount of rainfall are characterized by dense vegetation cover. These areas look like tropical forest. Sal and Bamboo are main species in these areas. Between the elevation of 1000 to 2000 meters evergreen broad leave Oak and Chestnut are the common species found in these forests. In eastern Himalayas the same elevation is occupied by sub tropical Pine forests. Chir is common species found in this part. Moist temperate forest in Himalayas are found between the elevation 1500 to 3500 meters which receives annual rainfall in the range of 100 to 250 cm. Oak, laurel, chestnut, cedar, Silver, Fir, spruce rhododendron and deodar are the main species found in this part of Himalayas. They have been widely exploited for their timber. Last type of vegetation found in Himalayas is known as Alpine vegetation which is found between 3000 to 3800 meters with large and extensive highland grassland and sparsely distributed pine, birch, sliver, fir and rhododendron trees.
INTEXT QUESTIONS 11.2

1. Why are the tropical rain forests called evergreen forests? Explain in 30 words.

2. Give reasons
   (i) Tidal Forest areas along the eastern coast experienced severe destruction during cyclones in recent years because

   ............................................................................................................
   ............................................................................................................

   (ii) Himalayan Forests have been economically more exploited in comparison to Tropical Evergreen Forests because

   ............................................................................................................
   ............................................................................................................

11.3.2 Wildlife in India

You have studied earlier in the lesson that due to its unique geographical position, India is rich in wildlife. Wildlife of India is a great natural heritage. It is estimated that about 80 percent of all known plant and animal species on the earth are found in India. Many plants synthesize substances that are useful to the maintenance of health in humans and other animals. In recent decades, human encroachment has posed a threat to India’s wildlife. In response to this, the system of National parks, Wildlife sanctuaries and protected areas, first established in 1935, has substantially expanded the provision to provide for the protection of wildlife animals by wildlife protection Act 1972. Efforts are being made to protect and preserve biological diversity of our country under various programs. India has preserved vast tracts of natural habitats, birds and plants in its 551 Wildlife Sanctuaries, 96 National Parks, 25 Wetlands and 15 Biosphere Reserves spread around in all the states of India. Besides this, there are 33 Botanical Gardens, 275 Zoological Parks, Deer Parks, Safari Parks, Aquaria etc. to make people aware conservation of threatened and endangered wildlife species in their respective areas. In India, for the purpose of effective conservation of natural habitat of wildlife, special schemes like Project Tiger 1973 and Project Elephant 1992 have been launched. These are very important as certain species are at the brink of extinction. However, none of these efforts will be truly successful unless every Indian recognizes their role in conserving bio-diversity.

   (i) Wildlife Sanctuaries: The main objective of the wildlife sanctuaries is to ensure maintenance of viable population of wildlife and their desired habitat. The wildlife sanctuaries in India are home to around two thousand different species of birds, 3500 species of mammals, nearly 30000 different kinds of insects and more
than 15000 varieties of plants. These sanctuaries and forest reserves are home to several endangered species of animals and birds like the Asiatic Elephant, the Royal Bengal tiger, the Snow Leopard and the Siberian Crane. Many of the forest reserves and wildlife sanctuaries of India are famous for some particular species of animals. For instance, the Kaziranga in Assam is known for the Indian Rhinoceros, while Periyar in Kerala is famous for its elephants. There are 551 wildlife sanctuaries in India. India is also home to several migratory animals and birds like Olive Ridley Sea Turtles, Siberians Cranes and Flamingos.

(ii) **National Parks:** The purpose of establishing national parks is “to conserve the natural and historic objects and the wild life and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” By 1970, India only had five national parks. In 1972, India enacted the Wildlife Protection Act to safeguard the habitats of conservation reliant species. The two main objectives of the act are; to provide protection to the endangered species listed in the Act and to provide legal support to the conservation area of the country classified as national park.

**Table 11.1 Rare Species of Animals Found in National Parks**

<table>
<thead>
<tr>
<th>National Parks (wild life sanctuaries)</th>
<th>Rare species of wild animals protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dachigram (J&amp;K)</td>
<td>Hangul, Musk deer</td>
</tr>
<tr>
<td>2. Corbett (Uttarakhand)</td>
<td>Tiger, Elephant, Panther, Deer</td>
</tr>
<tr>
<td>3. Dudhwa (U.P.)</td>
<td>Elephants and Tiger</td>
</tr>
<tr>
<td>4. Kanha (M.P.)</td>
<td>Tiger, Barasingha</td>
</tr>
<tr>
<td>5. Badipur (Karnataka)</td>
<td>Tiger and Barasingha</td>
</tr>
<tr>
<td>6. Periyar (Kerala)</td>
<td>Elephants</td>
</tr>
<tr>
<td>7. Bharatpur (Rajasthan)</td>
<td>Different types of water birds</td>
</tr>
<tr>
<td>8. Deset Park (Rajasthan)</td>
<td>Desert wolf, Fox</td>
</tr>
<tr>
<td>9. Gir (Gujarat)</td>
<td>Lion, Panther, Chital</td>
</tr>
<tr>
<td>10. Kaziranga (Assam)</td>
<td>Rhino, Wild Buffalo</td>
</tr>
<tr>
<td>11. Manas (Assam)</td>
<td>Elephant, Rhino, Wild Buffalo</td>
</tr>
<tr>
<td>12. Nam Dafa (Arunachal Pradesh)</td>
<td>Tiger, Gaur, Wild buffalo</td>
</tr>
<tr>
<td>13. Sundarbans (West Bengal)</td>
<td>Royal Bengal Tiger</td>
</tr>
</tbody>
</table>
Wetlands: A wetland is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others. The water found in wetlands can be saltwater, freshwater, or brackish. Most importantly wetlands also serve as natural wastewater purification systems. Wetlands are considered as biologically the most diverse of all ecosystems. Plant life found in wetlands includes mangrove, water lilies, cattails, sedges, tamarack, black spruce, cypress, gum, and many others. Animal life includes many different amphibians, reptiles, birds, insects, and mammals. Wetlands perform two important functions in relation to climate change. They have mitigation effects through their ability to sink carbon, and adaptation effects through their ability to store and regulate water. The Convention on Wetlands of International Importance, or Ramsar Convention, is an international treaty designed to address global concerns regarding wetland loss and degradation. The primary purpose of the treaty is to list wetlands of international importance and to promote their wise use with the ultimate goal of preserving the world’s
Methods include restricting access to the majority portion of wetland areas, as well as educating the public to combat the misconception that wetlands are wastelands.

About 25 wetlands or Ramsar sites have been identified of significance in India.

Table 11.2 Wetlands in India

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>State</th>
<th>Area (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ashtamudi</td>
<td>Kerala</td>
<td>614</td>
</tr>
<tr>
<td>2.</td>
<td>Bhitarkanika Mangroves</td>
<td>Orissa</td>
<td>650</td>
</tr>
<tr>
<td>3.</td>
<td>Chilika Lake</td>
<td>Orissa</td>
<td>1165</td>
</tr>
<tr>
<td>4.</td>
<td>East Calcutta Wetlands</td>
<td>West Bengal</td>
<td>125</td>
</tr>
<tr>
<td>5.</td>
<td>Kolleru Lake</td>
<td>Andhra Pradesh</td>
<td>901</td>
</tr>
<tr>
<td>6.</td>
<td>Loktak Lake</td>
<td>Manipur</td>
<td>266</td>
</tr>
<tr>
<td>7.</td>
<td>Point Calimere</td>
<td>Tamil Nadu</td>
<td>385</td>
</tr>
<tr>
<td>8.</td>
<td>Pong Dam Lake</td>
<td>Himachal Pradesh</td>
<td>157</td>
</tr>
<tr>
<td>9.</td>
<td>Sambhar Lake</td>
<td>Rajasthan</td>
<td>240</td>
</tr>
<tr>
<td>10.</td>
<td>Tsomoriri</td>
<td>Jammu and Kashmir</td>
<td>120</td>
</tr>
<tr>
<td>11.</td>
<td>Upper Ganga canal</td>
<td>Uttar Pradesh</td>
<td>266</td>
</tr>
<tr>
<td>12.</td>
<td>Vembanad-Kol Wetland</td>
<td>Kerala</td>
<td>1512</td>
</tr>
<tr>
<td>14.</td>
<td>Harike Lake</td>
<td>Panjab</td>
<td>41</td>
</tr>
<tr>
<td>15.</td>
<td>Bhoj Wetland</td>
<td>Madhya Pradesh</td>
<td>32</td>
</tr>
</tbody>
</table>

(iv) Biosphere Reserves

Biosphere Reserves are multipurpose protected areas to preserve the genetic diversity in representative ecosystems. The Indian government has established 15 Biosphere Reserves, which protect larger areas of natural habitat (than a National Park or Wildlife Sanctuary), and often include one or more National Parks and/or preserves along buffer zones that are open to some economic uses. Protection is granted not only to the flora and fauna of the protected region, but also to the human communities who inhabit these regions, and their ways of life. The main objectives to establish them are: (i) to conserve diversity and integrity of the life of plants, animals and micro-organisms, (ii) to promote eco friendly sustainable life in the areas, and
(iii) to promote ecological conservation, research, education, awareness and training in the life of such areas.

Figure 11.5 Biosphere Reserves in India

Table 11.3 Biosphere Reserves

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Nilgiri</td>
<td>Tamil Nadu, Kerala and Karnataka</td>
</tr>
<tr>
<td>2.</td>
<td>Gulf of Mannar</td>
<td>Tamil Nadu</td>
</tr>
<tr>
<td>3.</td>
<td>Sundarbans</td>
<td>West Bengal</td>
</tr>
<tr>
<td>4.</td>
<td>Nanda Devi</td>
<td>Uttarakhand</td>
</tr>
<tr>
<td>5.</td>
<td>Dihang-Dibang</td>
<td>Arunachal Pradesh</td>
</tr>
<tr>
<td>6.</td>
<td>Pachmarhi</td>
<td>Madhya Pradesh</td>
</tr>
<tr>
<td>7.</td>
<td>Simlipal</td>
<td>Orissa</td>
</tr>
<tr>
<td>8.</td>
<td>Achanakmar Amarkantak</td>
<td>Madhya Pradesh and Chhattisgarh</td>
</tr>
</tbody>
</table>
9. Manas Assam
10. Kanchenjunga Sikkim
11. Agasthyamala Kerala
12. Great Nicobar Andaman & Nicobar Islands
13. Nokrek Meghalaya
14. Dibru-Saikhowa Assam
15. Rann of Kachchh Gujarat

11.4 NEED OF CONSERVATION OF BIO-DIVERSITY

In section 11.1 we have described bio-diversity as the total number of genes, species and ecosystems of a region. We have also learnt that biodiversity is fundamental to our existence on the earth. We look for food, water, shelter and fibre in nature. All these are interrelated and interdependent. If any one component is disrupted, it would have multiple impacts on other components of biodiversity. If we want to conserve our natural vegetation and wildlife we need to relook at the way we exploit these. It is time to re-look at our lifestyle and bring it in harmony with nature. Vegetation is an integral part of our life. Let’s see how plant life and vegetation impacts us:

(i) Vegetation is a key component of biodiversity. Without vegetation, the animals and some micro-organisms would die for lack of habitat, food and oxygen.

(ii) Plant’s root systems hold the soil together, protecting it from being blown away by the wind or washed away by water.

(iii) Vegetation plays a major role in the water cycle. Plants provide a link between the ground and the atmosphere by drawing water up from the ground and releasing it through the leaves into the air as water vapour.

(iv) Vegetation is a natural barrier and slows down the flow of water over the surface of the ground.

(v) Through photosynthesis, vegetation removes carbon dioxide from the air and replaces it with oxygen. Other pollutants can also be filtered out of the air by vegetation.

(vi) Vegetation acts as a stabilising influence in the greenhouse effect. Conversely, clearing of vegetation releases high amounts of carbon dioxide – the main greenhouse gas.

(vii) Wildlife plays an important role in maintaining balanced food. This role helps in maintaining ecological balance resulting in healthy biodiversity.

(viii) The invisible micro-organism play an important role of scavengers, improving soil fertility and are of immense medicinal value.

You can now feel that conservation of biodiversity is of great significance not only to the world or national heritage but also for the survival of local people in any part
of the globe. We as a responsible citizen of the world need to understand our positive role in making responsible living choices. This would be our contribution in conserving biodiversity.

### Peoples Participation in Conserving Biodiversity
(A Case Study)

Twenty-five years old Rajender Singh left his job and committed himself to rural development. With four companions he boarded a bus and travelled to a desolate village near Alwar. At this time Alwar had been opened to miners and loggers, who decimated its forests and damaged its watershed. Its streams and rivers dried up, then its farms. Dangerous floods now accompanied the monsoon rains. Overwhelmed by these calamities, villagers abandoned their Johads. As men shifted to the cities for work, women spirited frail crops from dry grounds and walked several kilometers a day to find water. This was Alwar when Rajendra Singh first arrived in 1985. Before that he worked with nomadic tribes and tried to understand issues in natural resources management in rural areas.

Upon advice of a local village elder, he began organizing villagers to learn how to repair and deepen old johads. He initiated an awareness campaign for Gram Swawlamban, which is organised every year during the summer months for forty days in different hundreds of villages. In this campaign discussion on Gram Swawlamban, soil conservation, improved seeds, collection of herbal medicine and shramdan were the activities undertaken. Singh coordinated all these activities to mesh with the villager’s traditional cycle of rituals. He played a catalyzing role in the building of 8600 johads (water harvesting structures) in 1058 villages spread over 6500 sq.km. Out of these 3500 were built by TBS and as an after effect of these the community was motivated to build the remaining 5100 structures.

Through his determination, vision, hard work and dedication, he has transformed the life of people in 1058 villages of Aravali hills. He has turned the arid land cultivable, densely afforested large tracts making a wild life sanctuary by water management, made the dry rivers flow throughout the year. Aquatic life and bird sanctuary have flourished. Animal life has become lively, with desert beaming with life all around.

There is so much we can do to save nature.

Think what we give back to nature in lieu of what we take away. If we cut down a tree, we should plant two small ones in its place. Buy only those products which have not been tested on animals. Do not waste paper. Try to use recycled paper.
ACTIVITY 11.2

Find out if there are any wetlands in your state and its distance from your place of residence.

INTEXT QUESTIONS 11.3

1. Fill in the blanks correctly from the alternatives provided in the bracket:
   (i) At present there are .................. wild life sanctuaries (441/551)
   (ii) .................. in Assam is known for the Indian Rhinoceroses. (Manas/Kaziranga)
   (iii) Harike Wetlands is located in ................. (Punjab/ Himachal Pradesh)
   (iv) .................. biosphere reserve is in the state of Tamil Nadu. (Gulf of Mannar/Pachmarhi)

2. Define Wetlands

3. Make a list of any three efforts you can make to safeguard Biodiversity of your surroundings?
   (i) ............................................................................................................
   (ii) ............................................................................................................
   (iii) ............................................................................................................

WHAT YOU HAVE LEARNT

• We are fortunate to have such a great biodiversity on the planet we live on.
• Being an integral part of nature, it is important for us to save it.
• People all over the world are working to safeguard this irreplaceable natural wealth and biodiversity.
• Natural vegetation and wildlife are important aspects of biodiversity.
• India is among the twelve mega biodiversity countries of the world having rich wildlife heritage and great range of natural vegetation.
• It is really important to know about the threats and the need of conservation of this natural wealth.
1. Define biodiversity. Explain the interrelationship between natural vegetation, wildlife and micro-organisms.

2. Describe in brief the characteristics and distribution of Tropical Evergreen Forests in India.

3. Give any two differences between the moist deciduous forests and the dry deciduous forests in India.

4. State three objectives for establishment of biosphere reserves in India.

5. What are the main causes of loss of biodiversity? State any four.

6. Justify the need for conservation of natural vegetation, wildlife and micro-organisms with suitable reasons.

7. Study the table given below and answer the following questions.

<table>
<thead>
<tr>
<th>Natural Parts/Wild life Sanctuary</th>
<th>Protected Wild Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Kaziranga</td>
<td>1. Tiger</td>
</tr>
<tr>
<td>2. Manas</td>
<td>2. Elephant</td>
</tr>
<tr>
<td>3. Periyar</td>
<td>3. Musk Deer</td>
</tr>
<tr>
<td>4. Corbett</td>
<td>4. Lion</td>
</tr>
<tr>
<td>5. Dachigram</td>
<td>5. Rhino</td>
</tr>
<tr>
<td>6. Wild Buffalo</td>
<td></td>
</tr>
<tr>
<td>7. Panther</td>
<td></td>
</tr>
<tr>
<td>8. Beer</td>
<td></td>
</tr>
</tbody>
</table>

(a) Match the name of the animal to the national park in which they are protected?

(b) Encircle the animal which are not protected in any national park?

(c) Write the name of the animal which is protected in more than one National Park?

8. Refer to Figure No.11.3

(a) Find out the type of vegetation in your state.

(b) Which areas have thorn forests?

(c) Which areas have tidal forests and why are they restricted to those areas?
ANSWER TO INTEXT QUESTION

11.1
1. Biodiversity is fundamental to the existence of life on the earth because this is extremely valuable in different facets of life which includes providing of food, water, fiber, fuel etc. and regulating of climate and diseases.

2. A biodiversity hotspot is a region with a high level of endemic species. Endemic species are those species that are found in a certain limited area.

11.2
1. Trees in these forests remain green all the year round as the climate of the region is warm and wet throughout the year. The leaves of the trees do not fall in any particular season. Hence they are evergreen.

2. (i) Tidal forests along the eastern coast provide protection against cyclones. But in recent years due to massive deforestation of these forests, these areas have been experiencing severe destruction during cyclones in recent years

(ii) Tropical evergreen forest has a dense and mixed vegetation of all kinds and hence, their economic exploitation is not viable whereas species in Himalayan vegetation are less dense and found in pure stand.

11.3
1. (a) 551
   (b) Kaziranga
   (c) Punjab
   (d) Gulf of Mannar

2. A wetland is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water.

3. Some of the efforts you can make to safeguard Bio diversity of your surroundings are: (i) stop cutting trees; (ii) plant more trees; (iii) protect all animals; (iv) establishment of hospitals for injured birds or animals; (v) stop throwing garbage and polluting environment.
You are well aware that a family continues generation after generation and also that organisms produce their own kind. This process of reproducing one’s own kind ensures the continuance of the variety of organisms that inhabit the earth. Reproduction is a characteristic feature of every living being and has its own role to play in the body just like the other biological processes such as respiration, circulation, nutrition and others.

In this lesson, you shall learn how new organisms gain life, grow and become ready to give rise to another generation of similar individuals. You shall also learn the importance of reproductive health and hygiene so as to prevent the spread of sexually transmitted diseases. This will enable you to make correct choices at the appropriate time.

**OBJECTIVES**

After completing this lesson you will be able to:

- appreciate that reproduction is a characteristic feature of organisms for the continuance of their species and that asexual and sexual reproduction are the two different modes of reproduction;
- identify the different types of asexual reproduction in organisms;
- identify the sex organs and describe in brief the process of reproduction in flowering plants;
- state facts about reproduction in animals with special emphasis on human reproduction;
- identify the changes in the human body upon reaching puberty and emphasize importance of reproductive health and hygiene;
- identify the major organs of reproduction in humans (both male and female), state their location in the body and relate each organ with its function;
Reproduction

- mention the reproductive events leading to pregnancy and parturition, and express concern regarding negative consequences of adolescent pregnancy;
- demonstrate awareness regarding the prevention and transmission of Sexually Transmitted Diseases (STDs) and Reproductive Tract Infections (RTIs) caused by microbes;
- express awareness of increase in population growth and suggest methods of population control.
- understand modes of transmission and prevention of Human Immuno Deficiency Virus (HIV)/Acquired Immuno Deficiency Syndrome (AIDS) and utilize this information in making safe informed choices.

24.1 REPRODUCTION

You must have heard from your parents what a joyful event it was when you were born! Your parents, elder relatives or family friends might have told you how happy they were to see you take your first steps! And then, as an infant, how you got frightened when a dog barked! Ask your parents about your infancy and childhood. They would certainly remember many anecdotes of the past while you as a teenager are now busy understanding changes within yourself as you grow into an adult. Note the changes as you progressed from infancy to childhood and thence to adolescence.

ACTIVITY 24.1

As you do so, make an album of your photographs from infancy to date. If there are no photographs, collect pictures of infants and growing children to get an idea of how changes take place in the body as one grows up.

As you read this lesson, you shall begin to realize that a naturally occurring feature of all organisms is to grow up. Microbes, plants, animals all need to grow up to an extent when they are able to perpetuate their own species. Thus, the species lives on from one generation to the next. The biological process involved in the perpetuation of species is called reproduction. Reproduction may be defined as the biological process by which organisms give rise to their own kind. Reproduction may occur in two ways:

- Asexual reproduction
— Sexual reproduction

Bacterial and protozoan offspring may be produced by single individuals. This is termed asexual reproduction. Certain animals and many plants reproduce asexually as shown in figures 24.1 to 24.3. When two individuals are involved in reproduction, it is termed sexual reproduction. In sexual reproduction, male gamete fuses with female gamete to mark the beginning of a new individual. This is a more common mode of reproduction in plants and animals.

### 24.2 ASEXUAL REPRODUCTION

Reproduction by single individuals takes place in many ways in lower organisms like bacteria and protozoa and some algae. In plants, asexual reproduction is by vegetative propagation. Animals like sponges and hydra reproduce both asexually and sexually.

(i) Asexual reproduction in lower organisms

Asexual reproduction is of various types:

(a) **Binary fission:** A cell may divide to give rise to two individuals and lose its own identity as in binary fission that takes place in amoeba and bacteria (figure 24.1).

(b) **Budding:** In budding, a bud forms from the body of the mother cell and remains attached to it. The parental nucleus elongates and then divides into two, one of which moves into the bud. Example: yeast (figure 24.2).

In animals like sponges and hydra which are multicellular; a bud arises from some part of the body, enlarges and then detaches from the parent body after all its body parts have been formed (figure 24.3).

(c) **Spore formation:** The cytoplasm and nucleus of algae such as *Chlamydomonas* divide...
successively to form 4 to 8 spores. Spores are also formed for reproduction in fungus, moss and fern. Spores are single cells which upon their release from the parent plant develop into new individuals (figure 24.4).

(ii) Asexual reproduction in plants

**Vegetative Propagation:** In nature, new plants may arise from root, stem or leaves that is from the vegetative parts of the plant as shown in fig. 24.5 (a to h). This form of asexual reproduction in plants is termed **vegetative propagation**.

<table>
<thead>
<tr>
<th>Mode of reproduction</th>
<th>Specialised plant part</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Natural Methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Roots (fig. 24.5 a&amp;b)</td>
<td>Adventitious roots</td>
<td>Sweet potato, Dahlia</td>
</tr>
<tr>
<td>(b) Stem</td>
<td>(a) Runner (fig. 24.5g)</td>
<td>Lawn grass, Chrysanthemum</td>
</tr>
<tr>
<td>(c) Leaves</td>
<td>(b) Sucker(fig. 24.5h)</td>
<td>Onion</td>
</tr>
<tr>
<td></td>
<td>(c) Bulb (fig24.5c)</td>
<td>Potato, Canna</td>
</tr>
<tr>
<td></td>
<td>(d) Tuber (fig.24.5d)</td>
<td>Ginger</td>
</tr>
<tr>
<td></td>
<td>(e) Rhizome (fig. 24.5e)</td>
<td>Bryophyllum</td>
</tr>
<tr>
<td></td>
<td>(f) Adventitious buds (fig. 24.5f )</td>
<td></td>
</tr>
<tr>
<td>(B) Artificial Methods(fig. 24.6 a to c)</td>
<td></td>
<td>Rose, Money Plant</td>
</tr>
<tr>
<td>(a) Cutting</td>
<td></td>
<td>Jasmine, Grapevine</td>
</tr>
<tr>
<td>(b) Layering</td>
<td></td>
<td>Citrus, Mango</td>
</tr>
<tr>
<td>(c) Grafting</td>
<td></td>
<td>Orchid, Chrysanthemum, Asparagus.</td>
</tr>
</tbody>
</table>

New plants may be formed from roots (fig. 24.5 a,b) or stem (24.5 c,d,e) or leaves (fig.24.5f) or when a stem grows to a distance and then enters soil and strikes roots to form a new plant (fig. 24.5 g,h)
(iii) Artificial propagation in plants

Humans have taken hints from natural methods of vegetative propagation to grow many plants through artificial propagation. Fig. 24.6 shows the various methods by which farmers and nursery owners multiply desired plants using the method of artificial propagation.

(a): Cutting: A piece of branch is cut and embedded in the soil. Roots form and a new plant results.

(b): Layering: A branch of the plant is laid on the ground and a portion is embedded in the soil. This part strikes root and gives rise to new plant.

(c): Vegetative reproduction by gootee

(d): (a) The lower part of the stem or scion is cut in a wedge, (b) The shoot of the plant to be used as a stock is cut off. The stem is slit vertically and the scion is inserted into the stock and tied with a tape (c) The graft union occurs within a short time

Fig. 24.6 (a to d): Artificial vegetative propagation in plants
ACTIVITY 24.2

1. Take a branch from a champa tree or a money plant. Grow it. Observe how the branch produces a full fledged plant.

2. You may even try to grow some grass picked up from the wild. What do you find? Under which conditions does the grass reproduce to form a carpet of grass? Write your observations in the space provided below:

(iv) Other methods of asexual propagation

In the laboratories, researchers have raised offspring from single parent through tissue culture. Dolly was a sheep, an exact copy of her mother, raised through cloning.

(a) Micropropagation

Researchers have standardized the methods of tissue culture. Every living cell or every part of a plant has been found to be totipotent, that is, it has the potential to give rise to more plants. Can you explain why? Try and answer after you have finished reading this lesson and can understand that all the cells of an individual arise from a single cell, the zygote and hence all cells have the same genes. Genes control growth, development and all the life processes.

From a piece of plant, say root of carrot, or a leaf, cells can now be cultured in adequate nutrient solution to form an undifferentiated mass of cells called callus which can then give rise to new plantlets. The raising of plants through tissue culture is termed micropropagation. (figure 24.7)

*Fig. 24.7 Steps of Micropropagation (a) Leaf taken from a plant (b) Cells form undifferentiated mass (callus) (c) Hormones and nutrients added to cells (d) New plant grows from callus*
(b) Cloning

A clone is the genetic copy of the parent. The sheep Dolly, when born was an exact copy of her mother. Her mother’s udder cell nucleus was transferred into the egg of a “surrogate mother”, after removing the nucleus. Dolly’s mother provided her genes while the surrogate mother provided the womb (Fig. 24.8) for Dolly to develop from an embryo to a full fledged individual.

**Fig. 24.8 Cloning of the Sheep Dolly**

### INTEXT QUESTIONS 24.1

1. Define reproduction.

2. State one point of difference between asexual and sexual reproduction.

3. Why is binary fission considered to be an asexual form of reproduction?

4. Define vegetative propagation with the help of an example.

5. Define the following (i) callus (ii) clone

### 24.3 SEXUAL REPRODUCTION IN PLANTS

You already know that sexual reproduction requires fusion of male and female gametes. We shall now understand how sexual reproduction takes place in flowering plants.
Reproduction

(i) Sexual reproduction in plants

The reproductive organ of flowering plants is the flower (Fig. 24.9). **Stamens (Androecium)** which produce pollen are the male part. **Pollen grains** contain male sex cells. There may be several stamens in each flower. Each stamen (Androecium) has two parts. The upper part is known as **anther** which bears pollen. It is held on the lower part called **filament**. The **pistil (Gynoecium)** is the female part and its basal part is the ovary carrying eggs or ovules or female sex cells. The parts of the pistil are the stigma, style and ovary. In most plants, each flower bears both male and female parts. They are termed **bisexual**. In some plants there are male flowers with only androecium and female flowers bearing only gynoecium. They are **unisexual**.

**ACTIVITY 24.3**

1. Procure a wilted flower and look for the stamen and pistil. Identify the different parts and then check the terms for these parts in the pictures given in your book.

2. Do you think we should pluck flowers from the plants?  
   State ‘Yes’ or ‘No’ choosing points from the following
   - look nice on plants
   - are living
   - where will butterflies go? Provide food for the butterflies
   - are organs of reproduction?

3. What do you think will happen if we pluck all the flowers that bloom on a plant?  
   Write your answer in the space provided below:

(ii) Pollination and fertilisation

For fusion of their nuclei, pollen and ovule are brought together by several agencies like the wind, water, and insects. This transfer of pollen grain from anther to the stigma of a flower is called **pollination**. **Self pollination** is when pollen
of a flower falls on its own stigma and fertilizes the ovule. In **Cross pollination** pollen from one flower falls on the stigma of another flower of a different plant of the same species and then fertilizes the ovule of that flower. Agents like wind, water or insects help to transfer pollen from one flower to another.

For **fertilization or fusion of nuclei of pollen and ovule**, pollen is brought by any pollinating agent mentioned above, on the stigma of the pistil. Each pollen grain forms a pollen tube and pollen grain nucleus reaches the ovule as pollen tube pushes through the pistil (Figure 24.10). The fertilized ovules develop into seeds which are capable of germinating into seedlings and new plants (Fig. 24.11).

Once seeds are formed, they get dispersed or are carried away from the parent plant and then germinate under favourable conditions.

**INTEXT QUESTIONS 24.2**

1. What purpose does the flower serve in a plant?
Reproduction

2. Give one point of difference between self pollination and cross pollination.

3. What will happen if the pistil of the flower is removed?

4. Trace the path of the pollen after it lands on the stigma.

5. What is germination of seed?

ACTIVITY 24.4

Now that you have an idea of how plants reproduce, find answers to the questions below and perform the related activities.

1. Have you seen plants growing from buildings or near walls? Think and express how this may happen. Express your views in the space provided below:

2. Grow wet seeds which take less time to germinate (e.g. gram, moong). After they have sprouted. Sow them in pots. Maintain them till they become seedlings. Maintain a record of the time period showing maximum growth, flowering and formation of seeds.

24.4 SEXUAL REPRODUCTION IN ANIMALS

As mentioned earlier (24.1 section i )) lower animals like the sponge and hydra can reproduce through asexual methods. They can, however, also reproduce sexually. In all animals, the female produces eggs and the male produces sperms. An egg and a sperm fuse to form the zygote which then develops into the embryo and the embryo into a full-fledged individual. The development may occur partially or completely, inside the egg. Such animals that lay eggs include fish, frog, reptiles and birds and are thus called oviparous. In mammals such as cats,
dogs, cows and humans, the baby develops inside the mother’s womb. They are termed **viviparous**.

In tapeworms and earthworms both female and male sex organs are in the same individual. Such individuals are termed **hermaphrodite**. Sexes are separate in all other animals, and the male individual has male organs like testes etc. while the female has ovaries etc. Humans also belong to the animal kingdom. They are mammals and hence viviparous.

### 24.5 REPRODUCTION IN HUMANS

The period from infancy to reproductive maturity in humans includes childhood and adolescence. The pictures given below show the progression of human life through stages of infancy, childhood, adolescence, adulthood, and finally ageing.

#### 24.5.1 Adolescence in human beings

**ACTIVITY 24.5**

Look at the pictures depicting stages of human life. Write down two to three sentences that come to your mind about each of these stages. Encircle with a pencil the picture showing that stage of life at which you are now. Label the appropriate stages as infancy, childhood, adolescence, adulthood and old age.
The body undergoes natural changes as one grows into the reproductive period of life. These changes begin around the age of 10-11 and last till 18 to 19 years of age. This stage of life is called **adolescence**. The time period when changes occur in humans make them capable of reproduction, is called **puberty**. Not only humans, but no organism becomes mature and capable of reproduction soon after birth and needs to reach maturity and adulthood in order to do so. The period between birth and maturity is very short in animals. Perhaps it is the longest in humans.

Read carefully the table given below wherein changes during adolescence are listed. It is important to remember that although these changes occur in all adolescents, the timing and pace of changes may differ from individual to individual. This just goes to prove that each of us is unique!

Table 24.2 shows changes at puberty. The changes are physical, physiological and psychological.

### Table 24.2 Changes at puberty and adolescence

<table>
<thead>
<tr>
<th>Physical Changes</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Increase in height</strong></td>
<td>It is one of the most perceptible change during adolescence. Increase in height is dependent on the genetic make up, nutritional status, and physical activity levels of an adolescent.</td>
</tr>
<tr>
<td>• Bones elongate</td>
<td>Adequate nutrition is necessary for proper growth.</td>
</tr>
<tr>
<td>• Muscles develop</td>
<td>Adolescents need a balanced combination of food items that provide energy (known as carbohydrates and fats), that help in growth (known as proteins) and protect from infections by enhancing immunity (known as vitamins and minerals).</td>
</tr>
<tr>
<td>• Height increases</td>
<td>Depending on whether you are a vegetarian or a non-vegetarian, choose appropriately from the following five groups of food items.</td>
</tr>
<tr>
<td>•</td>
<td>1) cereals and millets, 2) vegetables and fruits, 3) milk, milk products, meat, fish, egg, 4) pulses, 5) fats and sugar</td>
</tr>
<tr>
<td></td>
<td>Please refer to the health and hygiene lesson 32 for more information on balanced diet.</td>
</tr>
<tr>
<td></td>
<td><strong>Chips, soda, chocolates, pastries and burgers should not replace a meal and should not be consumed on a regular basis.</strong></td>
</tr>
<tr>
<td></td>
<td>• Regular physical exercise helps in proper growth.</td>
</tr>
<tr>
<td><strong>2. Changes in body shape</strong></td>
<td></td>
</tr>
<tr>
<td>• Chest and shoulders broaden in boys</td>
<td></td>
</tr>
<tr>
<td>• Increased fat deposition below the waist (around hips) in girls</td>
<td></td>
</tr>
<tr>
<td><strong>3. Changes in the voice</strong></td>
<td>Boys develop a deep voice. Their voice sometimes cracks when the larynx or voice box is enlarging and voice control is lost during that time.</td>
</tr>
<tr>
<td>• In boys, voice box or larynx enlarges and is visible as the “Adam’s apple”</td>
<td>Girls develop a high pitched voice.</td>
</tr>
</tbody>
</table>
4. Development of sex organs
In both the females and males, sex organs mature during adolescence. More details on the structure and functioning of sex organs are provided later in this lesson.

5. Appearances of secondary sexual characters
- Axial (arm pits) hair and pubic hair appear.
- Breasts develop in girls.
- Facial hair begins to grow in boys.
- Girls and boys become capable of reproduction. It is important to observe proper hygiene and wash all parts of the body, including external genital organs in girls and testicles in boys.
- It is normal for adolescents to feel sexual excitement and masturbate. When a boy becomes sexually excited in a dream, he may experience an erection and ejaculate in his sleep. This is known as ‘wet dream’ and is normal.
- Breast development is one of the first signs of puberty in girls. Variation in the size and shape of breasts is normal and depends on the amount of fat stored in them. Size of the breasts is not correlated with production of milk or giving pleasure.

Do you know
If a female notices any change in her breasts, for example, a lump, changes in breast shape, discharge from nipples, pits or hollow in the skin around the breast, she should consult a health worker/doctor immediately.

<table>
<thead>
<tr>
<th>Physiological Changes</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| **1. Increased activity of sweat and sebaceous (oil) glands** | • Overactivity of oil glands may cause acne and pimples on the face. The acne usually go away once the hormonal changes stabilize. However, these can be reduced by washing face with soap and water several times in a day, eating lots of fruits and vegetables, drinking several glasses (at least 8-10) of water everyday and avoiding fried and fat rich food items. Avoid picking pimples as they could get infected and leave scars. Consult a health worker/doctor if the acne are particularly troublesome.  
• Regular cleaning and washing will help prevent odour due to increased sweating. |
| **2. Increase in appetite**  
Body requires more nutrition as it grows. | At adolescence, the body grows rapidly and this makes adolescents more hungry. |
| **3. Increase in the level of hormones in blood**  
Levels of growth hormone and sex hormones in blood increase. | • The growth hormone secreted by anterior pituitary gland controls growth.  
• Under the influence of hormones from anterior pituitary, sex organs begin to secrete sex hormones. The testes secrete testosterone in males and ovaries secrete oestrogen and progesterone in females. |
4. Menstruation

- In human females, the reproductive phase begins at puberty and lasts till the age of 45 to 50 years.
- A girl is born with a fixed number of ova (eggs). However, these begin to mature only at puberty. One ovum matures at a time and is released from the ovary once in 28 to 30 days. This happens under the influence of a hormone from anterior pituitary FSH or Follicle Stimulus Hormone. One ovum (egg) is shed alternately from each ovary every month.
- The egg (ovum) travels down the fallopian tube to reach the uterus.
- At the same time, the wall of the uterus under the influence of another hormone from anterior pituitary called LH or Luteinising Hormone thickens to receive fertilized egg. If there is no fertilization, the thickened lining of uterus and blood vessels are shed off and cause bleeding. This is called menstruation (Fig 24.12) and is also known as period.

The first menstrual bleeding is called menarche. Stoppage of menstruation at an age usually between 45 years and 55 years is termed menopause.

Many females have a period every 28 days. Some have them every 21 days and in others the cycle could be of 35 days. Periods usually last for 4 days but could be shorter or longer. Many adolescent girls have irregular and painful periods that settle down as girls grow up. If the problem persists, a medical doctor should be consulted.

Menstruation is not an illness. If the girl feels comfortable, she could do anything that she does normally. Some girls may get cramps and pain in the abdomen. Exercise may help to prevent the pain. Paracetamol and/or other pain killer as suggested by a doctor may help if the pain is difficult to bear.

Girls use sanitary towels, cotton wool, clean cloth or tampons to absorb blood during their periods but it is important to change these frequently (every 6-8 hours) to prevent infection from reaching vagina. If reused, cloth should be washed with a mild detergent and dried in the sun.

Adolescents may be biologically capable of reproduction but they are not ready to shoulder the responsibilities of parenthood. Adolescent girls are not physiologically mature for child bearing and many a time, both the adolescent mother and her baby suffer from complications. Adolescent parents are not likely to have good opportunities of education and livelihood and may not be able to provide for their child. Even though the legal age at marriage is 18 for girls and 21 for boys, child marriage is still a problem in our country. Data from the National Family Health Survey conducted in 2005-6 show that 27% young women and 3% young men in the age group of 15-19 were married at the time of the survey. Furthermore, findings from the same survey show that 30% females in the age group of 15-19 have had a live birth by the age of 19 years.
Can you reason out?

Can you give two reasons as to why menstruation does not occur during pregnancy?

**Hints**

(i) Menstruation occurs when fertilization does not happen and the egg as well as thickened lining of uterus and blood vessels are shed off.

(ii) During pregnancy, the growing foetus is attached to thickened uterine wall.

Psychological changes

Mental, emotional and intellectual maturity develops gradually:

- Adolescents are capable of abstract thinking.
- They experience mood swings.
- They become self conscious.
- Self image and identity becomes important.
- Friendship is very important to them.
- They start getting interested in one another in a sexual way.
- Opinions expressed by peer that are different from their personal beliefs could be a source of stress and anxiety as it is important for them to **fit in** with the group norms.

Adolescents should definitely enjoy this phase of their lives but also invest in their future! It is important to strike the right balance!!

Initiating and nurturing friendships and positive relationships is a vital part of growing up. However, it is important that relationships are built on equality, mutual respect and love. Relationships that lack these attributes could be exploitative and cause physical, emotional and psychological harm that may prevent young people from realizing their potential. Sexuality is an important part of growing up but decisions related to sex and sexuality should be based on appropriate information, an understanding of consequences and most importantly a sense of responsibility.

Striving for independence is a very important part of adolescence. Young people need to remember that they should be able to take responsibility for their independent decisions.
ACTIVITY 24.6

The following chart gives the average rate of growth in the height of boys and girls with age. The figures in columns 2 and 3, give the percentage of the height which a person has reached at age given in column 1. For example by age 11, a boy has reached 81% of his full height. These figures are only representative and there may be individual variations.

Use the table for yourself and your friends and work out how tall each of you is likely to be. Is it not fascinating that each one of you is likely to be slightly different from the other!

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>% of full height</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>8</td>
<td>72%</td>
<td>77%</td>
</tr>
<tr>
<td>9</td>
<td>75%</td>
<td>81%</td>
</tr>
<tr>
<td>10</td>
<td>78%</td>
<td>84%</td>
</tr>
<tr>
<td>11</td>
<td>81%</td>
<td>88%</td>
</tr>
<tr>
<td>12</td>
<td>84%</td>
<td>91%</td>
</tr>
<tr>
<td>13</td>
<td>88%</td>
<td>95%</td>
</tr>
<tr>
<td>14</td>
<td>92%</td>
<td>98%</td>
</tr>
<tr>
<td>15</td>
<td>95%</td>
<td>99%</td>
</tr>
<tr>
<td>16</td>
<td>98%</td>
<td>99.5%</td>
</tr>
<tr>
<td>17</td>
<td>99%</td>
<td>100%</td>
</tr>
<tr>
<td>18</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Present height (cm)/% of full height at this age x 100 
(as given in the chart)

*Example:*

A boy is 9 years old and 120cm tall. At the end of the growth period he is likely to be $120/75\times100 = 160$ cm tall.

ACTIVITY 24.7

- Have a frank and honest discussion with your friends about the kind of changes you are undergoing in your body and mind. You may find certain commonalities and some things that are unique to each of you.

- Is there a change during adolescence that makes you happy and a change that makes you nervous and anxious? Share it with your friend. You may go to
website of NIOS and Adolescence Toll free phone number 18001809393 for more information related to these changes

- Quote at least one incident when you experienced a mood swing. In your opinion, were you able to handle it well? If not, what could you do the next time to either prevent the mood swing or manage it better.

### 24.6 THE ORGANS OF REPRODUCTION IN HUMANS

Reproduction in humans require two individuals - a male and a female.

![Male Reproductive Organs](image)

**Fig. :24.13 Male Reproductive Organs**

(i) **The male reproductive organs**

The male reproductive organs are shown in Figure 24.13. The functions of its parts are tabulated in table 24.3.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A pair of testes</td>
<td>Generate Sperms</td>
</tr>
<tr>
<td>Two sperm ducts or vas deferens (Singular: Vas deferens)</td>
<td>Each arises from the testis and passes up into the body to join together and form the ejaculatory duct.</td>
</tr>
<tr>
<td>One ejaculatory duct</td>
<td>Is a common duct for passage of urine and sperms.</td>
</tr>
<tr>
<td>One Penis</td>
<td>Muscular organ which helps to transfer sperms into female body.</td>
</tr>
</tbody>
</table>
The testes lie outside the body within the scrotal sac. This is to ensure that the temperature at which sperms are being produced is 2°C less than body temperature as required for sperms to stay alive.

(ii) The Female reproductive system

The figures 24.14(a) and 24.14(b) are figures of (1) the human female reproductive system and (2) section of the female reproductive tract showing the movement of the egg released from the ovary/fertilised in the fallopian tube and zygote undergoing development till it reaches the uterus and implants in its wall for further development.

The female reproductive system is located in the lower abdomen. The organs of the female reproductive system and their functions are tabulated in Table 24.4. The ovary and oviduct are commonly found in all female animals and the uterus in those who do not lay eggs but give birth to young.

![Female Reproductive Organs in Humans](image)

![Female Reproductive System showing the movement of fertilised egg](image)

**Table 24.4 The human female reproductive organs and their functions**

<table>
<thead>
<tr>
<th>Organs</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A pair of ovaries</td>
<td>Produce ova</td>
</tr>
<tr>
<td>Two fallopian tubes</td>
<td>Are the oviducts through which eggs pass from the ovaries into uterus</td>
</tr>
<tr>
<td>One uterus</td>
<td>The womb in which the embryo develops</td>
</tr>
<tr>
<td>One cervix</td>
<td>The opening of uterus</td>
</tr>
<tr>
<td>One vagina</td>
<td>Female opening</td>
</tr>
</tbody>
</table>
INTEXT QUESTIONS 24.3

1. Define the terms (i) adolescence (ii) puberty (iii) hermaphrodite (iv) oviparous (v) viviparous (vi) foetus

2. Name the hormones secreted by the testes and ovary.

3. Name the part of the female reproductive system where the egg gets fertilised by the sperm.

4. State the function of (i) uterus (ii) vas deferens

5. Consider the three case studies given below. Please provide your suggestions for managing these situations in 2-4 sentences each.

   **Case 1:** Your friend, Suresh is extremely shy and withdrawn because he is growing hair at many places in his body. His voice is croaky and sometimes he gets dreams which make him feel ashamed of himself. How will you convince Suresh that what he is undergoing is absolutely normal and natural?

   **Case 2:** Rehman, your friend, is disappointed because he is the same age as most of the friends but in comparison to others, he looks baby-faced and has no facial hair. How will you get him out of this ‘odd man out’ feeling? Suggest two ways.

   **Case 3:** Your cousin Madhu is prevented from entering the kitchen and entering places of worship during menstruation and Madhu feels that she is being punished for something that is normal and definitely not her fault. Based on your understanding of menstrual cycle, do you think this is a correct practice? If not, please provide at least two reasons to convince your aunt to stop this practice.

6. Your friend Kiran would not look at boys during her periods as she had heard from someone that if she did so she would become pregnant.

Write a letter to Kiran that helps her realize that she is holding on to a false belief.

24.7 FERTILISATION AND EMBRYONIC DEVELOPMENT IN HUMANS

Observe figure 24.15 (a to g) carefully. It shows the steps of reproduction in humans. The figure (a) and (b) are the human gametes, *sperm, the male gamete* generated in
the testis (spermatogenesis) and egg or ovum, the female gamete produced in the ovary through the process of oogenesis.

- The nuclei of sperm and egg fuse inside the egg, forming the zygote. This fusion is termed fertilisation and takes place in the fallopian tube (the oviduct). (fig24.15(c)).
- The fertilised egg or zygote begins to divide repeatedly and upon reaching a stage containing cells and a cavity called blastocoel, gets embedded (e) in the thickened uterine wall in which many blood capillaries have formed.

**Gametes:**
Reproductive cells that fuse during fertilization to form a zygote which develops into an embryo. For example, Male gamete = sperm  
Female gamete = egg or ovule

**Fig. 24.15: Events in reproduction of humans**
In case fertilisation does not occur the egg disintegrates. The thickened wall of uterus along with capillaries breakdown leading to bleeding or menstrual flow (menstruation). In human female menstruation occurs every 28 to 30 days (fig. 24.12).

The embryo, now called foetus develops (f) and (g) into a full fledged individual in 280 days inside the uterus and is born under the influence of a hormone from posterior pituitary, called oxytocin.

**INTEXT QUESTIONS 24.4**

1. List, in a sequence the events that lead to the birth of a new individual.

2. Name the hormones responsible, for attaining reproductive maturity, and for formation and maturing of sperms and eggs in humans.

3. Given below is a list of hormones related to reproduction. List influence on functions in the space given below:

   FSH, LH, Estrogen, Testosterone, Oxytocin

<table>
<thead>
<tr>
<th>Hormones</th>
<th>function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**24.8 HUMAN POPULATION**

You may be aware that the population of India is more than a billion and continues to grow. In terms of numbers, India may overtake China that is currently the most populous nation of the world in the next two decades.

It is not difficult to imagine that a strong force of one billion people working together can achieve all the development goals and even more. However, India lags behind on several development indicators and needs to make systemic and consistent investments in education, health, employment and social welfare before its vast human potential can be realized. Young people like you have an important responsibility to take the country forward.
ACTIVITY 24.8

1. Suppose you are the Prime Minister of India. State three key areas in which your government will invest for improving the pace of development in the country so that the vast human potential can be realized?

____________________________________________________________________
____________________________________________________________________

2. India is struggling with issues related to a large population. On the other hand, countries like Japan and Sweden are worried that their population is not growing and are giving incentives to young people in their country to contribute towards population growth. Please fill the table below to identify the major advantages and problems that countries with large and small populations face.

<table>
<thead>
<tr>
<th>India (Large Population)</th>
<th>Sweden (Small Population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td>Problems</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24.8.1 Making Informed Choices about Family Size

The decisions that individuals make about the size of their families will contribute towards limiting the size of the population of the country. Decisions related to family size are motivated by people’s aspirations and resources. In a large segment of Indian society, there is pressure on the young couples especially, the females to prove their fertility and bear male children. Undoubtedly, children are a valuable component of the family. However, unplanned pregnancy may compromise the health and well being of both the mother and the child. In addition, if the parents are not ready to provide for the child both in economic and emotional terms, the child may not get the opportunities for holistic growth and development.

All of us recognize that planning is an important part of decision making but it is important to have correct and appropriate information to make informed decisions. Planning the size of the family and the timing of child birth helps to achieve better quality of life as there are likely to be sufficient resources to spend on food, education, health and well being of all the members of the family. Whose decision would that be?

Some of the modern methods for preventing pregnancy, also known as ‘contraception’ are outlined in Table 24.5 below. Contraceptive methods are...
broadly classified into two categories: temporary and permanent methods. With the use of temporary methods, fertility returns after stopping the use of these methods. Hence, they are appropriate to delay the birth of the first child and/or increase birth interval between two children. Permanent methods are irreversible for all practical purposes and are appropriate for couples who have completed their families and do not want any more children. Contraceptive methods should be adopted based on the couple’s need and after consultation with a trained medical practitioner.

### Table 24.5: Common Methods of Contraception

<table>
<thead>
<tr>
<th>Device</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temporary Methods</strong></td>
<td></td>
</tr>
<tr>
<td>Condoms in males/ Diaphragms in Females</td>
<td>Physical barrier that prevents sperm from meeting the egg</td>
</tr>
<tr>
<td>Intra Uterine Contraceptive Device (IUCD), for example, Copper T</td>
<td>Inserted in female body by medical practitioner to prevent implantation of the growing embryo.</td>
</tr>
<tr>
<td>Oral contraceptive pills</td>
<td>Pills interfere with ovulation and prevent release of ova from the ovaries. As a result, fertilization cannot occur. These should be started under guidance from a trained medical practitioner.</td>
</tr>
<tr>
<td><strong>Permanent Methods</strong></td>
<td></td>
</tr>
<tr>
<td>Vasectomy in males /Tubectomy in females</td>
<td>Are surgical methods for tying up the tube vas deferens through which sperms travel in males and in females blocking fallopian tube preventing fertilization.</td>
</tr>
</tbody>
</table>

The government has established a number of health service delivery institutions at different levels where contraceptive methods are available free of cost or at heavily subsidized rates. Clients may also seek counselling services at these centres.

### 24.9 REPRODUCTIVE TRACT INFECTIONS AND SEXUALLY TRANSMITTED DISEASES

Reproductive Tract Infections (RTIs) refer to infections of reproductive organs. These illnesses may occur due to poor genital hygiene, for example, poor
menstrual hygiene among girls. Importantly, RTIs include the illnesses that are transmitted from one person to another during sexual contact and are known as Sexually Transmitted Diseases (STDs).

### 24.9.1 STDs

These infections may be transmitted during vaginal or anal intercourses, or genital skin contact. Gonorrhea, syphilis, herpes, chlamydia, warts and chancroid are common STDs. Human Immuno-deficiency Virus (HIV) can also be transmitted through sexual contact.

Symptoms of STDs include,

- Itching or soreness of genitals or anus
- Blisters, sores, lump, rash in uro-genital areas
- Discoloured discharge that may be foul smelling from vagina in females and penis in males
- Pain during urination
- Women may also complain of pain in lower back and abdomen

Some infected persons may not show any symptoms and may pass on infection to their partners unknowingly.

Did you know that compared to men:

- women acquire STIs more easily as the disease causing organisms can stay inside the vagina for a longer time?
- women are also likely to be asymptomatic (without showing symptoms of STD) for longer periods of time after acquiring the infection?
- young women are more susceptible to acquire STDs as their vaginal mucosa is immature?

It is important to see a doctor if any of the symptoms of STDs occur. Prompt and complete treatment can cure most of the Sexually Transmitted Diseases. Untreated STDs can lead to infertility. The sexual partner of the infected person should also seek medical advice and treatment. Unless the infected individual is cured, s/he should avoid sexual intercourse. STDs can be prevented by:

- having one faithful sex partner
- having safe sex with correct and consistent use of condoms
24.10 HIV/AIDS

Human Immunodeficiency Virus (HIV) causes Acquired Immuno-Deficiency Syndrome (AIDS). HIV is a retro virus, i.e., its genetic material is RNA. It destroys vital cells of the immune system making the body vulnerable to several infectious agents. It infects T-lymphocytes and makes thousands of copies of the virus. HIV-infected individual may remain asymptomatic for 10-15 years. Gradually, the number of T-helper cells of the immune system decrease in number to a low when the victim loses resistance against other diseases. This is the stage of full-blown AIDS.

It is estimated that across the world, 30 million adults and 3 million children below the age of 15 live with AIDS. HIV may be transmitted from one infected individual to another individual by the following mechanisms:

- Unprotected sexual intercourse
- Infected blood
- Infected syringes and needles: Injection-drug users may acquire HIV through this route by sharing infected needles. Similarly, HIV may be transmitted if infected needles are used for tattooing, acupuncture
- Infected mother to her baby in utero (in the womb), during child birth and through breast milk

As discussed under prevention of STDs, HIV transmission can be prevented by:

- Having one faithful sex partner
- Having safe sex with correct and consistent use of condom

In addition, HIV transmission can be prevented by:

- Using sterilized needles for blood donation or transfusion or getting injections
- Pregnant women infected with HIV should seek advice from medical practitioner on the safest mode of delivery and seek counselling regarding breast feeding the baby.

Anti-retro viral therapy is available to check the progression from HIV infection to full-blown AIDS and has been shown to be effective.

You have just learnt how HIV/AIDS is transmitted. It is not transmitted through kissing, holding hands, hugging, sharing toilets, sharing clothes, food and drink, sneezing, coughing or mosquitoes. Hence, AIDS positive individuals should not be stigmatized or discriminated against.
INTEXT QUESTIONS 24.5

1. Name any four sexually transmitted diseases.

2. Name four devices which prevent fertilization in humans.

3. Expand the abbreviations (i) HIV and (ii) AIDS.

WHAT YOU HAVE LEARNT

• Reproduction is a characteristic of all living beings.
• It is the biological process of producing offspring of one’s own kind.
• Reproduction may be asexual or sexual.
• In asexual reproduction offspring are produced by single individual.
• In sexual reproduction, a male individual and a female individual are needed.
• Hermaphrodites like tapeworm and earthworm have both male and female organs in same individual.
• Asexual reproduction in protozoa is by binary fission, in yeast and hydra by budding. In plants, parts like roots, stem and leaves may give rise to new plants. This is called vegetative propagation. Plants may be artificially propagated by layering, cutting, goottee etc. Recent laboratory methods are micro propagation and cloning.
• Sexual reproduction requires the fusion of male and female reproductive cells/gametes. In plants, flower is the reproductive part. Its stamens are the male part and pistil, the female part.
• The male gametes is the pollen of one plant may reach the female gamete of the same flower or same kind of flower by being transferred on the stigma of the pistil by agencies like wind, water or insects.
• Fusion of male and female gametes is called fertilisation.
• After fertilisation, ovules form seeds. Seeds can germinate into new plants.
• Reproductive maturity in humans begins during puberty in the adolescents. During adolescence, boys and girls undergo physical, physiological and psychological changes.
Sexual reproduction in animals begins with fusion of sperm and egg (ova). Sperms develop testes, the male organ and ova in ovary, the female organ. Animals may lay eggs (oviparous) or the embryo may develop completely inside the uterus (viviparous).

Male and female reproductive parts in humans are: Male- a pair of 2 testes, 2 vas deferentia, one ejaculatory duct passing through penis. Female: - a pair of ovaries, 2 oviducts or fallopian tubes, one uterus, one vagina opening to the outside.

Reproductive events are under the control of hormones.

After fertilisation, the embryo which implants in the mother’s uterus becomes the foetus. Foetus completely develops in the mother’s womb.

India has the largest human population after China. Population is one of the greatest resources for the country. Planning the size of the family and the timing of child birth helps to achieve better quality of life as there are likely to be sufficient resources to spend on food, education, health and well being of all the members of the family. There are several methods of contraception that can be used based on the needs of the couple.

Certain diseases are transmitted through sexual acts. These are sexually transmitted infections due to virus and bacteria and HIV-AIDS caused by HIV virus.

1. Name the biological process by virtue of which a species continues from generation to generation?
2. Mention two differences between asexual and sexual modes of reproduction?
3. Mention an example for each of the following methods of reproduction.
   (i) Budding          (ii) Spore formation
   (iii) Binary fission  (iv) Vegetative reproduction
4. Why is vegetative reproduction considered as a type of asexual reproduction?
5. Mention the specialized parts that are responsible for vegetative mode of reproduction in the following plants
   (i) Ginger          (ii) Grass
   (iii) Onion         (iv) Potato
6. How is artificial vegetative propagation different from natural vegetative propagation? How is the former beneficial to humans?

7. How is a callus developed in tissue culture? Give the steps.

8. Why is it said that all living cells are totipotent? Explain.

9. Label the following parts in the given diagram
   (i) part that produces pollen.
   (ii) part of the flower that receives the pollen.
   (iii) part that contains ovules.
   (iv) the part of the flower that holds the anther.

10. Justify the following statements:
    (i) Birds, reptiles and frogs are called ‘Oviparous’.
    (ii) Human are ‘Viviparous’.
    (iii) Earth worm is a ‘hermaphrodite’.
    (iv) The sheep ‘Dolly’ was a clone of her mother.

11. Trace the events after pollination that lead to seed formation.

12. Identify (a) (b) (c) and (d) in the following table

<table>
<thead>
<tr>
<th>Reproductive organ of Human</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Testes</td>
<td>1) Produces the hormone........(a)......</td>
</tr>
<tr>
<td>2. ........(b)..................</td>
<td>2) The womb in which the embryo develops</td>
</tr>
<tr>
<td>3. Cervix</td>
<td>3) ........(c).........................</td>
</tr>
<tr>
<td>4. ........(.d..)...............</td>
<td>4) Arise from the testis and later join together to form ejaculatory duct.</td>
</tr>
</tbody>
</table>

13. List the physiological changes that arise at puberty in
   • human female
   • human male

14. Mention the psychological changes that are experienced by the adolescents.

15. Mention the fate of the thickened uterine lining in human if in case fertilisation does not occur.

16. Do you agree with the statement “A strong force of one billion Indians can achieve all the developmental goals and lot more”? Why/Why not?

17. Why is it that -
    (i) Women acquire STIs more easily as compared to men?
    (ii) Young women are more susceptible to acquire STIs as compared to men?
ANSWERS TO INTEXT QUESTIONS

24.1
1. Biological process by which organisms give rise to offspring of their own kind.

2. **Asexual**
   - Offspring produced by single individual
   - Sexual
   - Offspring produced by two individuals

3. Cell divides to give rise to two offspring while losing its own identity

4. New plants may arise and grow from roots, stems or leaves. e.g. *Bryophyllum*

5. (i) Undifferentiated mass of cells in culture medium (callus)
   (ii) Genetic copy of the parent, e.g. Dolly – the cloned sheep.

24.2
1. It serves as reproductive organ of the plants.

2. **Self pollination**
   - When pollen of the same flower on the stigma and then fertilizes the ovule of the same flower.
   **Cross pollination**
   - Pollen from one flower falls on stigma of another flower of the same species to fertilize the ovule of The latter.

3. Fertilisation leading to seed formation for new generation of plants will not be possible.

4. Pollen grain forms a pollen tube and pollen grain nucleus reaches the ovule as pollen tube pushes through the pistil. The pollen nucleus fuses with nucleus of ovule.

5. Fertilized ovules develop into seeds which are capable of germinating into seedlings and subsequently growing into new plants.

24.3
1. (i) Stage of life at the age between 11 to 19 years when physical and physiological changes take place in the body is called adolescence.
   (ii) The time period when changes occur that make human capable of reproduction.
   (iii) Both male and female sex organs are in the same individual.
(iv) Development of an embryo may occur up to an extent or up to completion inside the egg.
(v) Baby develops inside the mother’s womb/giving birth to young ones.
(vi) Developing embryo implanted in the uterus wall of the mother.

2. Testosterone and oestrogen
3. Developing embryo
4. (i) Embryo develops inside uterus
   (ii) Sperms pass through these into ejaculatory duct
5. Analysis case studies attempted by student incorporating knowledge gained on adolescence and puberty.

24.4
1. Human sperm and Human ovum “formation of zygote” “developing embryo” foetus in the uterus “born after development is complete”
2. FSH and LH
3. | Hormone | Function                                      |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FSH</td>
<td>Egg mature</td>
</tr>
<tr>
<td>LH</td>
<td>Egg shed</td>
</tr>
<tr>
<td>Estrogen</td>
<td>Secondary sexual characters in female</td>
</tr>
<tr>
<td>Testosterone</td>
<td>Secondary sexual characters in male</td>
</tr>
<tr>
<td>Oxytocein</td>
<td>Uterine contractions for deliver the baby</td>
</tr>
</tbody>
</table>

24.5
1. Syphilis, Gonorrhea, herpes, Chlamydia
2. IUCD – Copper T, Oral contraceptive pills, vasectomy in male/tubectomy in female, MTP.
3. (i) HIV – Human Immunodeficiency virus
   (ii) AIDS – Acquired Immuno Deficiency Syndrome
RELIGIOUS AND SOCIAL AWKENING IN COLONIAL INDIA

Read a conversation between Mimi, a thirteen year old girl, and her grandmother.

Mimi: “Which college did you go to read Grandma?”

Grandmother (smiling): “I never went to college, my dear. I only studied up to class 6 and was married when I was of your age.”

Mimi (shocked): “Married at thirteen! That is illegal, Grandma! Did you not protest?”
Grandmother: “Things were different at that time besides many of my friends got married at the same age.”

This made Mimi curious about the practices prevalent in the society when her grandmother was a child. She also wondered how things changed over a period of time. Who were the people responsible for bringing this change? Mimi wanted to know all this and more. In this lesson you will read how reforms were introduced in the 19th and 20th century in India. You will also read about the impact of these reforms on the society.

OBJECTIVES

After reading this lesson, you will be able to:

- identify the social practices that existed in our society during the 19th century;
- discuss the importance of socio-religious reform movements during the 19th and early 20th century in raising awareness about prevalent social practices;
- explain the efforts of the reformers to deal with issues like caste system, child marriage, sati pratha, through legislation and other means;
- discuss the role of reformers from the 19th century onwards in promoting school education in India;
- analyse the impact of the reform movement on Indian society.
6.1 SOCIETY IN THE EARLY 19TH CENTURY

The Indian society, which you see in 2012, is very different from the one in the first half of the 19th century. Two major social causes prevented the society’s progress. These were lack of education and subordination of women. Many sections of the Indian society were rigid and followed certain practices which were not in keeping with humanitarian values.

6.1.1 Lack of Education

Majority of people in those days were illiterate. All over the world education was in the hands of a very small number of people. In India also, education was limited to a handful of men belonging to the upper castes. Brahmins in India had access to the Vedas which were written in Sanskrit. It was a language known only to them. Religious texts were also controlled by these people. So they interpreted them in a way that benefitted them. Expensive rituals, sacrifices and practices after birth or death were outlined by this priestly class. It was mandatory for everyone to perform these rituals in the belief of a better life after death. Nobody could question the Brahmin priests because nobody knew what was written in the scriptures. Similarly in Europe, the Bible was written in Latin. It was the language of the Church and their priests interpreted the religious texts accordingly. And that is why, as a reaction, Europe saw the Renaissance and the Reformation Movement about which you have read earlier in this book. Even ideas like liberty, equality, freedom and human rights were introduced in Europe by various revolutions which took place there.

6.1.2 Position of Women

Girls and women today have better opportunities for their development. They have more freedom to study and work outside of home. However, way back in the 19th century the life was much harder for majority of the women. Certain social practices like female infanticide, child marriage, sati pratha and polygamy were prevalent in some sections of Indian society. Female infanticide or killing of a girl child was a very common practice. Girls who survived were often married at a very young age and often to men who were much older. Polygamy, a practice of a man having more than one wife was an accepted norm among many castes and religion. In some parts of the country Sati Pratha was practiced in which a widowed woman was compelled to burn herself on the funeral pyre of her husband. Those women who could escape the practice of Sati had to live a very miserable life. Women had no right to property. They also had no access to education. Thus, in general, women had a subordinate position in the society. The fear of the invader and loss of family honor was one reason. The other reasons were dowry and sharing of ancestral property which further deteriorated their status.
It was evident that certain practices and superstitions were preventing Indians from progressing. Reforms were needed to bring a change in the social and religious lives of the people.

**Do you know**

**Infanticide:** The killing of an infant born alive; the killing of a newly born child;

**Child Sex Ratio:** The number of girls per 1000 boys in the 0-6 years age group. In India, the ratio has shown a sharp decline from 976 girls to 1000 boys in 1961 to 914 girls to 1000 boys as per the 2011 census. As per global terms, the normal child sex ratio should be above 950.

**ACTIVITY 6.1**

According to the 2011 census, the states with the highest and the lowest sex ratio is Kerala with 1084 females per 1000 males, and Haryana with 877 females per 1000 males. Find out any 5 states having sex ratio of less than 914 females per 1000 males.

Visit the website www.censusindia.gov.in for information.

**6.2 A DESIRE TO CHANGE: SOCIO-RELIGIOUS AWAKENING**

What do you think could be the reasons that led to the awakening of the people against discrimination and inequality? Reformers like Raja Rammohan Roy, Ishwarchandra Vidyasagar, Swami Dayanand Saraswati, Jyotiba Phule, Sir Syed Ahmed Khan and Pandita Ramabai understood that ignorance and backwardness in the society was responsible for hindering its progress and development. This realisation was reinforced when they came in contact with the Europeans and found that life was very different in other parts of the world. When the British missionaries started spreading Christianity, they criticized and questioned many of our social and religious practices. Many of their ideas were accepted by our reformers. The desire to reform the society was so strong that these reformers were now ready to face challenges as well as resistance from the orthodox Indians. They started several movements to bring desirable changes in the society.

These were made possible by enlightened people like Swami Dayanand Saraswati and Raja Ram Mohan Roy. They studied the religious scriptures and criticized the prevalent religious and social practices. According to them, society should be based on the concepts of liberty and equality both for men and women and this was possible
Religious and Social Awkening in Colonial India

only by the spread of modern and scientific education especially among the women. These movements came to be called socio-religious movement because the reformers felt that no change is possible in a society without reforming the religion. We will read further to know why education and other privileges were available to only the upper classes in society.

6.2.1 The Caste System

Since ancient times, Indian society had a caste system which was originally occupation based. Over a period of time, interpretation of religious texts by the upper caste and lack of access to religious scriptures by the lower caste led to several superstitious practices in the name of religion. This also resulted in power being concentrated in upper caste and exploitation of the lower caste.

Hindu society was based on the Varna system, that is, Brahmin, Kshatriya, Vaishya and Shudra. According to this system people were divided on the basis of their occupation. The people who were engaged in praying and worshipping the Gods were categorized as Brahmins. Those who were engaged in wars were called Kshatriyas. Those whose occupation was agriculture and trading were known as Vaishyas and those who used to serve the upper three Varnas were known as Shudras. This caste system, which was purely based on occupation, had become hereditary. A person born in a particular caste could not change his/ her caste even though they might have changed their work. This created inequality in society. It also led to the exploitation of the lower castes. Therefore, caste system had became a major hindrance in the development of a healthy, democratic and progressive society.

Many socio-religious reformers and organizations stepped forward to fight against this social practice. Organizations, such as Brahma Samaj, Arya Samaj, Prarthana Samaj, Ramakrishna Mission and reformers like Jyotiba Phule, Pandita Ramabai, Sri Narayana Guru, Periyar, Vivekananda, Mahatma Gandhi and many others strongly protested against its rigidity. Most reformers considered the prevalent caste practices as against the original spirit of the Vedas and other scriptures. They considered the caste system as irrational and unscientific. They felt it was against the basic rules of humanity. The untiring and relentless efforts of the social reformers helped people to become more tolerant towards each other.

Article 14 of the Constitution states that, ‘it shall not discriminate against any citizen on the grounds of religion, race, caste, sex, place of birth or any of them.’ This constitutional provision has facilitated the participation of the marginalized in the social, political and economic development of the country.
6.2.2 The Prevalent Religious Practices

Most of the social practices were done in the name of religion. Hence, social reform had no meaning without religious reform. Our reformers were deeply rooted in Indian tradition and philosophy and had a sound knowledge of the scriptures. They were able to blend positive Indian values with western ideas and the principles of democracy and equality. On the basis of this understanding, they challenged the rigidity and superstitious practices in religion. They cited the scriptures to show that the practices prevalent during nineteenth century find no sanction in them. The enlightened and the rationalistic amongst them questioned the popular religion which was full of superstitions and was exploited by the corrupt priests. The reformers wanted society to accept the rational and scientific approach. They also believed in the principle of human dignity and social equality of all men and women.

6.2.3 The Educational Scenario

In the 19th century, many children, especially girls, were not sent to school. Education was imparted in traditional Paathshalas, Madrasas, Mosques and Gurukuls. Religious Education was imparted along with subjects like Sanskrit, Grammar, Arithmetic, Religion and Philosophy. Science and technology had no place in the curriculum. Many superstitious beliefs existed in the society. In certain communities girls were not allowed to be educated. It was thought that educated women would soon become widows after marriage! But in reality lack of education and awareness was the root cause of social and religious backwardness among the Indians. So it was important to promote modern education.

All socio-religious reformers whether Hindus, Muslims, Sikhs or Parsis aimed at the spread of modern education. They believed that education was the most effective tool to awaken and modernize our society.

INTEXT QUESTIONS 6.1

1. List any two social practices against which the reform movement began.
2. Why the caste system was considered irrational and unscientific?
3. What was the basis of the reformers’ criticism of rigidity in religion?
4. Read the excerpt below and answer the given question:

Dr. Bhim Rao Ambedkar belonged to a poor Mahar family, considered an untouchable caste. He had his college education in India and later earned degrees and doctorates for his study and research from Columbia University.
Religious and Social Awkening in Colonial India

and the London School of Economics. Dr. Ambedkar was the Chairman of the Drafting Committee of the Indian Constitution. Despite facing social and financial hardships, Dr. Ambedkar spent his whole life fighting against social discrimination and was awarded the Bharat Ratna posthumously in 1990.

(i) In addition to education, which other attributes (qualities) enabled Dr. Ambedkar to withstand the discrimination and contribute to the society?

ACTIVITY 6.2

Cite at least two instances where you observed caste-based discrimination. Note down your reactions in 50 words.

6.3 SOCIO RELIGIOUS REFORMERS OF THE 19TH CENTURY

Many Indian thinkers and reformers came forward to bring reforms in society. According to them society and religion were interlinked. Both needed to be reformed to achieve positive growth and development of the country. Hence our reformers took the initiative to awaken the Indian masses. Some of these reformers founded organizations to spread the awareness about which you will read now. Another major contribution of these reformers was in the field of education.

6.3.1 Raja Ram Mohan Roy

Raja Ram Mohan Roy was born in a Brahmin family of Bengal. He knew many languages and had read Quran, Bible and the New Testament along with Hindu scriptures in great depth. Liberal education exposed him to different cultures and philosophies. Deeply moved by the plight of his brother’s widow, who had been forced to commit Sati, he was determined to uproot this social practice. This led him to challenge other unfair social and religious practices prevalent at that time. He founded Brahmo Samaj in 1828. He was the first person to take an initiative to challenge the practice of Sati and it soon became his life-long crusade. He mobilized public opinion and cited the scriptures to show that this practice had no sanction in Hindu religion. In the process he faced displeasure and enmity of orthodox
Hindus. In his efforts he was supported by the then Governor General of India, Sir William Bentinck. A law was passed in 1829 making Sati illegal and punishable. He also made efforts to advocate widow re-marriage and condemned child marriage.

He represented a synthesis of the Eastern and the Western thoughts. An authority on the Vedas, Vedantas and Upanishads, he also took up the best in all religions as he was well versed in the scriptures. He advocated the importance of Vedas in reforming religion and upheld the fundamental unity among all religions. He held that all the principal ancient texts of the Hindus preached **Monotheism** (worship of one God) and opposed **Polytheism** (belief in more than one God). He was critical of idol worship and observance of meaningless rituals.

He strongly advocated the learning of English language, literature, scientific advancement and technology to modernize India. He maintained an English school in Calcutta at his own cost. Subjects like mechanics and philosophy were also taught among other subjects. A Vedanta college was opened in 1825. Raja Ram Mohan Ray helped in the opening of the Hindu college in Calcutta for higher learning.

### 6.3.2 Ishwar Chandra Vidyasagar

A great scholar and reformer, Ishwar Chandra Vidyasagar dedicated his entire life to the cause of social reforms. The first Hindu Widow Remarriage Act was introduced in 1856 owing to his relentless efforts. He also protested against child-marriage and campaigned against polygamy. Though he did not concern himself much with religious questions, he was against all those who opposed reforms in the name of religion.

Though he was a Sanskrit scholar, his mind was open to the best in Western thought. His major contribution was in the field of education. He encouraged the study of Sanskrit and Bengali literature. He also introduced the study of Western thought in the Sanskrit college to inspire the Indians to shake off their age-old beliefs and modernize their ideas. He believed that condition of women could be improved only through their education. His efforts in this direction were praise worthy. He helped in opening approximately 35 girls’ school in Bengal. He was a champion of women’s education. The admission of non-Brahmin students in the Sanskrit College was made possible through his efforts.

### 6.3.3 Swami Dayanand Saraswati

The Arya Samaj founded by Swami Dayanand Saraswati in 1875 undertook the task of reforming Hindu religion in North India. He considered Vedas to be infallible and
the foundation of all knowledge. He rejected all those religious thoughts which were in conflict with the Vedas. He believed that every person had the right to have direct access to God. It started the *Shuddhi Movement* to bring back those Hindus who had converted to Islam and Christianity. *Satyarth Prakash* was his most important book.

Figure 6.3 Swami Dayanand Saraswati

Arya Samaj advocated social reform and worked to improve the condition of women. It fought untouchability and the rigidities of the hereditary caste system and promoted social equality. The use of Hindi language in which he wrote and preached made his ideas accessible to the people of Northern India. Arya Samaj also had a major role to play in the national movement as it inculcated a spirit of self respect and self reliance among the people.

The role of Arya Samaj was commendable in promoting education among the masses. Some of Swami Dayanand’s followers later started a network of schools and colleges called D.A.V. (Dayanand Anglo Vedic) in the country to impart education on western lines without compromising on the Vedic teachings. They encouraged teaching of English and modern science along with Sanskrit and Vedic education.

6.3.4 Ramakrishna Paramhansa and Swami Vivekananda

Ramakrishna Paramhansa (1836-1886) highlighted the essential unity of religions and the need to lead a spiritual life. He believed that the different religions of the world are only different ways to reach the same god. Swami Vivekananda (1863-1902) was his foremost disciple.
The history of the world is the history of a few men who had faith in themselves. That faith calls out the Divinity within. You can do anything. You fail only when you do not strive sufficiently to manifest infinite power. As soon as a man or a nation loses faith in himself or itself, death comes. Believe first in yourself, and then in God. – Swami Vivekananda.

Vivekananda was the first spiritual leader who thought beyond religious reforms. He felt that Indian masses needed secular as well as spiritual knowledge to empower them to believe in themselves. Vivekananda established the Ramakrishna mission after the name of his guru Ramakrishna Paramhansa. Through his speeches and writings, he brought out the essence of Hindu culture and religion. He believed in the spirit of Vedanta and the essential unity and equality of all religions. He laid stress on the removal of religious superstitions, obscurantism, and outdated social customs. He tried to remove caste rigidities, and untouchability. He motivated the people to respect women while he himself worked for women’s upliftment and education. Vivekananda attached primary importance to the removal of ignorance among the people.

6.3.5 Sir Syed Ahmed Khan

Sir Syed Ahmed Khan believed that the religious and social life of the Muslims could be improved only by imbibing modern western scientific knowledge and culture. His major concern was the removal of social and educational backwardness among the Muslims. He worked hard to raise the status of the Muslim women. He was against...
Religious and Social Awkening in Colonial India

the *purdah* system, polygamy, easy divorce and lack of education among the girls. Though he was opposed by the orthodox Muslims, he made commendable efforts in promote women’s education. He tried to interpret the Quran in the light of reason and spoke out against fanaticism and ignorance. He also initiated social reforms for the upliftment of Muslim society.

Throughout his early life, he advocated the study of English language even against the opposition of the orthodox Muslims. He considered that only modern education could lead Muslims towards progress. He established an English school in Ghazipur (present day Uttar Pradesh) in 1864. He started the Mohammadan Anglo-Oriental College (M.A.O.) at Aligarh in 1875 which later developed into the Aligarh Muslim University. It provided education in humanities and science through English medium. He also established a scientific society for translating English books. He also published a journal for spreading awareness among the Muslims towards social reforms especially towards modern education. He started the Mohammadan educational conference for spreading liberal ideas among the Muslims. The movement for reform started by him is known as the Aligarh Movement which proved to be an important step towards social and political awakening among the Muslims.

![Figure 6.5 Sir Syed Ahmed Khan](image)

6.3.6 Jyotirao Govindrao Phule

Jyotirao Govindrao Phule from Maharashtra worked to attain equal rights for peasants and the lower caste. He and his wife, Savitribai Phule, are most known for their efforts to educate women and the lower castes as well as the masses. He first educated his wife, after which both of them opened a school for girls in India...
in August 1848, took up the cause of women and started a girls’ school in Poona (Pune) in 1851. He is also remembered for his efforts towards promoting widow remarriage. In September 1873, Jyotirao along with his followers formed the Satya Shodhak Samaj (Society of Seekers of Truth) with the main objective of liberating the lower castes and protecting them from exploitation and atrocities. He was popularly known as Jyotiba.

**Figure 6.6 Jyotiba Phule and his wife Savitribai Phule**

6.3.7 Justice Mahadev Govind Ranade

Justice Mahadev Govind Ranade established the Poona Sarvajanik Sabha and the Prarthana Samaj in 1867 in Bombay to bring about religious reforms. It sought to remove caste restrictions, abolish child marriage, the shaving of widows’ heads, the heavy cost of marriages and other social functions; encourage education of women and promote widow remarriage. Like Bramho Samaj, it advocated the worship of one God. It condemned idolatry and the domination of the priestly castes in religious matters. He introduced vernacular languages in the University curriculum which made higher education accessible to Indians. He attempted to reform the rigid traditions in the society without destroying the social atmosphere of India’s rich cultural heritage. He was also a founding member of the Indian National Congress.

**Figure 6.7 Justice Mahadev Govind Ranade**

6.3.8 Pandita Ramabai

In Maharashtra, Pandita Ramabai, a renowned social reformer, fought for the rights of women and spoke against the practice of child marriage. She promoted girls
Religious and Social Awakening in Colonial India

education and started the *Arya Mahila Samaj* in 1881, in Pune, to improve the condition of women, especially child widows. In 1889, she established the *Mukti Mission*, in Pune, a refuge for young widows who had been deserted and abused by their families. She also started *Sharda Sadan* which provided housing, education, vocational training and medical services to widows, orphans and the visually challenged. She also started *Sharda Sadan* which provided housing, education, vocational training and medical services to widows, orphans and the visually challenged. She also wrote many books showing the hard life of women, including child brides and child widows. The Pandita Ramabai Mukti Mission is still active today.

![Figure 6.8 Pandita Ramabai](image)

6.3.9 Annie Besant

Annie Besant was a member of the Theosophical Society and came to India for the first time in 1893. This movement was led by Westerners who glorified Indian religious and philosophical traditions and encouraged vernacular languages and literary works to instill a sense of pride in Indian heritage and culture. It aroused political awakening and helped Indians recover their self-confidence and get a sense of pride in their own country. The society also preached the universal brotherhood of man. It made immense contribution towards the development of Modern India. Annie Besant became the President of the Theosophical Society in 1907.

Besant opened a college for boys, the Central Hindu College at Banaras based on Theosophical principles with the aim to build a new leadership for India. The students studied religious texts along with modern science. The college became a part of the new University, the Banaras Hindu University from 1917.

![Figure 6.9 Annie Besant](image)

**ACTIVITY 6.3**

Identify any two social practices or superstitions which are still prevalent despite several reform movements and government regulations. What can you, as an individual do to challenge these social practices or superstitions?

**Clue:** Social practices or superstitions like dowry, gender discrimination, illiteracy, child marriage, female infanticide.

Possible Action: Lead by personal example, organise group discussion; write a letter to the newspaper, assist people in distress in public places etc.
6.3.10 Muslim Reform Movement

A few movements were launched which aimed to spread modern education and removing social practices like the polygamy. The Mohammedan Literacy Society of Calcutta was founded by Abdul Latif in 1863. It was one of the earliest organisations that promoted modern education among the upper and middle class Muslims. It also played an important role in promoting Hindu-Muslim unity. Shariatullah of Bengal, leader of the Faraizi movement in Bengal, took up the cause of the peasants. He also condemned the evils of the caste system among the Muslims.

There were several other socio-religious movements which in one way or the other helped the national awakening of the Muslims. Mirza Ghulam Ahmed had founded the Ahmediya Movement in 1899. Under this movement, a number of schools and colleges were opened all over the country. They emphasised the universal and humanitarian character of Islam. They favoured the unity among Hindus and Muslims.

One of the greatest poets of Modern India, Muhammad Iqbal (1876-1938) influenced the philosophical and religious outlook of several generations through his poetry.

6.3.11 The Akali Reform Movement

The formation of the two Singh Sabhas at Amritsar and Lahore in the 1870’s was the beginning of religious reform movement among the Sikhs. The setting up of Khalsa College in Amritsar in 1892 helped promote Gurmukhi, Sikh learning and Punjabi literature. The college was set up with help from the British. In 1920, the Akali movement which rose in Punjab, started the cleansing of the management of the Gurudwaras or Sikh shrines. A powerful Satyagraha in 1921 against the Mahants forced the Government to pass a new Gurdwara Act in 1925. With the aid of this act and by direct action, they freed the sacred places from the control and domination of corrupt Mahants.
6.3.12 Reform Movement among the Parsis

Narouji Furdonji, Dadabhai Naoroji, S.S. Bengalee and others began religious reforms among the Parsis in Mumbai in the middle of the 19th century. In 1851, they founded the Rahnumai Mazdayasnan Sabha or Religious Reform Association. They played an important role in the spread of education, especially among girls. They also campaigned against the orthodox practices in Parsi religion. In course of time, the Parsis became one of the most progressive sections of Indian society.

ACTIVITY 6.4

Make a list of 10 eminent personalities who have contributed towards making our society a better place to live in. Also find out the field in which they have contributed.

INTEXT QUESTIONS 6.2

1. Fill in the blanks with correct answer:

   (i) He ................... did not represent the synthesis of the thought of East and West
       (a) Swami Vivekananda (b) Rammohan Roy
       (c) Dayanand Saraswati (d) Iswarchandra Vidyasagar

   (ii) He did not emphasize the infallibility of the Vedas
       (a) Swami Vivekananda (b) Ramakrishna Paramhans
       (c) Dayanand Saraswati (d) Syed Ahmed Khan

   (iii) The movement started to free the sacred places from the control and domination of corrupt Mahants
       (a) Akali Movement (b) Caste reform movement
       (c) Shuddhi movement (d) Satyagraha movement.

2. Match the following:

   (i) Bramho Samaj (a) Swami Vivekananda
   (ii) Arya Samaj (b) Annie Besant
   (iii) Ramakrishna Mission (c) Swami Dayanand Saraswati
(iv) Theosophical Society  
(v) Akali Movement  
(vi) Satya Shodhak Samaj  
(vii) Aligarh Movement  
(viii) Arya Mahila Samaj  
(d) Jyotiba Phule  
(e) Pandita Ramabai  
(f) Raja Ram Mohan Roy  
(g) Sikhs  
(h) Justice Mahadev Govind Ranade  
(i) Sir Sayed Ahmed Khan  
(j) Dadabhai Naoroji

3. Write any two limitations of the reform movements.

4. Read the excerpt below and answer the given questions:

Ramvati is working as a peon in NIOS office. She got married at the age of 21, but unfortunately her husband passed away when she was 28. She was offered her husband's job at NIOS because she had completed her secondary school education. With this job Ramvati is now able to look after her children and herself. She leads a dignified life and her children are proud of their mother.

(a) What could have happened if Ramvati had got married as a child?
(b) If Ramvati was not allowed to work outside home, what could have happened to her and her family?

6.4 IMPACT OF THE REFORM MOVEMENTS ON INDIAN SOCIETY

The reform movements were able to create socio-religious consciousness among the Indians during the 19th century. All these movements laid stress on rational understanding of social and religious ideas and encouraged a scientific and humanitarian outlook. The reformers felt that modern ideas and culture could be best imbibed by integrating them into Indian cultural streams. The introduction of modern education guided the Indians towards a scientific and rational approach to life. All the movements worked to improve women’s status and criticized the caste system especially the practice of untouchability. These movements looked for social unity and strived towards liberty, equality and fraternity.

Importance was given to education especially women’s education. Some legal measures were introduced to raise the status of women. For example Sati Pratha and infanticide were declared illegal. Widow Remarriage was made possible by a law passed in 1856 and condition of widows improved. A law passed in 1872, sanctioned inter-caste and inter-communal marriages. Marriageable age of girls was raised to ten by a law passed in 1860. Further, Sharda Act was passed in 1929 preventing child marriage. According to it, a girl below 14 and a boy below 18 cannot
Religious and Social Awkening in Colonial India

be married. The impact of the efforts of these reformers was most evident in the National Movement. A large number of women came out to take part in the freedom struggle. The role of women like Captain Laxmi Sehgal of Indian National Army, Sarojini Naidu, Annie Besant, Aruna Asaf Ali and many others was extremely important in the freedom struggle. Women now came out of the purdah and took up jobs.

The persistent efforts of the reformers had immense impact on the society. The religious reform movements instilled in the minds of Indians greater self-respect, self-confidence and pride in their country. These reform movements helped many Indians to come to terms with the modern world. People became more conscious of their identity as Indian. It was ultimately responsible for their united struggle against the British in the freedom movement of India.

In the 20th century and especially after 1919, the Indian National Movement became the main propagator of social reform. Indian languages were used to reach the masses. They also used novels, dramas, short stories, poetry, the press and in the 1930’s used the cinema to spread their views. The movements promoted the feelings of self-confidence, self-respect, awareness and patriotism and thereby developed a feeling of national consciousness. Do you remember reading some of the novels and seeing some films related to Independence Movement. For a beginning start making a list of some such authors and their book. Make a list of some films also. Also make a list of some songs. May be this clue will help you “Insaf ki dagar pe, Bachhon dikhao chal ke, yeh desh hai tumhara, neta tumhi ho kal ke”, or “Vande Mataram” sung by Lata Mangeshkar in the same film.

These reform movements had certain limitations. It affected a very small percentage of the population, mostly the educated class and could not reach the vast masses of the peasantry and urban poor who continued to live in the same conditions.

Humanitarian: Having the concern for or helping to improve the welfare and happiness of all people.
Liberty: Freedom to act or think as you chose.
Fraternity: A group of people with something in common.

WHAT YOU HAVE LEARNT

- The Indian society was challenged by issues like superstitious beliefs, backwardness and evil practices such as Sati or widow immolation and untouchability.
- Some educated Indians like Raja Rammohan Roy, Iswarchandra Vidyasagar, Jyotiba Phule, Swami Dayanand Swaraswati, Sir. Syed Ahmed Khan, Swami
Vivekananda took the initiative to reform the society by introducing reforms in the religion first as the social practices were often driven by religious beliefs.

- All the socio-religious reformers emphasized upon modern education and scientific knowledge to reform the society. Women’s education has been specially emphasized upon to improve the position of the women in the society.
- The impact of the reform movements in the society was immense. Due to the persistent efforts of the social reformers many such practices like Sati, untouchability was abolished by law. Widow-remarriage was introduced. Modern education was encouraged in the society.
- Despite all the efforts, India still require more involvement of the educated people in spreading awareness. The role of media is very crucial in this regard.

**TERMINAL EXERCISES**

1. Explain the social practices that existed in 19th century India.
2. Why do you think reforms were needed to awaken our society?
3. Why do you think that the social reform movement had no meaning without religious reforms?
4. Do you think the reformers were able to bring change in the Indian society?
5. How did the socio-religious reform movements lead to the National Movement?
6. Explain the role of following reformers in challenging caste system and advocating widow remarriage:
   - (a) Raja Ram Mohan Roy
   - (b) Ishwar Chandra Vidyasagar
   - (c) Jyotiba Phule
7. Identify the common features amongst the following reformers:
   - (a) Theosophical Society and Ramakrishna Mission
   - (b) Akali Movement and Arya Samaj
8. Explain the hindrances in the growth of women’s education in the 19th Century India.
10. Study the map carefully and answer the questions that follow:
    - (a) Name the places where Brahma Samaj, Arya Samaj, Prarthana Samaj and M.A.O. College became popular.
    - (b) Name the social reformers who were active in Western India and also mark the places where they were active.
ANSWERS TO INTEXT QUESTIONS

6.1

2. Because it was against the basic tenets of humanity.
3. Courage, determination, motivation and a vision to achieve goals.
4. They found that the scriptures do not sanction rigidity and superstitions.
6.2

1. (i) (c) (ii) (d) (iii) (a)

2. (i) (f) (ii) (c) (iii) (a) (iv) (b) (v) (g) (vi) (d) (vii) (i) (viii) (e)

3. (a) She would have been illiterate, would have been married at an early age, would have many children and possibly had been suffering due to ill health as a result of child-birth at a very early age. She would probably have been dependant on her parents or in-laws for her survival.

   (b) She would be dependent on others resulting in low socio-economic status.

4. (a) It affected a very small percentage of the population, mostly the educated class.

   (b) It did not reach the masses.
Mona and Raju were excited about their proposed first trip to a hill station, Shimla, with their parents. While they were packing their clothes, their mother asked them to pack some woolen clothes also. They reside in Chennai, a city and capital of Tamil Nadu, a state in South India. They were really surprised as it was the month of May and it’s very hot in Chennai. Their mother told that although India has monsoon climate but in Shimla, it being a hill station the weather was cool. They were little confused with a few questions in their mind like - what is weather? What is the difference between the weather and the climate? Why do we find different climatic conditions in India? You will find the answers to such questions in the following lesson.

**OBJECTIVES**

After completing this lesson, you will be able to:

- list the factors that influence the climate of India;
- explain the mechanism of monsoon and its various characteristics;
- recognize the cyclic system of seasons along with their unique features;
- describe the distribution of rainfall in India;
- analyse how our social and cultural life is deeply associated with the cycle of seasons; and
- describe the global environmental changes and its impact on Indian climate.

**10.1 FACTORS AFFECTING THE CLIMATE OF INDIA**

When Mona and Raju were in the train along with their parents they asked the questions to their parents about the difference between the weather and climate. One of the fellow passengers was a teacher, Mrs. Rupa and she explained that climate...
Climate is always for a large area like a country or a big region and generally it does not change, like India has monsoon climate whereas weather is always for a smaller area like that of your city or village where it may frequently change like raining in the morning and sunny in the afternoon. Mrs. Rupa asked them to observe the changes in the weather conditions along the way to Shimla. They realized the changes: it was hot and humid weather in the southern regions and slowly it became hot and dry in the northern plains; and they felt cool on their way when they were close to Shimla. They asked the teacher the reason for it and she explained that there are many factors which affect the climate or weather.

10.1.1 Factors Affecting the Climate of India

1. **Location:** The places which are closer to equator have high temperature. As one moves towards the poles temperature decreases. As our country, India is located in Northern hemisphere closer to equator at 8°4¢ and 23½° Tropic of Cancer passes through the central part of India. So in south of this latitude we find tropical climate and towards the north we find sub-tropical climate. For example, Andhra Pradesh would be hotter than Haryana. Broadly speaking parts lying south of the Tropic of Cancer receive more solar heat than those lying north of it.

2. **Distance from the sea:** The southern half of India is surrounded by sea from three sides: the Arabian Sea in the west, the Bay of Bengal in the east and the Indian Ocean in the south. Due to moderating influence of the sea this region is neither hot in summer nor very cold in winter. For example the area of North India which is far away from the sea has extreme type of climate and the area of south India which is nearer to the sea has equable type of climate. We can see the variations in temperature and rainfall at different stations in the given table 10.1.

3. **Altitude:** It means the height above the average sea level. The atmosphere becomes less dense and we feel breathlessness as we go higher from the earth surface and thus the temperature also decreases with the height. For example, the cities located on the hills are cooler like Shimla whereas the cities lying in the plains will have hot climate like Ludhiana.
4. **Mountain Ranges:** Mountain ranges also affect the climate of any region to a great extent. The Himalaya Mountain is located in the northern part of our country with an average height of 6000m. It protects our country from cold winds of Central Asia. On the other hand, they check rain bearing South-West Monsoon winds and compel them to shed their moisture in India. Similarly, Western Ghats force rain bearing winds to cause heavy rain fall on the Western slopes of the Western Ghats.

5. **Direction of surface winds:** The wind system also affects the Indian climate. This system consists of monsoon winds, land and sea breeze, and local winds. In winter the winds blow from land to sea so they are cold and dry. On the other hand, in summer wind blow from sea to land bringing the moisture along with them from the sea and they cause wide spread rain in most part of the country.

6. **Upper air Currents:** Besides surface winds, there are strong air currents called Jet streams which also influence the climate of India. These jet streams are a narrow belt of fast blowing winds located generally at 12,000 metre height above the sea level. They bring western cyclonic disturbances along with them. These cyclonic winds originate near the Mediterranean Sea and move eastwards. On their way, they collect moisture from Persian Gulf and shed it in the North western part of India during winter seasons. These Jet streams shift northwards during summer season and blow in Central Asia. Thus helps in the onset of monsoons.

### ACTIVITY 10.1

Temperature (T) and Rainfall (R) of some important stations

<table>
<thead>
<tr>
<th>Stations</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Leh</td>
<td>T</td>
</tr>
<tr>
<td></td>
<td>R</td>
</tr>
<tr>
<td>Chennai</td>
<td>T</td>
</tr>
<tr>
<td></td>
<td>R</td>
</tr>
</tbody>
</table>

(i) Write annual range of temperature between two places.

(ii) Which is the rainiest month of the year in each stations?
Look at the map given above and answer the following questions:

(a) Name the important latitude drawn on the map which has divided India in two heat zones. Also tell the degree of that latitude.

(b) Name the cities located on map which are influenced by the sea and cities which are not influenced by the sea.

(c) Which mountain range protects our country from cold breeze of Central Asia?

(d) Observe the wind direction given on the map and tell why do we have dry winter season?

Mona and Raju returned from Shimla after five days stay. They were very happy and shared their experience with their friends. Few days later they were surprised to see a news headline that monsoons are coming on time. What is the meaning of
monsoon? They wanted to know the answers of their questions with the help of their teacher. Try to find out answers in the following section.

### 10.2 MECHANISM OF MONSOON

The word monsoon is derived from the Arabic word ‘Mausim’ which means season. Monsoon refers to the seasonal reversal in the wind direction during a year. During summer, the interior parts of North Indian Plains covering Rajasthan, Punjab, Haryana, and Western Uttar Pradesh are intensely hot. The daily maximum temperature in some of these parts is as high as 45° to 47° C. Table 10.1 given below indicates the climatic diversity in India. Try to understand the varying temperature that different stations in India have.

**Table 10.1: Temperature (in ° Celsius) and Rainfall (in cm) of some important stations in India**

<table>
<thead>
<tr>
<th>STATIONS</th>
<th>MONTHS</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
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<tbody>
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<td>-7</td>
<td>-1</td>
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<td>10</td>
<td>14</td>
<td>17</td>
<td>17</td>
<td>12</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>Rainfall</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>13</td>
<td>13</td>
<td>8</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>SHILLONG</td>
<td>Temp.</td>
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<td>11</td>
<td>16</td>
<td>19</td>
<td>19</td>
<td>21</td>
<td>21</td>
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<td>13</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Rainfall</td>
<td>14</td>
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<td>146</td>
<td>295</td>
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<td>THRUVANAN THEPAPURAM</td>
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</table>

**Do you know**

- Air has weight and this weight exerts pressure on us, which is known as air pressure.
- There is an inverse relationship between temperature and air pressure, i.e. if the temperature of any area is high then the air pressure will be low and vice-versa.
- Difference in the air pressure is responsible for the attraction of the winds.
The average maximum temperature is above 33°C in the month of May at Delhi and Jodhpur. Such high temperature heats up the air of that region. Hot air rises, low pressure area is created under it. This low pressure is also known as monsoon trough. It lies between Jaisalmer in the west and Balasore in Odisha in the East.

Figure 10.2 Temperature of May

On the other hand temperature over Indian Ocean is relatively low, as water needs more time to get heated as compared to land. So a relatively high pressure region is created over the sea. See the map 10.2 given above and try to understand the given phenomenon.

Thus, there is a difference of temperature and resultant pressure over North Central Indian Plains and Indian Ocean. Due to this difference, air from high pressure region of the sea starts moving towards the low pressure region of North India. Thus, by mid June the general movement of air is from equatorial region of Indian Ocean to the Indian subcontinent and the direction of these winds in general is from South-West to North-East. This direction is exactly opposite to that of the trade winds (North – East to South-West) prevailing during winter in India. This complete reversal
of wind direction from North-East to South West and vice-versa is known as monsoons.

These winds originate over warm seas. Therefore, they contain a lot of moisture. When these moisture laden winds move over the Indian sub-continent they cause wide spread rain throughout India and from June to September 80% to 90% of the total rainfall in India is confined to these four months only.

10.2.1 Characteristics of the Monsoon

1. Monsoons are not steady winds. They are irregular in nature affected by different atmospheric conditions i.e. due to regional climatic conditions. Sometimes monsoon early or some times late.

2. Monsoons are not equally distributed. Coastal areas like Kerala West Bengal and Odisha receive heavy rain fall, whereas interior regions like Haryana, Madhya Pradesh, receive less rainfall.
3. When monsoon arrives, it gives heavy rainfall which continues for several days. This is known as ‘burst of monsoon’. This occurs mainly at Kerala coast where it reaches first.

**ACTIVITY 10.2**

Observe the picture and answer the following questions:

![Image of three different seasons](a) (b) (c)

**Figure 10.4**

1. Identify the seasons in the given pictures (a), (b) and (c).
2. Arrange them on the basis of their occurrence.
3. Which season you like the most and why? Write answer in about 30 words.

**INTEXT QUESTIONS 10.2**

Look at maps (Fig. 10.2, Fig. 10.3) of advancing monsoon and answer the following questions:

1. Name the states which lie within the low pressure regions.
2. As the monsoon winds are coming from south-west which state they will strike first.
3. When the monsoon winds reach the Bay of Bengal, what is their direction?
4. Observe the rainfall data of the following cities and find out the average duration of monsoon in four cities. Name of the cities are:
   - Mumbai
   - Jaisalmer
   - Delhi
   - Shillong

A few months later Mona and Raju’s father was transferred to Delhi. They were excited to live in the capital of India. They shifted to Delhi. New home, new school, new friends and new environment and everything was new for them. They realized
that now they were going to see the real changes of the seasons which they had read in their book. Try to discover the various seasons and how they happen in the following section.

### 10.3 CYCLE OF SEASONS

Our country, India, enjoys variety of seasons due to geographical locations. Now you will know about the seasons of India and their unique features. We have four seasons:

(a) Cold weather season (December – February)
(b) Hot weather season (March – May)
(c) Advancing South – West monsoon season (June – September)
(d) Post or retreating monsoon season (October – November).

You will know more about each of them in the following section.

(a) **Cold Weather Season:** The duration of cold weather season is from December to February. The temperature decreases from the South to the North. December
and January are the coldest months and the average temperature in North is (12° to 15°C) and in South (25°C). Frost is common in the North and North-West India. There is light rainfall in this region due to Western disturbances. Higher slopes of the Himalayas experience snowfall. During the winter season, North-East trade winds prevail over India. They blow from land to sea. Hence, for most part of the country, it is a dry season. However, the Tamil Nadu coast receives winter rainfall due to these winds. A part of North-East trade winds blow over Bay of Bengal. They gather moisture which causes rainfall in the coastal Tamilnadu while the rest of the country remains dry. In the northern part of the country the weather is marked by clear sky, low temperatures and low humidity. The winter rainfall is very important for the cultivation of ‘Rabi’ crops.

(b) Hot Weather Season: By the end of February the temperature starts rising. So from March to May it is hot weather season. We find high temperature in plains, western part of India and in the central part of peninsular India. In Northern plains, thus, an elongated low pressure which is called monsoonal trough created here, which extends from Jaisalmer in western Rajasthan to Jharkhand and parts of Odisha to the East. However, over Indian Ocean south
of the equator high pressure belt begins to develop in this season. In North-West India, afternoon dust storms are common. During summer, very hot and dry winds blow over North Indian plains. They are locally called ‘Loo’. Exposure to these hot winds may cause heat or sun stroke. This is also the season for localized thunderstorms, associated with violent winds, torrential downpours, often accompanied by hail. In West Bengal, these storms are known as the ‘Kaal Baisakhi’ (calamity for the month of Baisakh). Towards the close of the summer season, pre-monsoon showers are common, especially in Kerala and Karnataka. They help in the early ripening of mangoes, and are often referred to as ‘mango showers’.

(c) Advancing South West Monsoon Season: After the scorching heat of summer season people eagerly wait for the rains which can give them relief. Farmers wait for the rains so that they can prepare their fields for the next cropping season Kharif. June to September are the months of advancing South-West monsoon season. By the end of May the monsoon trough further intensifies over north India due to high temperature in the region. The General direction of the wind during this season is from South-West to north-east. These winds

![Figure 10.7 Advancing Monsoon of India]
are strong and blow at an average velocity of 30 km per hour. These moisture laden winds first hit at Andaman and Nicobar Islands in the last week of May and Kerala coast in the first week of June with violent thunder and lightning. This South-West monsoon that flows into India brings about a major change in its weather. Two branches of south-west monsoon originate from: (i) Arabian Sea and (ii) Bay of Bengal.

The Arabian Sea Branch obstructed by Western Ghats gives heavy rainfall on the Western side of Western Ghats. It reaches Mumbai by 10th June (See Fig. 10.7). When this branch crosses the Western Ghats and reaches the Deccan Plateau and parts of Madhya Pradesh, it gives less rainfall as it is a rain shadow region. Further, this branch reaches in Northern Plain by 20th June.

The monsoon winds that move from Bay of Bengal strike Andaman and Nicobar islands North-Eastern states and coastal areas of West Bengal and covers the whole of India by the 15th of July. They cause heavy rainfall in the region. However, quantity of rainfall decreases as they move towards West over the Northern plains. For example, rainfall at Kolkata is 120 cm, Allahabad 91 cm and Delhi 56 cm. You must have seen that rainfall does not continue for several days. The monsoon tends to have ‘breaks’ in its rainfall which causes wet and dry spells. This means that monsoon rains occur only a few days at a time. Rainless dry spells occur in between. As the monsoon comes after the hot and dry summer season, the rainfall brings down the temperature. We can see this decline is from 5°C to 8°C between mid June and mid July. This is the time when many parts of India face floods also. This is mainly because of heavy rainfall and our inability to manage our water resources more systematically. On the other hand, there are many areas that experience drought conditions during this season.

**ACTIVITY 10.3**

Collect the information from the newspapers and other sources and find out which parts of India are regularly affected by the floods and droughts. Also paste the newspaper cuttings as a sample. Identify name the reasons and collect the information about the most recent.

**(d) Retreating or Post Monsoon Season:** October and November are the months of post (or retreating) monsoon season. The temperatures during September-October start decreasing in North India. Monsoonal trough also becomes weak over North-West India. This is gradually replaced by a high pressure system. The South-West monsoon winds weaken and start withdrawing gradually from North Indian Plains by November. In October the weather remains humid and warm due to continuing high temperature and moist land in
The month of October. In Northern plains hot and humid weather becomes oppressive at this time. It is commonly called ‘October Heat’. However, towards the end of October, temperature starts decreasing, making nights pleasant. This is also the time of cyclonic storms which develop in the Bay of Bengal as the low pressure of North India shifts to this area. These storms create havoc in coastal areas of Odisha, Andhra Pradesh and Tamil Nadu, especially in the deltas of Mahanadi, Godavari and Krishna rivers.

Figure 10.8 Retreating Monsoon

INTEXT QUESTIONS 10.3

Choose the correct answer:

(i) The hot and dry wind blowing in the northern plain in the summer are called—
(a) Kaal Baisakhi                  (c) Trade winds
(b) Loo                          (d) All of the above

Figure 10.8 Retreating Monsoon
(ii) Which mountain range acts as a barrier in the path of the Arabian Sea branch?
(a) Aravallis (c) Western Ghats
(b) Eastern Ghats (d) Raj Mahal hills

(iii) The tropical cyclones of the Bay of Bengal usually occur during
(a) South-west monsoon (c) Retreating monsoon season
(b) Hot weather season (d) Cold weather season

(iv) Which place would be the hottest one in March?
(a) Delhi (c) Deccan Plateau
(b) Shillong (d) Punjab

(v) Monsoons are called ....................
(a) Seasonal winds (c) Permanent winds
(b) Temporary winds (d) Local winds

Seasons, its cycle, causes and effects were now clear to Mona and Raju. Only one question remained unanswered. If the monsoons came in a particular area for certain duration so it means the rainfall distribution in India was uneven? Try to find the answer with the help of Rainfall distribution map.

10.4 DISTRIBUTION OF RAINFALL
Rainfall in India is highly uneven over a period of time in a year. As we move from East to West in Northern plains, we observe that in central India rainfall decreases. In peninsular region, India’s rainfall decreases from coast to interior parts. In North-East India, the rainfall increases with altitude. India is the unique example of rainfall distribution with marked contrasts. Both, one of the rainiest and driest places of the world are located in India itself. Can you think why? Spatial variations in rainfall in India can be shown under the following headings. Observe the given map and find out the states under the given categories –

(a) Areas of heavy rainfall (more than 200cm): Maximum rainfall in India occurs in the western coast, sub Himalayan regions of north-east and Garo, Khasi and Jaintia hills of Meghalaya.

(b) Area of Moderate rainfall (100-200cm): Areas receiving 100 to 200cm rainfall in India include some parts of the Western Ghats, West Bengal, Odisha and Bihar and many states.

(c) Areas of Low rainfall (60 to 100cm): This is the region of low rainfall, which includes parts of Uttar Pradesh, Rajasthan, interior deccan plateau.

(d) Areas of Inadequate rainfall (Less than 60cm): This is region of scanty rainfall. The western part of Rajasthan and Gujarat, Laddakh and south central part receives a rainfall of less than 20cm.
ACTIVITY 10.4

List out the festivals of India in the table given below. Also find out which season is economically significant in your area and why?

<table>
<thead>
<tr>
<th>List of the festivals</th>
<th>Areas where celebrated</th>
<th>Date and month</th>
<th>Season</th>
<th>Economically Significant</th>
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</tbody>
</table>

Do you see co-relation between seasons of festivals and harvest seasons. Please provide one reason.

Figure 10.9  Annual Rainfall of India
10.5 SOCIO-CULTURAL LIFE

You are now well aware about the cycle of seasons but a second thought comes to our mind what do the relationship between the seasons and our life? Are they so important that they affect our life? The answer is ‘yes’. They do affect our social and cultural life. As India is an agricultural country the main economic activity of agriculture is totally dependent on the cycle of seasons. The time of *Kharif* crop is advancing monsoon season and harvesting is post monsoon season. *Rabi* crop is grown in winter and *zaíd* crop is at the end of winter season. Floods and droughts are hindrances in the economic growth of the nation as our economy is agro based economy.

All our activities are related with the seasons. As winter season comes the days become shorter and we start purchasing woolen clothes. Groundnuts, almonds and calorie rich food become very important in our diet. In spite of cold weather people celebrate many festivals like *Makar Sankranti* in many states, *Lohri* in Punjabi and *Pongal* in Tamil Nadu in the month of January. *Basant Panchami* is also celebrated in the month of February in which people pray for good harvest. Summer season is very dry but it reminds us of juicy fruits, ice creams and variety of drinks. What are the fruits available in this season? *Holi* and *Baisakhi* are the main festivals of the season. By the end of summer farmers start preparing their fields so that they can welcome the rains. This is the time when people of Kerala celebrate *Onam* which coincide with their harvest season. Post Monsoon is the harvesting time. It is also a festival time of *Dusshera, Durga Pooja* and *Diwali* which are celebrated all over India.

10.6 GLOBAL ENVIRONMENTAL CHANGES AND ITS IMPACT ON INDIAN CLIMATE

After studying this lesson you must have understood that India is fortunate to have four clear seasons’ summer, winter, spring and monsoon. However, these days one can notice disturbance in the cycle of seasons. This is due to global warming which is a burning topic of today’s world. It has a significant political, social and economic impact that may affect almost every aspect of our lives and lifestyles. The global warming has a serious impact on world’s climate and India cannot escape it. Don’t you think that it is important for everybody to know about it and think how each one of us can contribute in reducing its extent?

Let us understand what is global warming. During the last decades of urbanization, industrialization and population growth the atmosphere has been polluted. Human activities increase the amount of carbon dioxide, Chloro Floro Carbon (CFC) and other dangerous gases. About 51% of the solar energy is absorbed by the earth’s surface, which increases its temperature. The rest of the heat is reflected back in to the atmosphere. This helped in maintaining temperature. But now due to pollution some of the reflected heat is trapped by green house gases (GHGs), mainly carbon
It has increased the temperature of the Earth’s surface. There is evidence to show that CO₂ levels are still increasing. Many countries have signed a convention to reduce GHGs under the U.N. framework. However, the current international agreements are still not effective enough to prevent the significant changes in climate.

We already know that 70% of Indians are working in agriculture sector. Any change in temperature will have an adverse effect on agriculture. This will have a serious social and economic impact on India. After reading the chapter we can clearly see that climate plays a very important role in Human life. Our food, our festivals, and our economy everything is closely linked with the cycle of seasons. If the seasons are favourable, human life will be good and comfortable. Since the state of the weather affects agriculture, health, transportation etc it is important that all of us make some change in our lifestyle to reduce CFC and other harmful gases.

**ACTIVITY 10.5**

Keep a diary of events about natural calamities such as earthquakes, cyclones and geographical events. Record them with name of the event, date and their impact.

**INTEXT QUESTIONS 10.4**

1. Why do we find the rainfall distribution in India highly uneven?
2. Name the three regions of India receiving lowest rainfall.
3. Name the months of *Kharif* and *Rabi* season.
4. When do we have the *zaid* season?
5. Which human activities are responsible for global warming?

**WHAT YOU HAVE LEARNT**

- Climate of India is affected by many factors like location, distance from the sea, altitude, mountain ranges, direction of surface winds and upper air currents.
- India has a special system of reversal of winds which is known as monsoon and it comes with a system.
- India has a cyclic system of season and it has four main seasons. They are winter, summer, advancing monsoon and retreating monsoon.
- Seasons play an important role in our day to day life and affect our activities and eating habits.
- Global warming influences Indian climate also.
TERMINAL EXERCISES

1. Describe any five factors which are responsible for affecting the climate? Explain with the help of examples for each factor.

2. Differentiate between climate and weather.

3. How are winds and their directions responsible for affecting the climate? Explain by giving examples.

4. Define monsoon. Identify the main reason which is responsible for moving trade winds in opposite direction?

5. Mention any four characteristics of cold weather season.

6. List any four main features of hot weather season?

7. By giving examples explain the effects of the global warming in India. What are the causes behind it?

ANSWERS TO INTEXT QUESTIONS

10.1

(a) Tropic of cancer, 23½° N

(b)

Incluenced by sea

(i) Mumbai

(ii) Chennai

Not incluenced by sea

(iii) Lucknow

(iv) Delhi

(c) Himalayan Mountain Ranges

(d) Winds are coming from North-East. Since they are coming from land, they are dry and unable to give rain to the country.

10.2

1. Rajasthan, Punjab, Haryana, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Madhya Pradesh and Chhattisgarh and parts of Odisha.

2. Kerala.
3. South to North and North-East and North-West.

4. (a) Mumbai: 4 months     (c) Delhi: 4 months
    (b) Nagpur: 4 months     (d) Shillong: 6 months

10.3
1. (i) (b) Loo
    (ii) (c) Western Ghats
    (iii) (c) Retreating monsoon season
    (iv) (c) Deccan Plateau
    (v) (a) Seasonal Winds

10.4
1. When monsoon winds enter from the coast, they give the maximum rain there. When they reach the central or northern regions, they become dry, resulting less rainfall.

2. Regions of low rainfall –
   1. Northern leh-ladakh region
   2. Western Rajasthan
   3. South-Central part

3. Kharif – June and July    Rabi – October and November

4. From the end of the winter season i.e. March to May.

5. Urbanization, Industrialization, Deforestation, burning of fossil fuels, etc.