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Science and Technology

6

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Preface

It gives us an immense pleasure in presenting this book- Green Science and Technology for class 6. This book is written specially to meet the requirements of the new syllabus introduced by the Government of Nepal, Ministry of Education, Science and Technology, Curriculum Development Centre, Sano Thimi, Bhaktapur, Nepal.

Our aim and effort while writing this book has been to help students understand, enjoy and appreciate the fascinating subject of Science and Technology by making the process of learning enjoyable and stimulating. We have attempted to present the subject matter covering the entire prescribed syllabus in a simple language and interesting style with a large number of illustrative examples for easy understanding and application of the fundamental principles of Science and Technology. Each unit of the book has been carefully planned to make it student-friendly and present the subject matter in an interesting, understandable and enjoyable manner. A **Structural Programme Learning Approach** (SPLA) has been followed and exhaustive exercises are given at the end of each unit to test knowledge, understanding and applications of concepts taught/learnt.

The text is supplemented with weighting distribution, learning objectives, word power, teaching instructions, sample test papers and a large number of well-labelled accurate pictures. We sincerely hope that this book will serve its intended purpose and be received enthusiastically by both the students and teachers concerned.

We wish to express our sincere gratitude to Green Books Team for publishing this book. Our hearty thank goes to Focus Computer for excellent type setting and layout.

We also wish to acknowledge my great indebtedness to many teachers for their valuable suggestions and advice concerning the textbook. We are confident that as result of their suggestions this book will be more useful than any other textbooks. However, sympathetic criticisms and constructive suggestions for further improvement of the book, if any, will be welcomed and with warm regards incorporated in the subsequent editions.

Author and Editor
Kathmandu, Nepal
June, 2021

Contents

UNIT

1

Scientific Learning

Estimated teaching periods : 10

Before You Begin

Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanation and predictions. The word science has been derived from the Latin word "Scientia" which means knowledge . Science is based on research, which is commonly conducted in academic and research institution as well as in government agencies and companies. The learning based on scientific facts and evidences that can be verified experimentally is called scientific learning. It focuses on systematic knowledge of matter. The scientific learning process includes observation, classification, measurement, comparison, evaluation, analysis and conclusion.

The knowledge which man has gainead through observations and experiments, when organised systematically is called science. Physics is a science of measurement. In physics, we deal with a large number of physical quantities like length, mass, time, volume, pressure, velocity, force, etc. These quantities can give clear understanding only if we can measure them and express our conclusion into these measurements. Therefore, physics is also called the science of measurement. The comparison of an unknown physical quantity with a known standard quantity of the same kind is called measurement. Measurement is very important in our daily life.

Learning Objectives

After completing the study of this unit, students will be able to:

- introduce scientific learning.
- explain the steps of scientific learning process and adopt scientific learning process.
- introduce measurement and describe its importance.
- say how to use the units of measurement.
- introduce local systems of measurement and describe the importance of SI System.
- introduce various systems (MKS, CGS and FPS) of measurement.
- show the relation between multiples and sub-multiples of length, mass and time and use them.
- identify simple devices for measurement and use them.

Syllabus

- Introduction to scientific learning
- Steps of scientific learning process
- Measurement and its importance
- Local and standard units of measurement
- Multiple and sub-multiple units
- Length and its measurement
- Time and its measurement
- Temperature and its measurement
- Area and its measurement
- Volume and its measurement

Glossary

application	:	an act of applying or an act of putting to use
derived	:	something obtained from something else
evaluate	:	to determine or fix the value of sth
fundamental	:	basic, forming the source or base from which everything else is made
horizontal	:	going across and parallel to the ground
immerse	:	to put something into a liquid so that it is completely covered
mass	:	the total quantity of matter present in a body
measurement	:	the comparison of an unknown physical quantity with a known standard quantity of the same kind
observation	:	the act of careful watching and listening
parallax	:	the effect by which the position or direction of an object appears to change when the object is seen from different positions
prediction	:	the act of saying what will happen in the future
regular	:	having a fixed geometrical shape
scientific	:	of or relating to science
time	:	the duration between any two events
weight	:	the force with which a body is pulled towards the surface of the earth

1.1 Introduction to Scientific Learning

Science is the knowledge which is gained through observation and experiments, when organized systematically. Science focuses the systematic and organized study of an event, matter or subject.

Scientific learning is the learning which is gained through observation and experimentation. We require special procedural skills for scientific learning. The major procedural skills that are essential for scientific learning are as follows:

i. Observation ii. Classification iii. Measurement iv. Comparison
v. Evaluation vi. Analysis vii. Conclusion

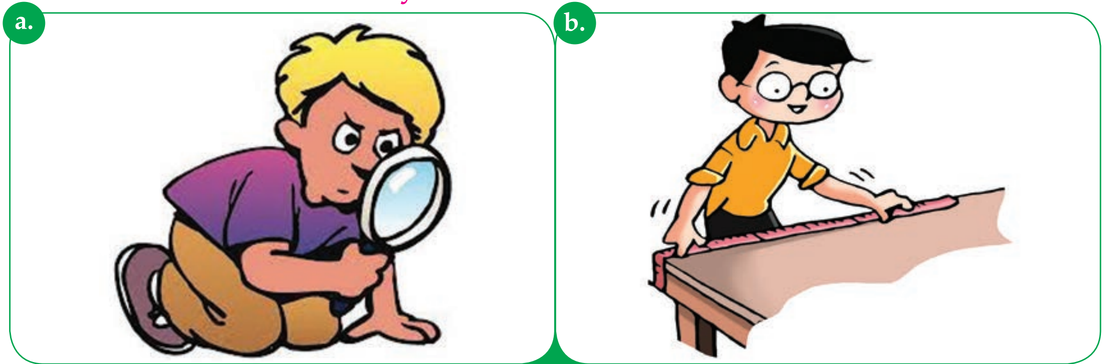


Fig.1.1

In scientific learning, first of all we observe things carefully, we ask questions, we do predictions, we do experiments and finally draw conclusion. The conclusion is drawn by analyzing the things. The conclusion drawn in this way is called scientific principle.

Sir Issac Newton saw an apple falling down from a tree and propounded law of gravitation. This is called scientific principle. Similarly, James Watt observed the lid of a kettle moving due to steam and he invented steam engine. This is also called scientific principle.

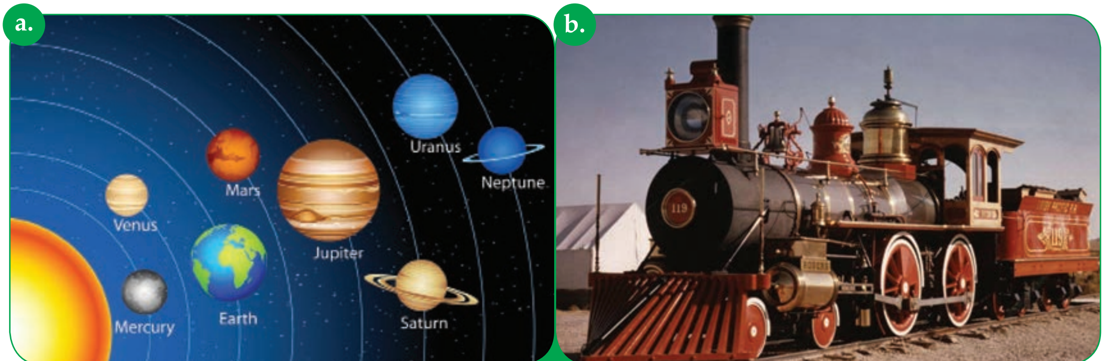


Fig.1.2

1.1.1 Scientific Learning Process

Let's perform following activities to develop the concept of scientific learning process.

Activity 1

- Observe all the things kept in your school bag such as books, notebook, geometry box, tiffin box, eraser, pen, pencil, water bottle, etc.
- Observe these things carefully and classify them on the basis of their shape, size, colour, hardness, density, etc.
- Now, fill in the given table on the basis of your observation.

Objects having similar shape	Objects having similar size	objects having similar colour	Hard objects	Soft objects	Heavy objects	Light objects

- Study the data filled in above table and draw conclusion and fill in the space given below:

Conclusion

1. Objects have different shape, size and colour.
2. ....
3. ....
4. ....
5. ....

The learning process which includes observation, prediction, experimentation, discussion and conclusion is called scientific learning process.

Activity 2

- Observe various things kept in your study room.
- Classify them on the basis of their shape, size, colour, density, etc.
- Draw any two conclusions from your study and discuss in your classroom.

1.1.2 Steps of Scientific Learning Process

The major steps of scientific learning process are described below:

1. Observation

This is the process of looking closely, noticing from different view points, and quietly watching. It is the very first step of scientific learning. In fact, learning begins from careful observation of the things and events. Therefore, we should observe the things carefully using all the senses for a meaningful learning.

Fig.1.3

2. Comparison

It is the second step of scientific learning process. Making comparisons invites children to move beyond telling what they noticed about something and to begin expressing relationships between things. How are these plants the same and or different? Where have you seen similar plants? etc.

Fig.1.4

3. Classification

This is the process of grouping things on the basis of their characteristics or traits. Children match, group, and organize materials in many different ways. Classification is the third step of scientific learning process. It helps us to understand that objects can belong to more than one group at a time.

4. Prediction

This is the process of questioning and speculating, based on prior knowledge gained in the first three steps. Children get better and better at prediction through experience. So we should provide lots of opportunities for this process skill.

5. Experimentation

It is the next step of scientific learning process. This comes when children test out their predictions and try out their ideas. The key to this step is to provide plenty of different materials and time to explore. Provide materials for free exploration in your science area. So children can visit and revisit them on their own-which is how children conduct their own version of an "independent study". This step is considered as the most important step for scientific learning.

Fig.1.5

6. Evaluation

This is where children communicate the findings of their experiments with others, taking their concrete experience, verbalizing it and representing the information abstracting with graphs, drawings, charts and field books. We can draw conclusion by analyzing the facts obtained from experimentation.

7. Application

This step involves applying the understandings gained from the experiment to a larger field of experience, encouraging children to broaden the scope of their experiments, try them again with new materials and see if their understandings are consistent. Application is the last step of scientific learning process.

Activity 3

- Collect some objects from your home such as sugar, piece of stone, rubber, plastic, eraser, pen, piece of paper, piece of copper wire, etc.
- Observe each of them carefully and predict whether they dissolve in water or not.
- Note down your prediction in a table.
- Now, take a pot with water and conduct experiment whether they dissolve in water or not.
- Note down the result of your experiment on the table. Compare your prediction and the result after experimentation.
- Write down the conclusion of this activity.

1.2 Measurementt

Fig.1.6

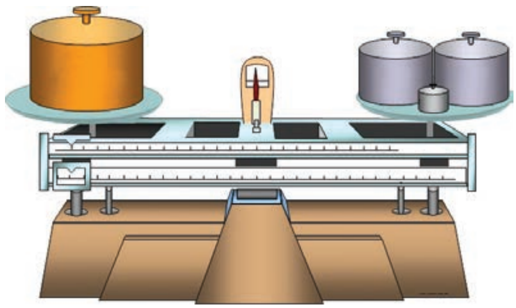
We measure various quantities like length, mass, area, time, temperature, speed, etc. in our day to day life. We measure things while buying and selling goods. We measure various quantities to do experiments in a science laboratory. To measure a physical quantity, we compare that physical quantity with a known standard quantity of the same kind. So, measurement is the comparison of an unknown physical quantity with a known standard quantity of the same kind.

Different tools or instruments are used to measure different physical quantities. A beam balance is used to measure the mass of a body. A spring balance is used to measure the weight of a body. A watch is used to measure time and a metre rod or scale is used to measure the length of a body.

Activity 4

- Study the given figures. What is shown in each of them? Discuss in the classroom.

a.



b.

Fig.1.7

Activity 5

- Take a measuring tape and measure the length and breadth of your classroom and writing board.
- Take a digital balance and measure the mass of your bag, science book, geometry set and pen.
- Take a stop watch and measure the time taken by your friends to write the definition and importance of measurement.

1.2.1 Importance of Measurement

The importance of measurement in our daily life is given below:

1. Measurement makes buying and selling goods easier.
2. It helps to get the accurate amount of physical quantities.
3. It is important to perform experiments in a science laboratory.
4. It is important in laboratories for getting proper amount of medicines.
5. It is important in construction of roads, buildings, bridges, etc.

1.2.2 Physical Quantities

The quantities like length, mass, time, area, volume, temperature, etc. can be measured. These quantities are known as physical quantities. Thus, those quantities which can be measured are called physical quantities. Some other examples of physical quantities are force, speed, pressure, acceleration, energy, power, electric current, etc. We cannot measure love, feeling, kindness, anger, beauty, desire, experience, happiness, etc. So they are not called physical quantities.

> **Do your know?**
> Length is called a physical quantity because it can be measured. But love is not a physical quantity because we cannot measure it.

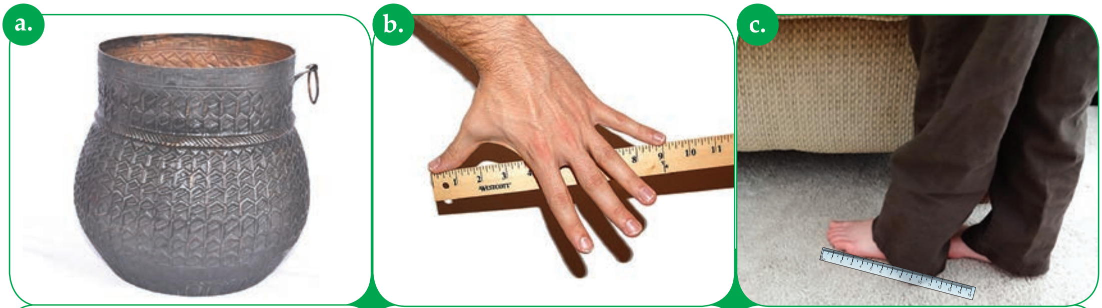
1.2.3 Units of Measurement

A unit is a standard quantity which is used to compare an unknown physical quantity. Similar physical quantities are measured in terms of unit. Metre (m), second (s), newton (N), pascal (Pa), etc. are some examples of units.

Here, meter (m) is the unit of length, second (s) is the unit of time, newton (N) is the unit of force and pascal (Pa) is the unit of pressure.

1.2.4 Local Systems of Measurement

In rural areas, people use mana, pathi, dharni, muri, pau, sher, chhatak, etc. to measure the mass of different goods. Similarly, they use haat (cubit), bitta (outstretched palm), foot, etc to measure the length of different objects. These units vary from person to person and hence give different measurement of the same object. Therefore, these units of measurement are not reliable due to lack of uniformity as they differ from place to place and person to person. To bring uniformity in the units of measurement throughout the world, scientists have developed different systems of measurement and standard units. These systems of measurement help to maintain uniformity in measurement throughout the world.



a. Pathi | b. Outstretched palm | c. Foot

Fig.1.8

Activity 6

- Measure the length of your classroom using your cubit (haat) and outstretched palm. Ask all the students of your class to measure the length of the same room one by one and keep the record. Do you get the same measurement? Why?
- Now, take a measuring tape and measure the length of the same classroom. Ask your friends to measure the length of the classroom using the same tape? Do all friends get the same length? Why?
- Discuss in the classroom and draw the conclusion.

Activity 7

- What types of local units are used in your locality? Discuss in the classroom and fill in the given table.

Physical quantities	Mass	Length	Time	Area	Volume	Temperature
Local units of measurement						
Standard units of measurement						

1.2.5. Standard Units of Measurement

In October 1960, the 12th General Conference of Weight and Measures in France, agreed to use international system of units to bring uniformity in scientific measurement throughout the world. This system is called

SI system. SI means 'system international de units' in French. SI system is the standard international system of units. Some examples of SI units are as follows:

S.N.	Physical quantities	Fundamental units	Symbols
1	Length	meter	m
2.	Mass	kilogram	kg
3.	Time	second	s
4.	Temperature	kelvin	K
5.	Electric current	ampere	A
6.	Luminous intensity	candela	Cd
7.	Amount of substance	mole	mol.
8.	Area	square metre	m^2
9.	Volume	cubic metre	m^3
10.	Force	newton	N
11.	Pressure	pascal	Pa
12.	Density	kilogram per cubic metre	kg/m^3
13.	Speed/Velocity	metre per second	m/s
14.	Energy	joule	J
15.	Power	watt	W

These fundamental units are also known as standard units of measurement as they are accepted, applied and valid all over the world.

1.2.6 Length and its Measurement

The distance between any two points is called length. For example the length of a stick is 2m means that the distance between the upper tip and lower tip of the stick is 2 times of the metre rod. In our practical life, we

a.

Ruler

b.

Measuring tape

Fig.1.9

use different forms of length like breadth, thickness, depth, radius, height, diameter, etc. We use different measuring devices such as scale, inch tape, metre rod, measuring tape, etc. to measure length.

Length is a fundamental physical quantity measured in metre (m) unit in SI system. To measure the length, the given object is compared with the standard length of a scale or metre rod or a measuring tape. Length is also measured in millimetre (mm), centimetre (cm), decimetre(dm), kilometre (km), etc.

Do you know ?

The distance between any two points is called length. It is measured in mm, cm, m, km, etc.

The multiples and sub-multiples of metre (m) are as follows:

1000 m	= 1 km
1 cm	= 10 mm
10 cm	= 1 dm

1 m	= 100 cm
1000 mm	= 1m

We measure short distances in metre (m). Sometimes, metre is considered too short to measure very long distances such as length of a river, a highway, etc. Such distances are measured in kilometre, mile, etc. Similarly, very short distances are measured in millimetre (mm) and centimetre (cm).

Activity 8

Make a list of any five measuring devices and write their uses.

S.N.	Name of measuring devices	Uses
1.		
2.		
3.		
4.		
5.		

Worked out Numerical Problems

1. Convert 2.5 km into m.

Sol^n: 2.5 km = 2.5 × 1000 m [$\because$ 1 km = 1000 m]

= 2500 m

2. Convert 810 cm into m.

Sol^n: $810 \text{ cm} = \frac{810}{100} \text{ m} \quad [\because 100 \text{ cm} = 1 \text{ m}]$

$= 8.1 \text{ m}$

3. Convert 4 m 75 cm into cm.

Sol^n: $4 \text{ m } 75 \text{ cm} = 4 \times 100 \text{ cm} + 75 \text{ cm}$

$= 400 \text{ cm} + 75 \text{ cm}$

$= 475 \text{ cm}$

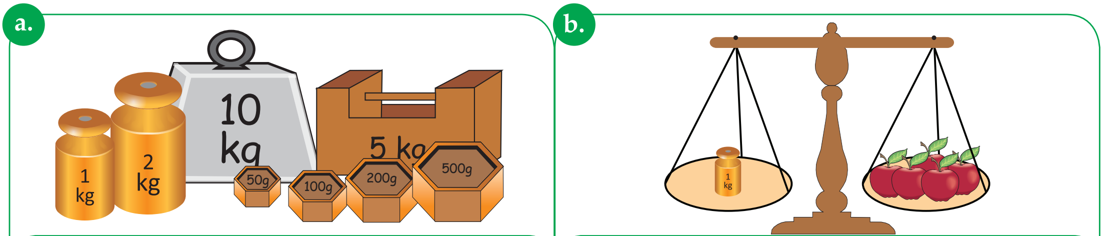
Activity 9

Search in the internet and find out the length of the following. Express their length in kilometre, metre, centimetre and millimetre.

S.N.	Highways/bridges	Length in			
		km	m	cm	mm
1.	East west highway				
2.	Araniko highway				
3.	Karnali bridge				
4.	Dodhara bridge				
5.	Prithvi highway				
6.	Dashrathchand highway				

1.2.7 Mass and its Measurement

The total quantity of matter contained in a body is called mass of the body. The mass of a body depends on the number of atoms and the mass of each atom of that body. The SI unit of mass (m) is kilogram (kg). Mass is also measured in gram (g), milligram (mg), etc. The mass of a body



Measuring masses *Measuring the mass of apples*

Fig.1.10

does not change from place to place. So it is called a constant quantity. The mass of a body is measured by a beam balance or physical balance.

The object whose mass is to be measured is placed in the left-hand pan and the weights or standard masses are added to the right hand pan until the beam attains equilibrium. In this position, the total mass of 'weights' on the right hand pan gives the mass of the object.

The mass of light objects is measured in milligram (mg), gram (g) and kilogram (kg). Similarly, the mass of heavy objects is measured in quintal, metric ton, etc. The sub-multiples and multiples of a kilogram are as follows.

SI unit	Sub-multiples	Multiples
1 kilogram (kg)	1 milligram (mg) = $\frac{1}{1000000}$ kg	1 quintal = 100 kg
	1 gram (g) = $\frac{1}{1000}$ kg	1 ton = 1000 kg

Worked out Numerical Problems

1. Convert 2525 g into kg.

Sol^n: $2525 \text{ g} = \frac{2525}{1000} \text{ kg}$ [$\because$ 1 kg = 1000 g]

$= 2.525 \text{ kg}$

2. Convert 8 kg 550 g into g.

Sol^n: 8 kg 550 g = (8×1000)g + 550 g [$\because$ 1 kg = 1000 g]

= 8000 g + 550 g

= 8550 g

3. Convert 7 quintal into gram.

Sol^n: 7 quintal = 7×100 kg [$\because$ 100 kg = 1 quintal]

= 700 kg

= 700×1000 g [$\because$ 1 kg = 1000 g]

= 700000 g

Activity 10

- Take a beam balance or pan balance with measuring weights.
- Measure the mass of your bag, science book, notebook, instrument box, apple, water bottle, etc. one by one.
- Express mass of each objects in kg, g and mg.

1.2.8 Time and its Measurement

Time is defined as the duration between any two events. The SI unit of time is second (s). It is determined on the basis of time taken by the earth to rotate in its own axis. A watch or clock is used to measure time.

a.

Quartz watch

b.

Mechanical watch

c.

Atomic clock

Fig.1.11

One mean solar day is defined as the time taken by the earth to complete one rotation around the sun about its axis. This time duration is divided into 24 intervals. One interval out of 24 intervals of a mean solar day is called one hour. The duration of one hour is divided into 60 equal intervals, one interval of which is called one minute. One minute time is divided into 60 equal intervals, one interval of which is called one second.

The multiples and sub-multiples of second are as follows:

60 seconds	= 1 minute	60 minutes	= 1 hour
24 hours	= 1 day	7 days	= 1 week
12 months	= 1 year	365 days	= 1 year
10 years	= 1 decade	100 years	= 1 century

Conversion of one day into seconds

One day $= 1 \times 24$ hours

$= 1 \times 24 \times 60$ minutes

$= 1 \times 24 \times 60 \times 60$ seconds

$= 86400$ seconds

$\therefore$ One day $= 86400$ seconds

Do you know?

- One second time is defined as one part of 86400 parts of a solar day.
- A leap year has 366 days.

A variety of clocks like mechanical clock (pendulum clock), quartz clock and atomic clock are used to measure time.

A mechanical clock or pendulum clock works on the basis of the oscillation of a simple pendulum. This type of clock cannot measure time accurately. Quartz clocks work due to vibration of quartz crystal. It is more accurate than mechanical clock. Similarly, an atomic clock works due to emission of radiation by Cs-133 isotopes. It measures time most accurately.

a.

Digital Clock

b.

Table Clock

Fig.1.12

Activity 11

- Take a wrist watch and calculate the time taken to reach from school to home.
- Convert that time into hour and seconds.

Activity 12

- Observe different types of clocks kept at your home and school.
- Study their structure and draw a neat and labelled figure of each.

1.2.9 Temperature and its Measurement

Why do you use thermometer when you fall sick? What do we measure using thermometer? We use a thermometer to measure the temperature of our body.

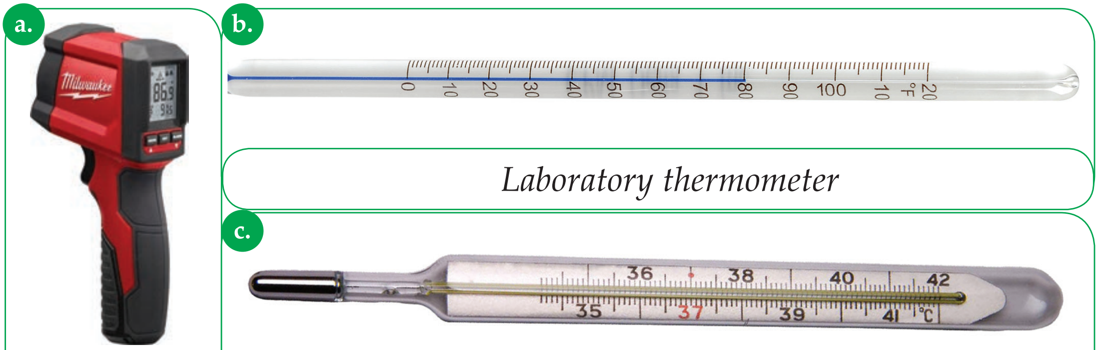
Do you know?

Heat always flows from the body at higher temperature to the body at lower temperature.

The temperature of a body is defined as the degree of hotness or coldness of the body. Temperature of a body is the measure of the average kinetic energy or thermal energy of its molecules. Temperature is the property of a substance which determines the direction of flow of heat. Temperature is measured by using thermometer.

The SI unit of temperature is kelvin (K). But temperature is commonly measured in degree Celsius (°C) and degree Fahrenheit (°F).

We can feel hotness or coldness of a body by touching it. But we cannot measure the temperature of that body just by touching. A device that is used to measure the temperature of a body is called thermometer. So, thermometer is the device which is used to measure the temperature of a body.



Thermal gun

Laboratory thermometer

Clinical thermometer

Fig.1.13

Activity 13

- Take a clinical thermometer and measure body temperature of all the students of the class one by one.
- Take a laboratory thermometer and measure the temperature of ice, cold water, hot water and tea.

1.2.10 Regular objects and Irregular objects

Those objects which have a fixed geometrical shape and proper dimension are called regular objects. Book, chalk box, pencil, brick and chalk are some examples of regular objects.

Book *Pen* *Ball*

Fig.1.14

Those objects which do not have a fixed geometrical shape and proper dimension are called irregular objects. A piece of stone, leaf, a piece of paper and a piece of broken glass are some examples of irregular objects.

Piece of a brick *Leaf* *Broken glass*

Fig.1.15

Activity 14

- Collect any eight objects from your surroundings.
- Observe their shape and classify them as regular and irregular objects.

1.2.11 Area

The total surface possessed by a body is called its area. The SI unit of area is square metre (m^2). It is also measured in cm^2, km^2, etc.

We can measure the area of regular plane surfaces by using the given formulae.

1. Area of a rectangular object (A)
   = length (l) × breadth (b)
   $\therefore$ A = l × b
2. Area of a square (A) = $(\text{length})^2$
   $\therefore$ A = l^2

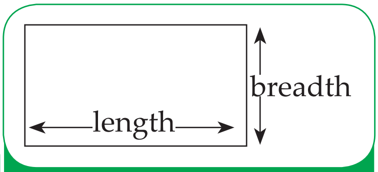


Fig.1.16

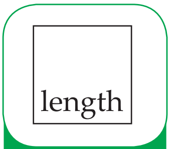


Fig.1.17

Worked out Numerical Problems

The length of a rectangular room is 10 metre and its breadth is 8 metre. Calculate its area.

Solution

Length (l) = 10 m

Breadth (b) = 8 m

Area (A) = ?

We know that,

Area of a rectangular body (A) = length (l) × breadth (b)

= 10 m × 8 m

= 80 m^2

$\therefore$ Area of rectangular body (A) = 80 m^2

Activity 15

- Calculate the area of your science notebook by measuring its length and breadth.
- Calculate the area of your classroom by measuring its length and breadth.

The area of an irregular body cannot be measured by using different formulae because they have no proper dimension for the measurement of length, breadth, height, etc. So the area of an irregular body can be measured by using graph paper.

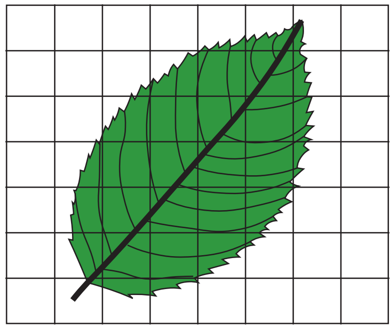


Fig.1.18

The irregular object (say a leaf) is placed on a graph paper and its outline is drawn by using a sharp pencil. Then the leaf is removed and the number of complete squares and squares which are half and more than half within the outline is counted. However, the squares which are less than half are ignored. By multiplying the total counted squares and area of unit square of a graph paper, the approximate area of the given irregular object is calculated.

Activity 16

- Calculate the area of a leaf by using a graph paper.
- Calculate the area of a piece of stone by using a graph paper.

1.2.12 Volume

Volume of a body is defined as the total space occupied by the body. Its SI unit is cubic metre (m^3). The volume of a solid object is measured in mm^3, cm^3, m^3, etc. Similarly, the volume of liquid substances is measured in millilitre (ml), litre(l), kilolitre (kl), etc.

The volume of regular solid objects can be calculated by the given formulae:

i. Volume of a rectangular solid or a cuboid (V) = length (l) × breadth (b) × height (h)

$\therefore$ V = l × b × h

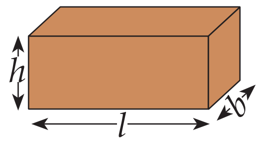


Fig.1.19

ii. Volume of a cube (V) = $(\text{length})^3$

$\therefore$ V = l^3

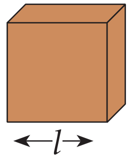


Fig.1.20

Worked out Numerical Problem

The length, breadth and height of a box are 0.5m, 40cm and 20cm respectively. Calculate the volume of the box.

Solution:

Length (l) = 0.5m

= 0.5 × 100cm = 50cm

Breadth (b) = 40cm

Height (h) = 20cm

Volume (V) = ?

We know,

V = l × b × h

or, V = 50 × 40 × 20 cm^3

= 40,000cm^3

$\therefore$ The volume of the box (V) = 40,000cm^3

Measurement of the volume of a liquid

The volume of liquids is measured by different measuring devices. In the science laboratory, volume of different liquids is measured by using a measuring cylinder. Measuring cylinders are of different capacities like

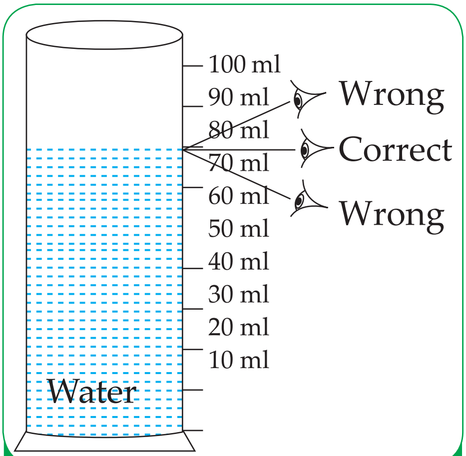


Fig.1.21

10, 25, 50, 100, 250, 500, 1000 millilitres. Volume of a liquid is measured in millilitres (ml) or cubic centimetre (CC) and litre (l). To measure the volume of a liquid, the liquid is poured into a measuring cylinder. The reading at the surface of the liquid is noted which is the volume of the liquid.

Different liquids form different surfaces in a measuring cylinder. Liquids like water, alcohol, kerosene, oil, etc. form a concave surface and liquids like mercury form a convex surface in the cylinder. The eye should be kept in the level with the bottom of the meniscus in the concave surface and eye should be kept at the upper meniscus in the convex surface of liquid in the measuring cylinder to avoid parallax error.

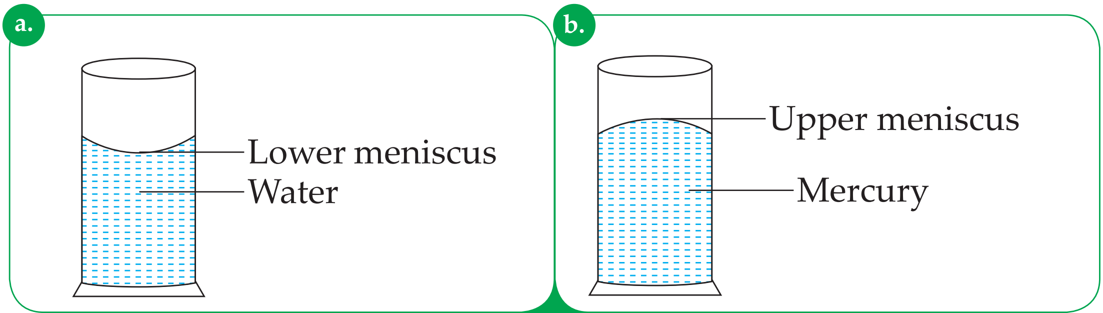


Fig.1.22

Measurement of the volume of irregular solid objects

The volume of irregular solid objects can be measured by displacing water (liquid)using a measuring cylinder. When an irregular body is completely immersed in the liquid (water), it displaces liquid (water) equal to its volume and the level of water increases. The increase in the volume of water is the volume of that object. This method is called a water displacement method. It is applicable for irregular solid objects which are insoluble in liquid (water) and can be handled by using a measuring cylinder.

Experiment

To measure the volume of a piece of brick by water displacement method

Materials Required: Measuring cylinder, a piece of brick, thread, water

Procedure

- Take a measuring cylinder and fill it in half with water.
- Record the level of water in the cylinder. Let it be Vi which is the initial volume of water.
- Now, tie the given piece of brick with a thread and immerse it into the water in the measuring cylinder. The level of water rises in the cylinder.
- Record the level of water rise. It is the final volume (Vf) of water.

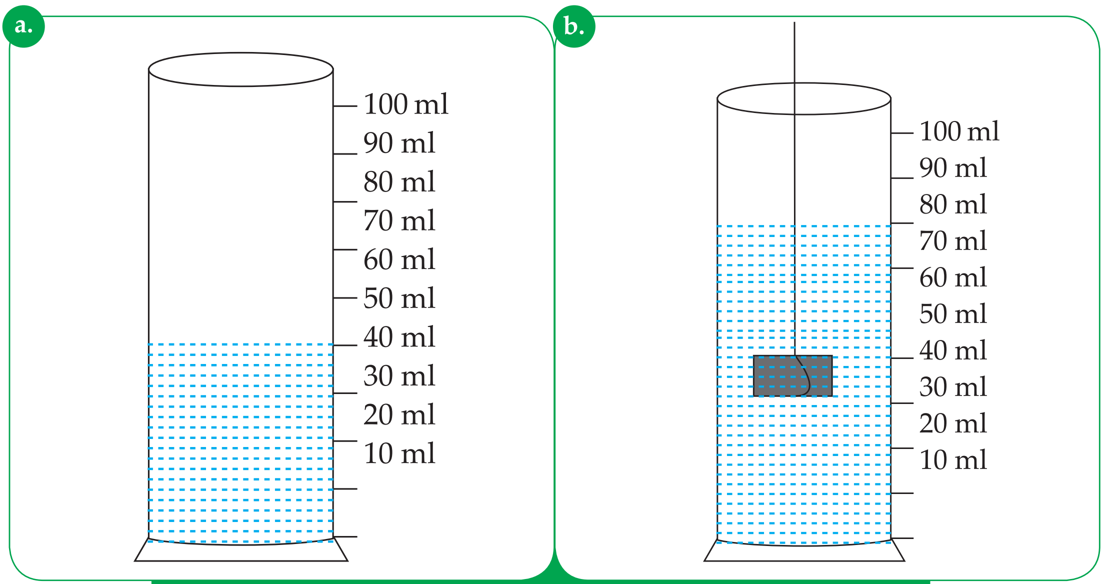


Fig.1.23

Observation

Initial volume of water in the cylinder (Vi) = 40 ml

Final volume of water in the cylinder (Vf) = 70 ml

Volume of given irregular body (V) = Vf - Vi = 70 ml - 40 ml = 30 ml

$\therefore$ Volume of the piece of brick = Volume of the water displaced

= 30 ml

= 30 cm^3 [$\therefore$ 1 ml = 1cm^3]

Precautions

1. Measuring cylinder should be placed on a plane surface and water should be at rest.
2. The reading of level of the water should be taken at the bottom of the meniscus.

Activity 17

Take a piece of stone and measure its volume by water displacement method.

Activity 18

- Calculate the volume of the given objects :
  a. Science Textbook
  b. Chalk box
  c. Duster
- Express the volume of each object in cubic metre (m^3).

Key Concepts

1. The learning based on scientific facts and evidences that can be verified experimentally is called scientific learning.
2. The knowledge which man has gained through observations and experiments, when organized systematically is called science.
3. The major procedural skills that are essential for scientific learning are as follows:

i. Observation	ii. Classification	iii. Measurement
iv. Comparison	v. Evaluation	vi. Analysis
vii. Conclusion		

4. The learning process which includes observation, prediction, experimentation, discussion and conclusion is called scientific learning process.
5. Measurement is the comparison of an unknown physical quantity with a known standard quantity of the same kind.
6. Those quantities which can be measured are called physical quantities.
7. A unit is a standard quantity which is used to compare an unknown physical quantity.

8. In Nepal, "Department of Weights and Measures" in Kathmandu maintains the standard units to measure different physical quantities.
9. The distance between any two points is called length. Its SI unit is metre (m).
10. The total quantity of matter contained in a body is called mass of the body. Its SI unit is kilogram (kg).
11. Time is defined as the duration between any two events. The SI unit of time is second (s).
12. One mean solar day is defined as the time taken by the earth to complete one rotation around the sun about its axis.
13. A variety of clocks like mechanical clock (pendulum clock), quartz clock and atomic clock are used to measure time.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. The learning which is gained through observation and experimentation is called scientific learning. ☐

b. Measurement is the comparison of an unknown physical quantity with a known quantity of the same kind. ☐

c. Physical quantities connot be measured. ☐

d. Mana and pathi are local units of measurement. ☐

e. In MKS system, length is measured in centimetre. ☐

f. Mass is measured by using a beam balance. ☐

g. The duration between any two events is called time. ☐

h. The volume of a regular solid object is measured by a measuring cylinder. ☐

i. The area of an irregular object can be measured by using a graph paper. ☐

2. **Fill in the blanks using appropriate words.**

a. .... learning focuses on systematic knowledge of matter.

b. The quantities which can be measured are called ....

c. Very long distances are measured in ....

d. The SI unit of time is ....

e. In SI system, amount of substance is measured in ....

f. The interval between any two events is called ....

g. .... is the SI unit of temperature.

h. The volume of .... is measured by using measuring cylinder.

3. **Tick (√) the best answer from the given alternatives.**

a. There are .... steps of in scientific learning process.

☐ five ☐ six ☐ seven ☐ eight

b. Which of the given quantities is not a physical quantity?

☐ length ☐ mass ☐ love ☐ time

c. The standard unit of .... is ampere.

☐ time ☐ mass ☐ length ☐ electric current

d. A short duration of time is measured in ....

☐ day ☐ hour ☐ minute ☐ second

e. The SI unit of mass is ....

☐ newton ☐ kelvin ☐ kilogram ☐ metre

f. The total quantity of matter contained in a body is called ....

☐ time ☐ mass ☐ length ☐ measurement

g. SI unit is accepted throughout ....

☐ Nepal ☐ Asia ☐ the world ☐ France

4. **Answer the following questions.**

a. What is science? Write its literal meaning.
b. What is scientific learning process?
c. Write down the main steps of scientific learning process.
d. What is measurement?
e. Write down the importance of measurement.
f. Define physical quantities with any three examples.
g. Give any three examples of local system of measurement.
h. Define unit? Write down local units and standard unit of mass.
i. What is length? Write down standard unit of length.
j. Define mass and write its standard unit.
k. What is time? Name the device which is used for measuring time.
l. Name any five physical quantities.
m. Define length. Write its SI unit.
n. What is meant by the mass of a body? Write its SI unit.
o. What is the duration between any two events called? Write down its SI unit.
p. Define regular body with any three examples.
q. What is area? How is the area of a leaf measured?
r. Define volume. Write its SI unit?

5. **Differentiate between:**

a. Local units and Standard units
b. FPS system and MKS system
c. Length and Time

6. **Describe the main steps of scientific learning process in brief.**

7. **Describe the method of measuring the length of a body.**

8. **Describe the method of measuring the mass of a body.**

9. **How many seconds are there in one solar day? Show with calculation.**

10. Give reason.

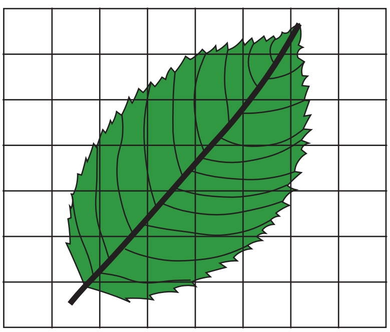
a. Length and mass are called physical quantities.
b. Standard physical quantity is used for correct measurement.
c. Graph paper is used to measure the area of an irregular body.
d. A measuring cylinder is used to measure the volume of an irregular solid object.

11. Match the following.

Physical quantities	*SI units*
length	m^2
mass	m/s
volume	K
temperature	m
density	m^3
area	kg
speed	kg/m^3

12. Numerical problems

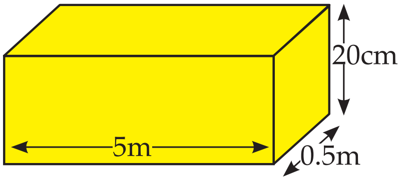
a. Convert 6 km into cm. [Ans: 600000 cm]
b. Convert 6530 m into km. [Ans: 6.53 km]
c. Convert 40 kg 350 g into g. [Ans: 40350 g]
d. Convert 2563 g into kg. [Ans: 2.563 kg]
e. Convert 1 day into seconds. [Ans: 86400 s]
f. The length of a white board is 80 cm and its breadth is 65 cm. Calculate its area. (Ans: 5200 cm^2)
g. Study the given figure and calculate the area of the leaf.



Area of each square = 1 cm^2

h. The length, breadth and height of a box are 8m, 6m and 3m respectively. Calculate its volume. (Ans: 144 m^3)

i. Study the given figure and calculate its area and volume.

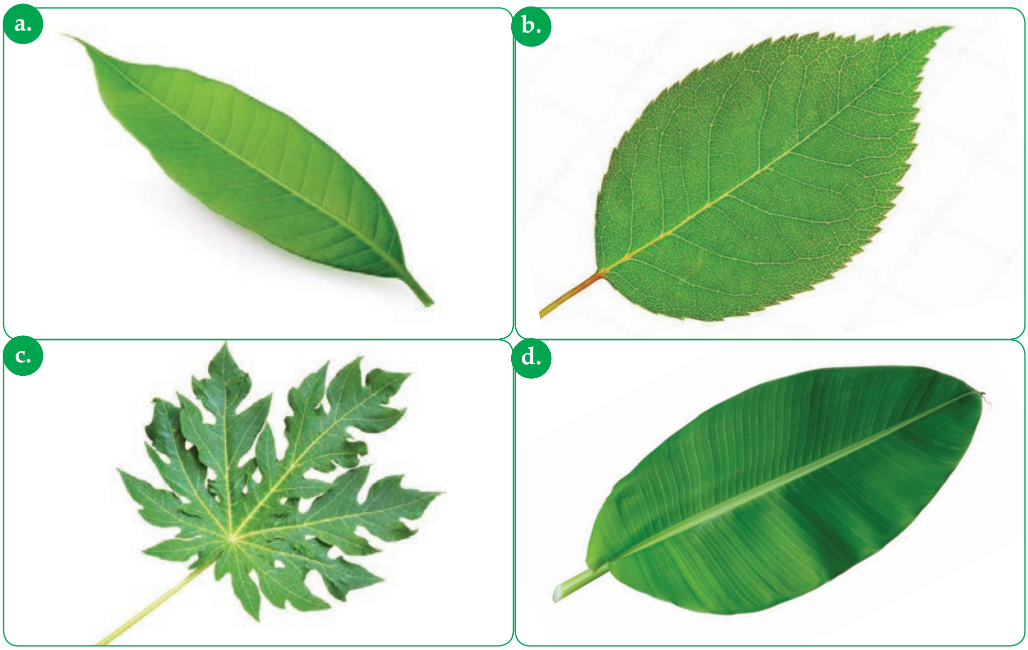


(Ans: A = $2.5m^2$, V = $0.5m^3$)

j. Convert $1m^2$ into cm^2. (Ans: 10,000 m^2)

k. Convert $1km^2$ into m^2. (Ans: 10,00,000 m^2)

13. Study the given figures and draw conclusions adopting scientific procedural skills.



14. Why does a tailor take measurement before stitching clothes for us? What happens if you don't take measurement before stitching clothes? Explain.

UNIT

2

Information and Communication Technology

Estimated teaching periods : 30

Before You Begin

Today's era is the era of information and communication. Information can be defined as the collected knowledge, facts or details about something or somebody. Similarly, communication is the act of expressing ideas and feelings giving people information by various means. We use various means such as books, newspapers, internet, radio, television, etc. to collect and transmit information. Technology refers to the application of scientific knowledge in practice to do various works in our daily life. Local technology is a traditional technology of a particular locality. It is based on the knowledge and skill of the local people. It transfers from one generation to another. Local resources are used in local technology. The modern technologies are the advanced form of traditional technologies. Thus, there is a close connection between traditional technology and modern technology.

Smartphone and computer are the most important means of two way communication. The major parts of a computer are CPU (Central Processing Unit), keyboard, mouse, and Monitor. The use of a computer is increasing day by day. A computer is used for internet phone, sending e-mails, chatting, video conference, etc. We can copy, record, play and print the data by using computer.

Learning Objectives

After completing the study of this unit, students will be able to:

- introduce technology and describe simple (local) technology and modern technology with examples.
- compare simple technology and modern technology in different sectors.
- explain the use of mobile phone and computer in our daily life.
- introduce computer and its components.
- state working principles of computer.
- describe types of computer and describe laptop, desktop, tablet, iPad and smart phone as the form of computer.
- explain the use of word processor.
- describe the use of multimedia.
- create power point presentation.
- prepare spreadsheet and use it.

Syllabus

- Introduction to technology
- Simple technology and modern technology
- Comparison between simple technology and modern technology
- Use of smart phone and computer in our daily life
- Things to remember while using computer and smart phone
- Components of computer
- Types of computer
- Use of word processor
- Use of multimedia
- Creating powerpoint presentation
- Use of spreadsheet

Glossary

alignment	:	arrangement in a straight line or in correct relative positions
communication	:	the imparting or exchanging of information by speaking, writing, or using some other medium
computer	:	an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program
information	:	knowledge obtained from investigation, study, or instruction
ipad	:	Interactive Personal Application Device
laptop	:	a computer that is portable and suitable for use while travelling
mobile phone	:	a telephone with access to a cellular radio system so it can be used over a wide area, without a physical connection to a network
multimedia	:	using more than one medium of expression or communication
technology	:	the application of scientific knowledge for practical purposes, especially in industry,the study and transformation of techniques, tools, and machines created by humans
rural	:	in, relating to, or characteristic of the countryside rather than the town
powerpoint	:	a software package designed to create electronic presentations consisting of a series of separate pages or slides
smartphone	:	a mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, internet access, and an operating system capable of running downloaded apps
spreadsheet	:	an electronic document in which data is arranged in the rows and columns of a grid and can be manipulated and used in calculations
tablet	:	a small portable computer that accepts input directly on to its screen rather than via a keyboard or mouse
word processor	:	computer program used to write and revise documents, compose the layout of the text, and preview on a computer monitor how the printed copy will appear

2.1 Introduction to Technology

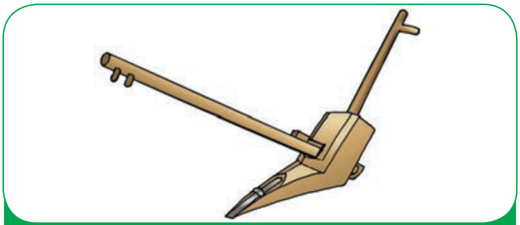


Fig. 2.1

We use different types of instruments to do our daily work. You might have seen various types of instruments used in kitchen to do various works. Such instruments are pastry board and roller, lemon squeezer, grater, knife, tongs, pestle, etc. Similarly, the instruments used in farming are plough, spade, sickle, rake, shovel, watering can, lawn mover, wheelbarrow, ploughing tractor, etc. Instruments that we use to do our daily work in different places are based on technology.

Technology refers to the application of scientific knowledge for developing machinery or equipment. Some machines or equipment are based on simple technology. Simple technology has two or less simple machines. For example, tong, knife, sickle, etc. Some machineries have several simple machines. For example, microwave oven, lawn mover, etc. The technology of such machineries is called modern or advanced technology.

2.1.1 Use of Simple Technology

Fig. 2.2

We use knife or sickle to cut vegetables. We use sickle, axe, etc. to cut firewood. We use plough to plough field. We dig farm by spade. We use pestle to grind spices. Knife, sickle, axe, plough, spade, water mill, etc. are simple machines. These machines are based on simple technology. The use of simple machines makes our work easier and faster. The instruments or machines that make our daily work easier and faster are called simple machines. The technology on which simple machines are based to construct them is called simple technology.

Simple technology is called local technology. Local technologies are developed on the basis of traditional knowledge and skill of local people. Local or simple technologies are different in different locality or community. These technologies are developed due to the geographical and communal diversity. In different localities or communities, various types of local technologies are in practice in different sectors. These sectors are agriculture, animal husbandry, water management, fabric production, food and beverage production, sculpture, infrastructure building, etc. The use of local technology makes works easier and faster in different sectors.

Activity 1

Observe the following machines of simple technology. Identify them by discussing among your friends. Enlist them with their names and uses. You may take help of your parents/guardians or teachers in this regard.

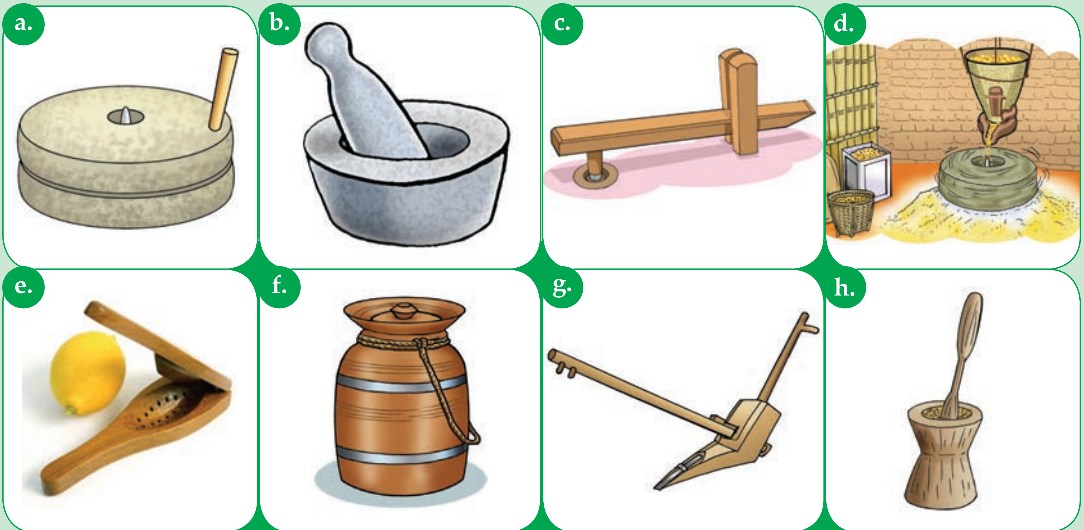


Fig. 2.3

Activity 2

Observe the simple machines that are used in doing works inside and outside of your home. Make their list with their uses as shown in the given example. Note that you should not repeat the simple machines shown in the activity.

Example.

Simple machine	Use
Spade	To dig the field for farming

2.1.2 Use of Modern or Advanced Technology

Fig. 2.4

What do you see in the above figures? In above figures, modern machines are shown that are used to do different works. Now-a-days, different types of advanced or modern machines are used. For example, refrigerator to preserve vegetables or fruits. Air conditions is used to make room cool or warm. We use computer to do different works at home or in the offices. Different means of transportation are used to transport people or goods. Refrigerator, air conditioner, computer, television, scooter, car, aeroplane, etc. are advanced or modern machines. These machines are based on modern technology.

Modern machines are operated with the help of electric or mechanical power. Some modern machines are operated automatically also. Modern machines make our work easier and faster. They also save our time, energy and power. Modern machines are complex in their structure, The machines having complex formation or structure and used to make our work easier, faster and comfortable are called advance or modern machines and the technology is called modern technology.

Some modern machines are used inside our home to do different works. For example, refrigerator, air conditioner, grinder, television, computer, etc. Some modern machines are used outside of our home to do different works. For example, tractor, car, aeroplane, ship, dozer, etc.

Activity 3

Make a list of modern machines used to do work inside your home. Also, write their uses as shown in the following table.

Modern machine	Use
Grinder	To make pickle
Television	To watch audio-visual content

Activity 4

Make a list of modern machines that are used to do work outside of your home. Also, write their uses as shown in the following table.

Modern machine	Use
Bus	To carry people from one place to another.
Tractor	To plough field for farming

2.1.3 Use of Simple Technology and Modern Technology in Agriculture

Fig. 2.5

In above pictures, you can see simple machines and modern machines that are used in agriculture. Sickle, plough, spade, etc. are simple machines used in doing different works in farms. These machines are simple in structure and their construction is based on simple technology.

Now-a-days, modern machines are used to cut cereals like paddy, wheat, etc. Similarly, tractors are used to plough farming fields. Different modern machines are used for plantation. These machines are complex in structure. They are constructed on the basis of advanced technology. They are operated with the help of electric or mechanical power. Ploughing and tilling machine, cutting machines, threshing machines, etc. are some examples of modern machines of agricultural sector.

Activity 5

Observe agricultural activities of your community. Watch or listen or read the programs/news related to agriculture. Discuss the answers of the given questions among your friends.

a. What are the machines used in agricultural sector?
b. Where are the simple machines and modern machines used in agricultural activities?
c. What is used to plough field in modern time instead of a plough?
d. What are the machines used to cut cereals now-a-days instead of sickles?
e. What are the differences you have observed between simple technology and modern technology used in agriculture sector?

2.1.4 Use of Simple Technology and Modern Technology in Grinding and Milling

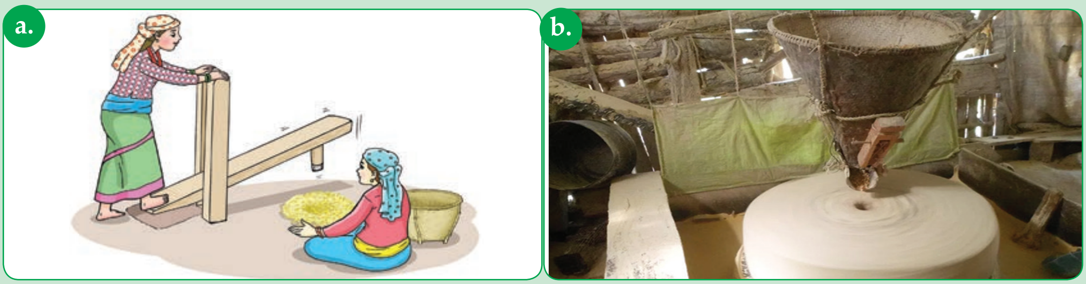
Simple machines	Modern machines
a. 	b. 

Fig. 2.6

You might have seen different machines used for grinding and milling. Janto, paanighatta, etc. are used to grind grains. Similarly, khal, silauto and lohoro, etc. are used to grind spices. Okhal, dhiki, etc. are used to pound rice. These are simple machines used in grinding and milling. Now-a-days, different types of grinding and milling modern machines are available. Modern floor mill are used to grind grains. Similarly, rice mills are used to mill rice. These machines are based on modern technology. Modern machines are operated with the help of electric power. In comparison to simple machines, modern machines used in grinding and milling are easier and faster in doing works.

Activity 6

Look at the following pictures carefully. Discuss the structures and working process of the simple machines among your friends.



Activity 7

Find the answers to the following questions by asking your parents or community members. Discuss the finding answers among your friends in the classroom.

a. Which simple machines were in practice in grinding and milling sectors before inventing modern machines of these sectors?

b. Which simple technology and modern technology are used to grind spices and medicines?

c. What was the water purification technology before the use of the water filter?

d. What are the simple technology of making pickle, bitten rice, gundruk, chhurpi, masaura, etc. Are there any modern technology to make these food stuffs?

2.1.5 Comparison between Simple Technology and Modern technology

Simple technology	Modern technology
1. It is developed on the basis of knowledge and skill of local people.	1. It is developed on the basis of modern scientific knowledge and skill.
2. Simple machines of this technology are simple in structure.	2. Modern machines of this technology are complex in structure.
3. Simple/local technology might be different from one locality to another.	3. Modern technologies are almost similar.
4. The machines of simple technologies are easy to operate. Special knowledge/ skill is not needed to operate them.	4. Knowledge and skill is needed to operate the machines of modern technologies.
5. The machines of simple technologies are operated manually.	5. The machines of modern technologies are operated with the help of electric power.

Modern technologies are developed on the basis of ancient/local/simple technologies. For example, modern floor mill is developed on the basis simple technology of griding (Jaanto, Panighatta). Modern technologies have been developed with the invention of science and technology. In urban areas, modern technologies are common. But in rural areas of Nepal, traditional/local technologies are yet in practice. In comparison to traditional technologies, modern technologies are faster, easier and more convenient in doing works of different sectors.

Project work 1

Divide the students of your class into four groups. Copy the following table in chart papers. Complete the table and discuss your work among your friends.

Work	Traditional/simple technology	Modern technology
Grinding grains	Jaanto, Panighatta	Modern flour mill
Grinding spices	Khal, Silauto and lohoro	Modern grinder
Making bread		
Cooking food		
Ploughing field		
Ironing clothes		
Extracting oil		
Milling rice		
Warming room		
Cutting cereals		
Threshing cereals		
Cooling water in summer		
Extracting butter from curd		
Crossing river		
Making wine		

Carrying patients to hospitals		
Transporting goods		
Making pickle		

Project work 2

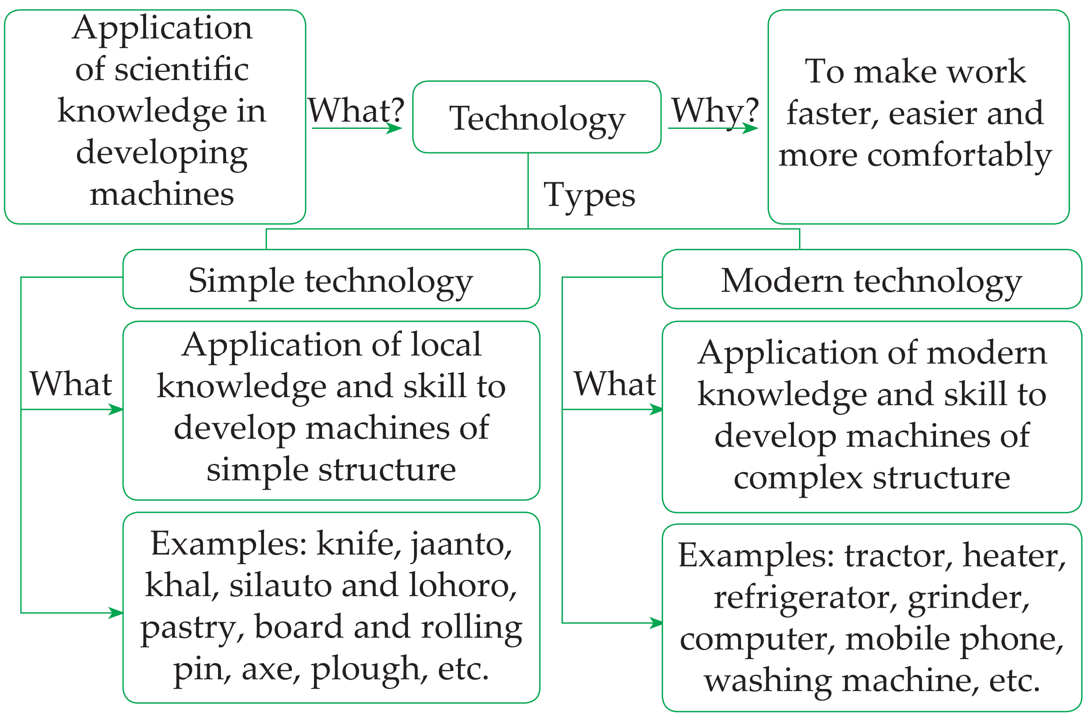
Find answers to the following questions by asking your family/ community members. Discuss the finding among your friends in the classroom.

a. Which simple technologies are used to get light in the areas where there is not access of electricity?

b. Which simple technology and modern technology are used to cook food by using animal dung?

c. Which simple technology and modern technology are used to grind spices (chilly, turmeric, etc) and make pickle?

Concept Mind Mapping



Key Concepts

1. Information can be defined as the collected knowledge, facts or details about something or somebody. Similarly, communication is the act of expressing ideas and feelings giving people information by various means.
2. Technology refers to the application of scientific knowledge for developing machinery or equipment.
3. The instruments or machines that make our daily work easier and faster are called simple machines. The technology on which simple machines are based to construct them is called simple technology.
4. Local technologies are developed on the basis of traditional knowledge and skill of local people.
5. The use of local technology makes works easier and faster in different sectors.
6. The machines having complex formation or structure and used to make our work easier, faster and comfortable are called advance or modern machines and the technology is called modern technology.
7. Ploughing and tilling machine, cutting machines, threshing machines, etc. are some examples of modern machines of agricultural sector.
8. In comparison to simple machines, modern machines used in grinding and milling are easier and faster in doing works.
9. In urban areas, modern technologies are common. But in rural areas of Nepal, traditional/local technologies are yet in practice.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a.	Technology makes our works easier and faster.	
b.	Panighatta is based on local technology.	
c.	Jaanto is operated with the help of electric power.	
d.	Modern machines are simple in structure.	
e.	Washing machine is a modern machine.	

2. Fill in the blanks with correct words from the brackets.

a. Sickle is an example of .... technology. (simple/modern)

b. Refrigerator is .... in structure. (complex/simple)

c. Grinder is a .... related modern machine. (kitchen/agriculture)

d. Induction stove is an example of .... technology. (local/modern)

e. Generally, machines of simple technology are used in .... areas of Nepal. (rural/urban)

f. Modern technologies use .... power of operate. (manual/electric)

3. Look at the following pictures carefully. Identify and classify them into simple technology and modern technology by making table in your exercise book.

a.


b.


c.


d.

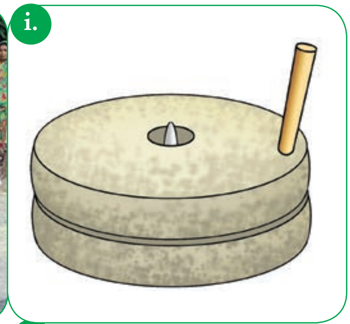

e.


f.


g.

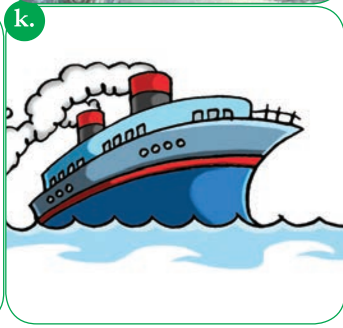
h.

i.



j.

k.



l.

4. Differentiate between:

a. Simple technology and modern technology

b. Jaanto and Panighatta

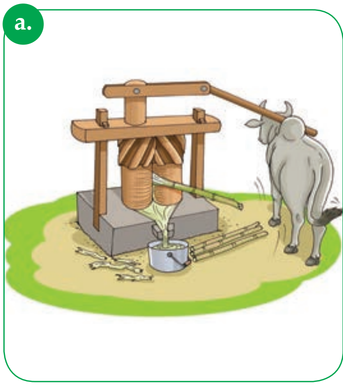
c. Khal and grinder machine

d. Coal iron and electric iron

e. Boat and ship

5. Look at the following pictures carefully. Discuss the answers to the given questions among your friends and write them in your exercise book.

a.



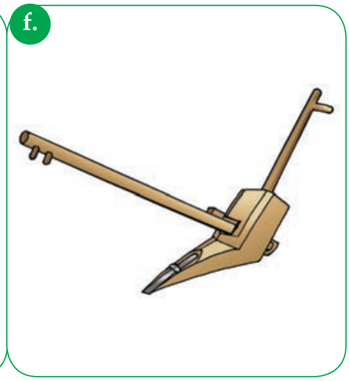
b.

c.

d.

e.

f.



Questions

a. Identify the machines shown in the pictures and write their name.

b. Classify the given machines into simple machines and modern machines.

c. Which of the above machines are used in rural areas of Nepal?

d. Differentiate between simple machines and modern machines shown in the pictures.

6. Answer the following questions.

a. What is technology? Why is it used?

b. Write down the benefits of technology.

c. Define simple local technology and modern technology with four examples of each.

d. Compare between simple technology and modern technology of grinding and milling.

e. In modern time, tractor is used in place of plough in agriculture, why?

f. 'Modern technology is preferred to traditional technology in agriculture at present.' Explain this statement with suitable reasons.

7. Draw the pictures of Panighatta and modern flour mill in your exercise book. Also, explain their structure and working mechanism.

2.2 Use of Computer and Mobile Phone in Daily Life

Computer and smartphone have become the part of our life. They have become necessary in education, entertainment, business, communication, health, etc. These devices have enabled people around the world to connect and communicate, get latest news and information, do Online business, etc.

Fig. 2.7

A mobile phone is an advanced technology tool. Smartphone is a mobile phone which has more facilities than a normal mobile phone. It has touch screen which allows you to interact with it. It is a low capability computer and can run small programs. It can be used to make phone call, send or receive message, take photo or video and play audio or video. It can be used to browse the web sites and run many apps like calculator, sound recorder, word processor program, scanner, Facebook, YouTube, Shareit, Xender, Viber, WhatsApp, Zoom, etc. Nowadays, it is widely used for online banking, online shopping and digital wallet.

Activity 8

Write the names of your family members who use smartphone and fill the table asking them for what purpose they use the smartphones.

S.N.	Family member	Name	Purpose of using Smartphone
1	Father		
2	Mother		
3	Sister		
4	Brother		

- Do you use smartphone?
- For what purpose do you use smartphone?

Computer is the advanced technology device. It is fast, accurate, diligence and versatile device. It helps you to do tasks accurately, fast, easy and organized ways. It is used in communication, education sector, health sector, business, security, research, transportation, bank and finance sector, office, entertainment, etc. The use of computer in communication has made the world as a small place. It helps people to communicate or exchange message from anywhere in the world at the fast speed. The use of computer in education sector has changed the way of teaching and learning process. Online teaching is becoming popular in education sector. For the Online teaching Google Classroom, Google Meet, Zoom, etc. can be used.

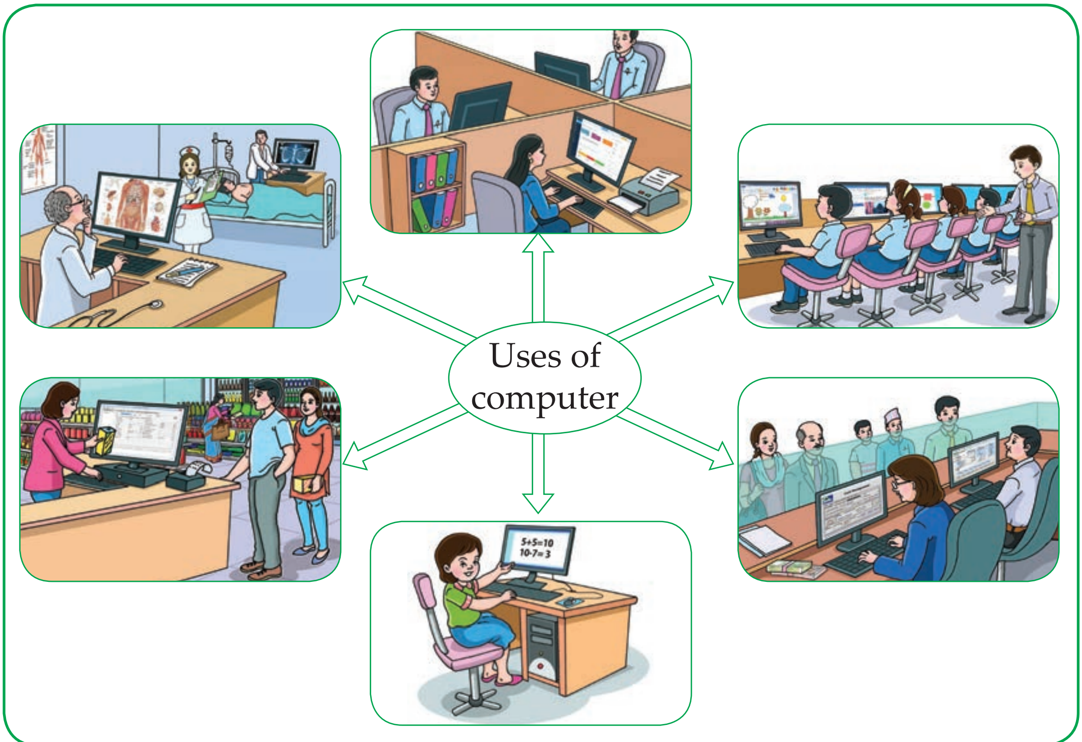


Fig. 2.8

The following are the some tasks that can be performed with the help of computer:

a. It enables you to search and get variety of information through web sites.

b. It enables you to send/receive messages to or from your friends or relatives.

c. It enables you to communicate with your friends or relatives.
d. It enables you to play songs and videos.
e. It enables you to prepare documents like notes, letters, books, magazines, etc.
f. It enables you to manage accounts of customers, households, etc.
g. It enables you to present information in more attractive ways.
h. It enables traffic to control road traffics.

Activity 9

Discuss in class about the uses of computer.

Activity 10

Write the names of your family members who use computer and fill the table asking them for what purpose they use the computer.

S.N.	Family member	Name	Purpose of using computer
1	Father		
2	Mother		
3	Sister		
4	Brother		

- Do you use computer?
- For what purpose do you use computer?

2.2.1 Things to remember while using mobile phone and Computer

Computer and smartphone are the useful devices. You have to use them properly. These devices may harm you if they are not use properly. When you use these devices continuously for a long time they may cause several health problems. They may cause redness eyes, blurred vision, headache, dry eye problem, eyestrain, decreased attention, shortness of temper, sleep disorders, etc. When you use the keyboard continuously for a long period of time you feel pain in your wrists and in fingers. Due to wrong posture you may feel pain at the back of neck.So, you should not use these devices continuously for a long time. While using these devices, you need to take break after each 20 minutes, blink eyes frequently and splash eyes with water. We should keep screen at right distance, adjust the brightness and text size. Smartphone should not be used while charging.

Activity 11

- Discuss in class about the harms that may cause due to prolonged use of smartphone and computer.
- Discuss in class how to avoid harms due to use of computer and smartphone.

2.2.2 Computer

The computer word is derived from the Latin word '*Computare*'. The Latin word '*Computare*' means to calculate. In the earlier days, when computer was being developed, it was developed just for calculation. The modern computer of today is fast, accurate, reliable, versatile, diligence, automatic and can store data. It can process raw data (i.e. unprocessed facts) and produce information (i.e. processed data/ meaningful facts) according to the instructions given by a user.

Fig. 2.9

So, a computer is a programmable electronic device that can process raw data according to the instructions and give information as the output.

2.2.3 Components of Computer

Computer system is made up of computer hardware and software. Computer hardware and software work together to perform tasks according to the instructions of a user.

Computer hardware is the physical part of a computer. You can see or touch computer hardware.There are many different computer hardware. They are grouped in input device, output device, central processing unit and storage device.

Input device | Microprocessor | Output device | Storage device

Fig. 2.10

An input device is used to enter data and instructions to a computer. Keyboard and mouse are the common input devices. Touch pad, joystick, scanner, microphone, etc. are also input devices.

An output device displays or presents information. Monitor and printer are the basic output devices. Other output devices are speaker and plotter.

The central processing unit(CPU)is the main brain of the computer. It is also known as microprocessor. It processes data according to instructions and produces information.

A storage device stores data and information temporarily or permanently. Hard disk, optical disk (Compact Disc, Digital Versatile Disc and Blu-ray disc), and pen drive are the storage devices. The data stored in the storage device can be reused in future. Nowadays, files, programs and software can be stored in Cloud Storage. The data stored in the Cloud Storage can be accessed from anywhere. Google Doc, YouTube, Facebook, etc. are the programs stored in the cloud storage.

Computer hardware performs tasks only when it gets instructions. A set of instructions given to a computer system to do task is known as a program. The collection of programs is known as software. Software is not physical parts of computer. You cannot touch software. Windows XP, Windows 7, Windows 10, Microsoft word, Microsoft excel, Microsoft PowerPoint, VLC media player, web browser, etc. are software.

Activity 12

- Discuss in class about the input, output, storage and processing devices of computer.
- Visit the computer lab and identify different devices attached with computer.
- List the hardware of computer in the lab.
- Open a computer in the Lab and list the software used in the computer.

2.2.4 Working Principle of Computer

A computer works according to the IPO principle. According to IPO principle, computer converts data into information in three major steps.

Step 1

Computer takes data and instruction centered by a user through input devices. The data or instruction entered to the computer is known as Input.

Step 2

Computer processes or converts the data according to the instructions. Treating data according to the instructions fed by a user is known as Processing. The processing of data is performed in the Central Processing Unit (CPU).

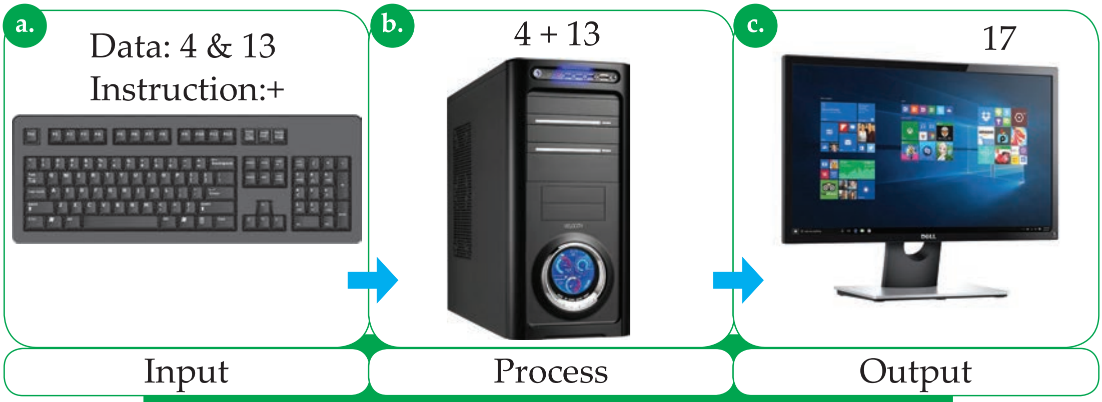


Fig. 2.11

Step 3

When data is processed, information is produced. Computer gives or provides information to a user through output devices. The information is also known as output. The output can be stored in a storage device.

2.2.5 Types of Microcomputer

Personal computers (PCs), i.e. microcomputers are commonly used at home, office, business, hospital and many other places. According to the size and portability, microcomputers are categorized into Desktop, laptop, netbook, tablet, iPad and smartphone.

A desktop computer is large in shape and size. It has separate input unit, CPU and output unit. It is required to keep on the desk or table and has no backup power supply unit. It is the powerful microcomputer and can perform many tasks.

The advancement in technology has enabled to develop small, light and portable computers. Laptop, tablet, iPad and smartphone are the compact and portable microcomputers. These portable computers have backup power supply unit and can be used anywhere there is no electricity. Laptop is as capable as desktop computer. But tablet, iPad and smartphone have lesser capability than the desktop and laptop.

a. Laptop b. Tablet c. Smartphone d. iPad

Fig. 2.12

Activity 13

- Discuss in class about different types of microcomputers that you have seen.

2.2.6 Word Processor

A word processor is application software that enables you to prepare documents like letters, notes, reports, books, etc. It allows you to insert pictures, tables and charts in the documents. It allows you to modify, format, save and print documents. Microsoft Word, Google Docs, Open Office Writer, InDesign and Frame Maker are some popular word processors.

Loading Microsoft Word (MS-Word)

Microsoft word is the word processor developed by Microsoft Corporation. It is the popular word processor and is used for preparing any kind of documents. You can open Microsoft Word by clicking on Start button, point to All Programs and selecting Microsoft Word2010/2013inMicrosoft Office.

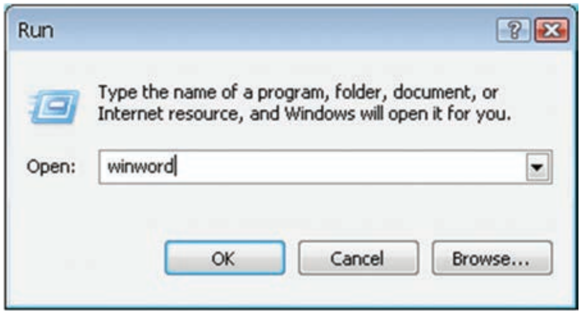


Fig. 2.13

You can open Microsoft Word simply by the following ways, too.

a. Press on Windows button and R keys on the keyboard. It opens Run dialog box.

b. Type WINWORD in the text box area.

c. Press OK button or press Enter key. It opens MS-Word program.

Opening a new or existing document

When you open MS-Word,you see a blank document called 'Document1' on the document window. Now you can enter text in the document. You can type continuously and whenever you have to change line or paragraph, press the Enter key. You have to put one space gap after full stop(.), comma(,), semicolon(;) and word.

You can create a blank new document any time by pressing Ctrl+Nkeys on the keyboard. You can open the existing document and read or modify the contents of the document. To open the existing word document, select Open command on File tab, specify the file location and select the file and press the Enter key.

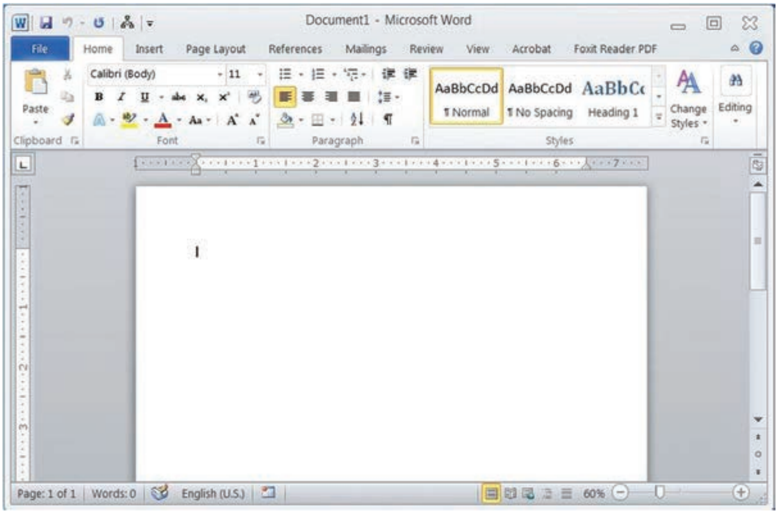


Fig. 2.14

Saving a Word Document

Once the document is ready you can save the document in the specified location on the disk for future use. When you save a document, MS-Word automatically adds . DOCX (.DOC in the earlier version) extension to the document file.

To save a document, follow these steps.

a. Click on Filetab and select Save As command from the list of options or click on Save button ( ) on the toolbar. It displays Save As dialog box.

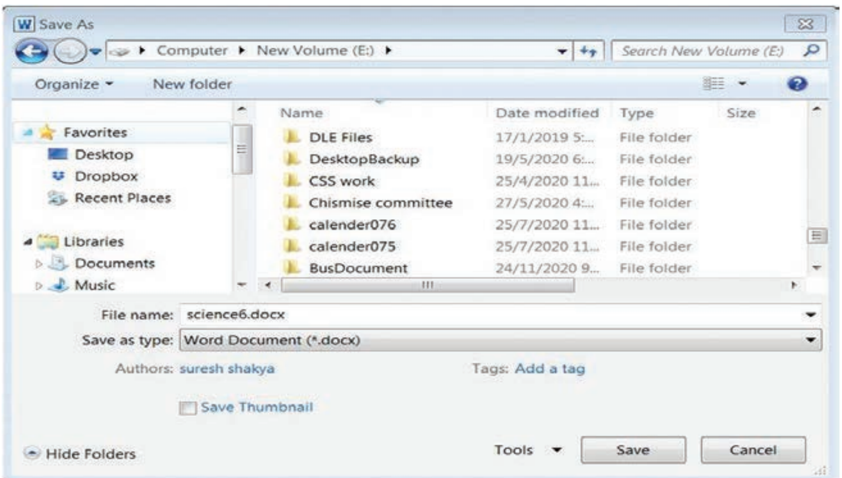


Fig. 2.15

b. Select the location where you want to save the document from the Save in drop down list box.

c. Type the name of the file in the File name text box.

d. Click on Save button.

Any modification in the document can be saved just by pressing Save ( ) icon on the toolbar.

Closing Word Document and MS-Word Application

You can close a document by selecting Close command on the File tab. Similarly you can close Word application just by clicking on the Close icon ( ) of the title bar.

Lab Activity 14

- Open Microsoft Word and type some information about your family and save the document.
- Close document and Microsoft Word.
- Open the document that you have just created and add some more text in it and save the document again.

Selecting text

You can format text in a document only when you select the text. When you select a text, the selected text is highlighted. You can select text either using mouse or keyboard.

- To select any amount of text, place the cursor at the beginning of the text and click and drag the mouse over the text that you want to select.
- To select a single word, double click on the word.
- To select a paragraph, triple click on any word of the paragraph or double click on the selection bar.
- To select entire document, press 'CTRL + A' keys on the keyboard.

Copying, Cutting or Moving text

The selected text can be copied, cut or moved from one location to another. To copy, cut or move text, follow these steps:

a. Select the text.

b. Click on Copy( ) icon or Cut( ) icon under the Clipboard group of Home tab.

c. Place the insertion point at the new location where you want to keep the selected text.

d. Click on Paste ( ) icon under the Clipboard group of Home tab.

Note

The shortcut keys for Copy, Cut and Paste are Ctrl + C, Ctrl + x and Ctrl + V respectively.

Undo and Redo

The Undo command and Redo command are very useful commands. While formatting a document if you do any mistake then you can reverse the previous action by the Undo command. The Undo command is one step backward command. The Redo command is the reverse of the Undo command. The Redo reapplies the last action reversed by the Undo command. The Redo command is one step forward command. You can apply Undo command and Redo command by clicking on the Undo icon and Redo icon on the Quick toolbar.

Lab Activity 15

- Open Microsoft Word and enter some information about your school.
- Select text and practice cut, copy and paste.
- Practice Undo command and Redo command.

Formatting Word Document

You can change font, font size, font color, font style, line spacing, alignment of paragraph, etc. in a document. The changes in the document improve the appearance of the document. The changing the appearance of the document is known as Formatting. The formatting makes text distinct and attractive.

To format text, you have to follow these steps:

a. Select the text.

b. Select Home tab, under the Font group, perform the following one or more tasks.

- Click on down arrow next to Font drop-down list box (Times New Roman) and select the required font from the list of fonts.
- Click on down arrow next to Font Size (12) and select the appropriate font size.
- Click on down arrow next to Font color (A) and select the font color.
- Click on Bold button (B) to make the selected text bold.
- Click on Italic button (I) to make the selected text italic.
- Click on Underline button (U) to underline the selected text.

Changing the alignment of a paragraph

MS-Word allows you to position the text at left, center, right or justify. The positioning of text on a page is known as alignment. When you enter a text, it is aligned to the left side of the page. A paragraph can be position on a page in four different ways. The different alignments of paragraph are:

Alignment	Purpose
a. Left Align	Align the text to the left.
b. Right Align	Align the text to the right.
c. Center Align	Place the text at the center of the page. Both left side and right side text appear in zigzag.
d. Justify	Align the text to both left and right margins.

To set the alignment, follow these steps:

a. Click anywhere in the paragraph you want to align.

b. Click on Left (), Center(), Right() or Justify() icon on the Paragraph category of the Home tab.

Note

You can use shortcut key as:

Ctrl + L for Left alignment.

Ctrl + E for Centre alignment.

Ctrl + R for Right alignment.

Ctrl + J for Justify alignment.

Lab Activity

Open Microsoft Word and enter the text as shown below:

ALIGNMENT OF A PARAGRAPH

MS-Word allows you to position the text at left, center, right or justify. The positioning of text on a page is known as alignment. When you enter a text, it is aligned to the left side of the page.

- Center the title ' **ALIGNMENT OF A PARAGRAPH**' and apply the Bold style.
- Set the font of Title text as 'Cambria' and font size as 14.
- Set the font of paragraph as 'Times New Roman' and font size 12.
- Align the paragraph to justify.

TABLE in MS-Word

You can insert a table in a document. A table consists of rows (i.e. horizontal lines) and columns (vertical lines). In a table rows intersect columns and form cells. You can fill or store data in cells. A table helps you to organize data and perform mathematical calculation.

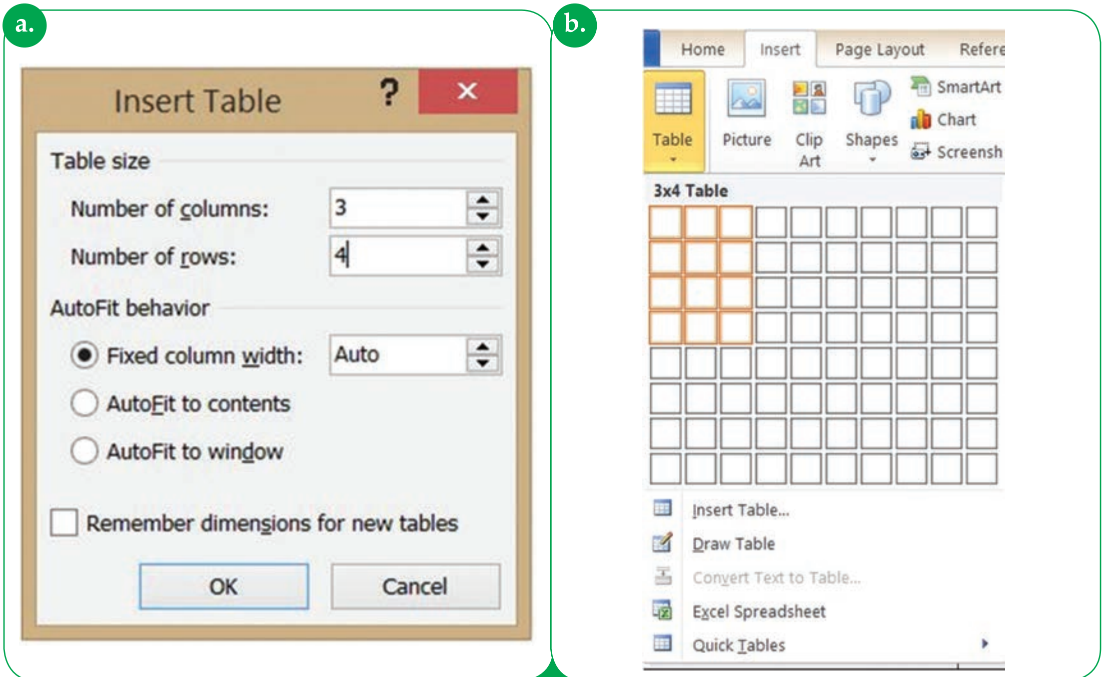


Fig. 2.16

To insert a table in a document, follow these steps:

a. Place the Insertion point where you want to insert a table.

b. Click on the Insert tab, click on Table under the Tables group and perform one of the tasks:
   - Hover the mouse pointer over the Table Grid and move the cursor till the number of rows and columns that you want in a table and click the left mouse button.
   - Click on Insert table and enter values in the Number of columns and Number of rows under Table size group and click on the OK button.

c. Enter required data in a cell through keyboard and press Arrow key or Tab key to move to next cell. You can directly click on a cell to move from one cell to another.

Selecting cell(s), row(s), column(s) or entire table

To select a cell, row, column or the entire table, perform the following tasks:

To select	Do this
Cell	Click the left edge of the cell that is to be selected. If you have to select multiple cells then click and drag the mouse pointers over the cells.
Row	Click on the row selection bar next to the row which you want to select. Click and drag the mouse over the selection bar to select more than one row.
Column	Click on the column's top gridline or top border. Click and drag the mouse over the top border
Table	Click on the selection handle.

Use of table tools

You can resize cell size, align the data in the cell, add or remove border and shading, add or remove rows/columns, etc. in a table. When you click on a table, you will see Design tab and Layout tab under Table Tools on the Ribbon. These two tabs have all the tools for formatting table.

Changing Column Width and row height of a Table

You can change a column width and row height in a table. To change the column width or row height, follow these steps:

- Place the mouse pointer on the border between columns in a table. When you see sizing tool (i.e. double arrow), click and drag either left side or right side to change the column width.
- Place the mouse pointer on the border between rows in a table. When you see sizing tool, click and drag either up or down to change the row height.

Adding a row or column in a table

You can add row or column in a table. To add row or column in a table, follow these steps:

a. Select the cell in a table where you want to add row or column.

b. Select Layout tab under the Table Tools on the ribbon.

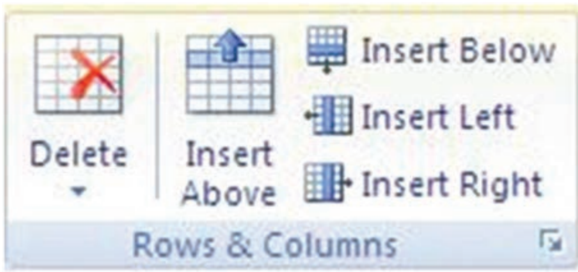


Fig. 2.17

c. Do one of the following:

- Click Insert Above or Insert Below in the Rows and Columns group to add a row just to the above or below of the cell that you clicked in.
- Click Insert Left or Insert Right in the Rows and Columns group to add a column just to the left or right of the cell that you clicked in.

Deleting row, column or the entire table

You can remove unnecessary row, column or the entire table. To remove or delete row, column or table, follow these steps:

a. Select row (s), column (s) or table that to be deleted.

b. Select Layout tab and Delete in the Rows & Column group.

c. Click Delete Rows, Delete Columns or Delete Table.

Merge or split cells

The cells in a table can be joined into a single cell. In the same way, you can split a cell into two or more cells.

To merge cells of a table, follow these steps:

a. Select the cells that you want to merge.

b. Under Table Tools, on the Layout tab, in the Merge group, click Merge Cells.

To split a cell of a table, follow these steps:

a. Select a cell that you want to split.

b. Select the Layout tab under Table Tools and click on Split Cells in the Merge group.

c. Enter the number of columns or rows that you want to split the selected cell into.

Alignment of text in a table

You can align the text in a cell of a table horizontally (left, center or right) or vertically (top, middle or bottom). To align the text in a cell, follow these steps:

a. Select a cell or cells which contents to be aligned. It displays table tools.

b. Select Layout tab, in the Alignment group, select appropriate text alignment.

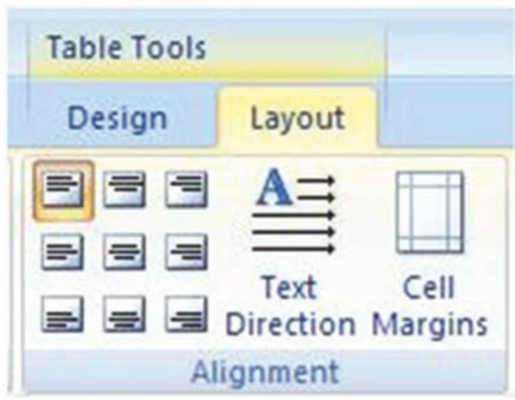


Fig. 2.18

Adding borders to a table

When you print a document with tables, you may not see the row lines and column lines. You have to add border to see lines in a table.

To add the border to a table, follow these steps:

a. Select a table.

b. Select Design tab under the Table Tools.

c. Choose the down arrow next to Borders in the Table Styles on the Design tab. It displays predefined borders.

d. Choose the appropriate border style.

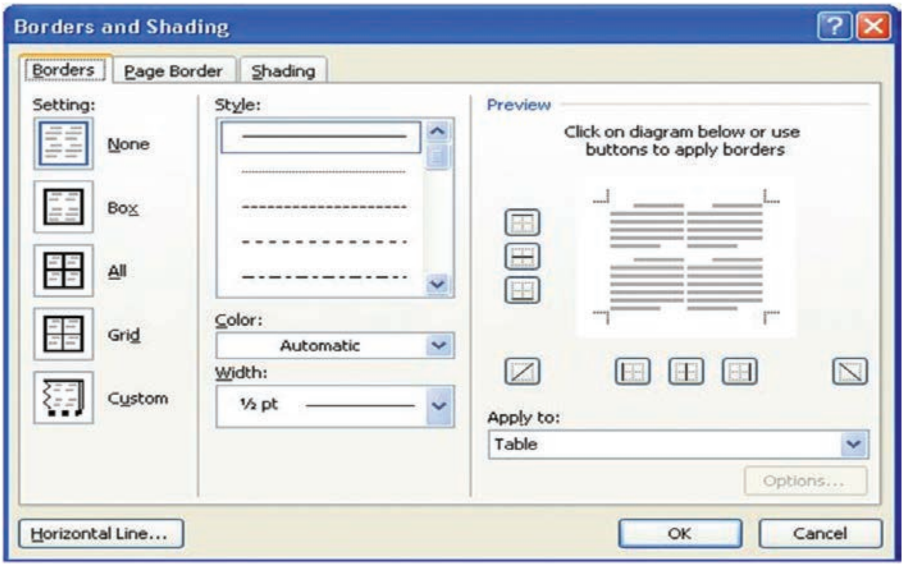


Fig. 2.19

Activity 16

Open Microsoft Word and create a table of 6 rows and 4 columns.

Enter the text as shown below:

S.N.	Student's name	Date of Birth	
		In BS	In AD
1	KushumaThapa	2077-09-13	2020-12-28
2	Amrit Gurung		
3			
4			

- Merge the cells in the 3rd column and 4th column of the first row and place the 'Date of Birth' at center of the cell.
- Merge the first two cells in the first row and second row.
- Bold the title.
- Center the text in 3rd and 4th rows.

2.2.7 Multimedia and Its Uses

You can present information using different media like text, audio, picture, video and animation. When information is presented using more than one medium, the information becomes more clear, enjoyable and understandable. You may have seen information in many digital ads and awareness notices are presented using more than one media. The combination of more than one medium such as text, sound, picture, video or animation is known as multimedia. Multimedia enhances the information for better communication and understanding.

Multimedia is used in education, training, advertisement, entertainment, business and many other areas. Nowadays, in many schools, colleges and universities are using multimedia for the better teaching and learning process. Multimedia enables students to learn lesson easily and quickly. Students can remember the lesson taught with multimedia for long time, too.

Multimedia presentation can be prepared by using Microsoft PowerPoint, Open Office Impress, Google Slide, etc. You can create or modify Images for multimedia by using software like Adobe Illustrator and Adobe Photoshop. You can create animations for multimedia by using 3D Studio Max, Animator Pro, etc. Similarly, you can edit sound and video by using Sound Forge and Adobe Premier respectively.

Once the multimedia presentation is ready you can present multimedia using computer, projector, speaker and big screen.

Creating Multimedia with Microsoft PowerPoint

Microsoft PowerPoint (i.e. MS-PowerPoint) is the presentation software developed by Microsoft Corporation. You can prepare simple multimedia lessons in MS-PowerPoint. A multimedia lesson created in PowerPoint is known as presentation. A presentation contains many slides arranged in sequential order. A slide contains information which is presented using text, images, audio, video or animation.

To open MS-PowerPoint, type Powerpoint the Search programs and files text box and press the Enter key. You will see the blank slide, i.e. Title Slide with two placeholders.

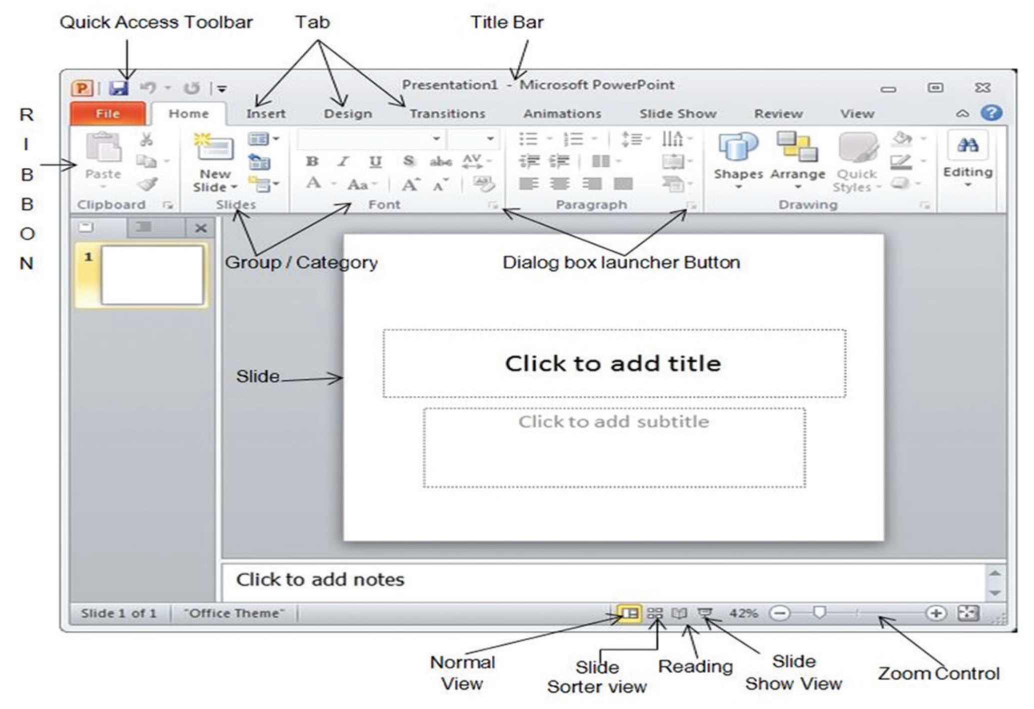


Fig. 2.20

Click on the title and sub title placeholders and type text. You can add a new slide in the presentation just by clicking on New Slide button on the Slides group of the Home tab. You can change the layout of the slide just by clicking on Slide Layout button on the Slides group of the Home tab and select the appropriate layout for the slide. You can add an image or clip art in the slide just by clicking on Picture button or Clip Art button on the Images group of the Insert tab. Similarly, you can add audio and video by clicking on Video or Audio button on the Media Group of the Insert tab. While adding picture, audio or video in the slide, you have to specify the location of them. Once the slides are ready you can save them just by clicking on Save icon the Quick Access Toolbar.

Adding Transition effect to slide

You can add transition effect to the slide. The transition effect is displayed while shifting from one slide to another during presentation.

To add transition effects to the slides, follow these steps:

a. Select the slide or slides on which transitions effects have to be applied.

b. Click on Transitions tab, in the "Transition To This Slide" group, select transition effect (Wipe, Fade, Push, etc), transition sound (like Bomb, Camera, Laser, Hammer, etc).

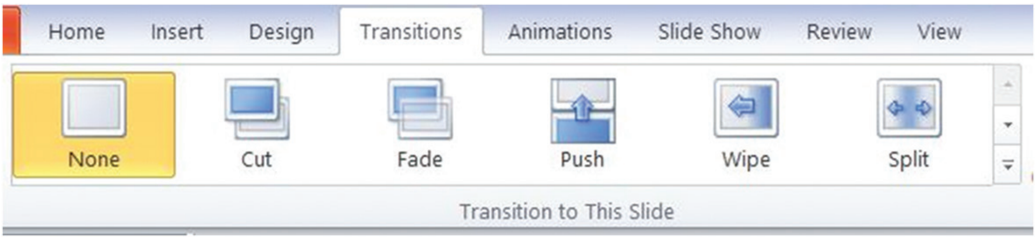


Fig. 2.21

c. Click on Apply To All button for applying transition effects to a slide or all the slides.

Presenting Slide show

You can show your presentation to audience. To show the presentation, follow these steps:

a. Open the presentation that you want to show to audience.
b. Press F5 key or click on Slide Show View ( ) button to begin from the first slide of the presentation.

Note

- Press Shift + F5 key to start the slide show from the current slide.
- Press space bar, left arrow key or left mouse button to move forward.
- Press right arrow key or right arrow button to move backward.
- Press Esc key to stop slide show.

Activity 17

- Prepare a presentation about technology and present the presentation in the class with the help of teacher.
- Prepare a presentation about your family and present the presentation.
- Prepare a presentation about any festival that you celebrate.

Use of Spreadsheet

In a school student's personal information, academic information and fees details are prepared and stored in the computer. In a bank, the account details of customers are prepared and stored in computer. In business, sales records and profit or loss information is prepared and stored in computer. To keep account of customers, fees records of students, calculate profit or loss, etc. spreadsheet software is used. Some popular spreadsheet software are Microsoft Excel, Google Sheet, Open Office Calc, Quattro Pro and Apple Works. Spread sheet software enables a user to perform mathematical calculations easily and accurately. It also enables a user to organize and sort data. So, it is used to keep day to day financial information and to prepare invoices, mark ledgers, report cards, salary sheets, etc.

MS-Excel is the spreadsheet software developed by Microsoft Corporation. It allows you to create and manage workbooks. A workbook file created in MS-Excel has . xlsx extension. By default there are three spreadsheets in a workbook. A spreadsheet is also called a worksheet. A spreadsheet is like a page of paper having rows (horizontal spaces running from the left to right) and columns (vertical spaces running from top to bottom).Rows in the spreadsheet are identified with row numbers like 1, 2, 3, 4, and so on. Similarly, Columns in the spreadsheet are identified with column labels like A, B, C, ... and so on.

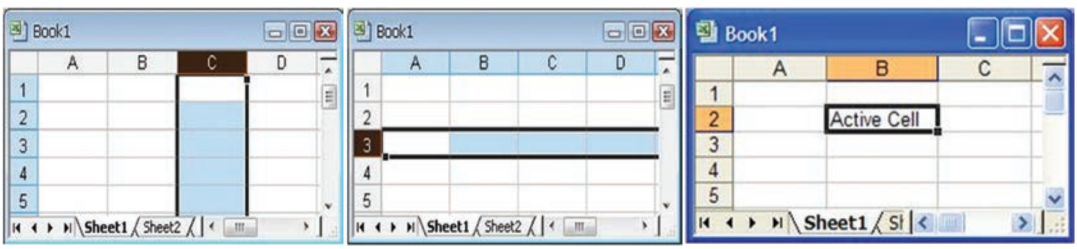


Fig. 2.22

There are many small rectangle spaces in a spreadsheet which are called cells. These cells are formed by intersecting rows and columns. Each cell is identified by its address. A cell address of a cell is represented by column heading followed by the row number. For example, F6 represents the cell formed by intersecting column F and row 6.

Filling data in Spreadsheet

You can enter text, number, formula, etc. in an active cell. To enter the data in spreadsheet, follow these steps:

a. Click a cell where you want to enter data.
b. Type the required data. As you type, the data appears in the cell and in the formula bar.
c. Press Enter key or tab key or arrow key to accept the data entry. Press Esc key to cancel text entry.

You can modify the content of a cell partially or completely. To edit the content of cell double click in the cell or by press F2 key. When the entered data is longer than the cell width, you have to increase the column width. To increase the column width, place the mouse pointer where two columns meet and when you see double headed arrow, drag to adjust the column width or double click.

Data Auto fill

You can fill text, series of numbers, dates or replicate formula in rows or columns using the Fill Handle. The Fill Handle is a small black box at the lower-right corner of a selected cell or range.

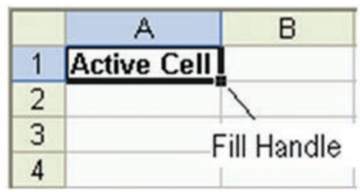


Fig. 2.23

To fill the data of a cell to other cells, follow these steps.

a. Select the cell which data you want to fill in other cells.
b. Place the mouse pointer on the Fill Handle ( ) of the cell, where it changes into plus sign.
c. Click and drag the fill handle down or to the right to copy the data to adjacent cells.
d. Release the mouse button.

To fill the serial numbers, you have to enter 1 in a cell and press and hold Ctrl key and drag the fill handle of the cell.

Sorting Data in a Spreadsheet

You can arrange data in a worksheet either in the ascending or descending order. In the ascending order, the list is arranged in an 'alphanumerical' manner (from 0 to 9, or A to Z manner). In the descending order, the list is arranged in the reverse order (from Z to A or 9 to 0 manner).

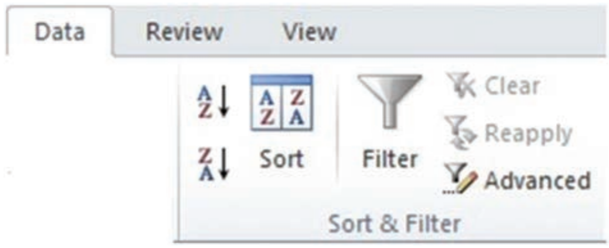


Fig. 2.24

To sort the data in aspread sheet, follow these steps.

a. Select the cells that you want to sort.

b. Click Data tab, under Sort & Filter group, select Sort Ascending or Sort Descending button.

Activity 18

Open Microsoft Excel and enter the following data as given below.

	A	B	C	D	E
1			**Wage Information of workers**		
2					
3	**s.no.**	**Date**	**Worker Name**	**Payment**	**Remarks**
4	1	7/5/2077	Lakpa Tamang	रु 8,750.00	Skilled worker
5	2	7/5/2077	Saroj Lama	रु 4,800.00	Semi skilled worker
6	3	7/5/2077	Binita Thapa	रु 2,000.00	Unskilled worker
7	4	8/5/2077	Lakpa Tamang	रु 8,750.00	Skilled worker
8	5	8/5/2077	Saroj Lama	रु 4,800.00	Semi skilled worker
9	6	8/5/2077	Binita Thapa	रु 2,000.00	Unskilled worker
10			**Total**	**रु31,100.00**	

Sheet1 Sheet2 Sheet3

- Type 1 in A4 and fill serial numbers in A5 to A9.
- Adjust the column widths of B, C, D and E.

Activity 19

Open Microsoft Excel and enter the following data as given below.

ABC Department Store					
s.no.	Item code	Item Name	Purchased Quantity	Sale Quantity	Stock
1	101	Sona Papadi	120	45	75
2	102	Jambo Wai Wai	450	125	325
3	103	Digestive Biscuit	158	80	78
4	104	Chicken Suasage	325	29	296
5	105	Buff Suasage	458	354	104

- Merge cells from A1 to F1 and align the text to center.
- Fill serial numbers in column A
- Fill Item code.
- Arrange the data in descending order based on Stock.
- Sort data in ascending order based on Purchased Quantity.

Key Concepts

1. Computer and smartphone have enabled people around the world to connect and communicate, get latest news and information, do online business, etc.
2. A smartphone is an advanced technology tool that can be used to make phone call, send or receive message, take photo or video and play audio or video.
3. Computer is a programmable electronic device that can process raw data according to the instructions and give information as the output. It helps you to do tasks accurately, fast, easy and organized ways.
4. Smartphone and computer may cause several health problems when you use these devices continuously for a long time.
5. Computer hardware is the physical part of a computer that you can see or touch.

6. An input device is used to enter data and give instructions to a computer.
7. An output device displays or presents information.
8. A storage device stores data and information temporarily or permanently.
9. A set of instructions given to a computer system to do task is known as a program.
10. The collection of programs is known as software. It does not include the physical parts of computer.
11. A desktop computer is large in shape and size and has separate input unit, CPU and output unit.
12. Laptop, tablet, iPad and smartphone are the compact and portable microcomputers. They have backup power supply unit and can be used anywhere there is no electricity.
13. A word processor is application software that enables you to prepare documents like letters, notes, reports, books, etc.
14. The combination of more than one medium such as text, sound, picture, video or animation is known as multimedia. Multimedia enhances the information for better communication and understanding.
15. Spreadsheet software enables a user to perform mathematical calculations easily and accurately. It also enables a user to organize and sort data.

Exercise

1. Fill in the blanks with the appropriate words.

a. A smartphone is an .... technology tool.

b. A computer is fast, ..., diligence and versatile device.

c. Computer system is made up of .... and software.

d. .... and Facebook are the programs stored in the cloud storage.

e. .... is an application software that enables a user to prepare letters, notes, etc.

f. A word document file has ....extension.

g. The positioning of text on a page is known as ....

h. Microsoft PowerPoint and Google Slide are the popular .... software.

i. .... key starts the slide show from the first slide of the presentation.

j. MS-Excel and Google Sheet are .... software.

k. The F6 cell in Excel represents the cell formed by intersecting column .... and row ....

2. State whether the following statements are True or False.

a. A smartphone is the simple technology device.
b. You can use a smartphone only for communication.
c. Google Classroom, Google Meet, Zoom, etc. can be used for online teaching.
d. A computer can do its tasks automatically without any instruction.
e. Computer software is the tangible parts of a computer.
f. A desktop computer can be used anywhere where there is no electricity.
g. The combination of more than one medium that helps to present information effectively is known as multimedia.
h. The transition effect can only be applied to the first slide of a presentation.
i. Spreadsheet software enables a user to perform mathematical calculations easily and accurately.
j. A cell address of a cell is represented by column heading followed by the row number.
k. The Fill Handle feature enables a user to fill a series of numbers in a row.

3. Choose the correct option from the given alternatives.

a. A smartphone can be used to ....

i. make a phone call | ii. send or receive text message
iii. record sound | iv. All of the above

b. A computer is used in .... field.

i. Education | ii. Entertainment
iii. Bank | iv. All of the above

c. The continuous use of smartphone and computer may cause ....

i. blurred vision
ii. dry eye problem
iii. headache
iv. All of the above

d. .... input device is normally used for entering text in computer.

i. Joystick
ii. Type Writer
iii. Pencil
iv. None of the above

e. .... is the storage device.

i. Pen drive
ii. Mouse
iii. Monitor
iv. Google Doc

f. The shortcut key for copying text is ....

i. Ctrl + V
ii. Ctrl + C
iii. Alt + C
iv. Alt+ V

g. Microsoft word is used for ....

i. keeping accounts of customers
ii. preparing presentation
iii. preparing documents
iv. All of the above

h. The shortcut key for center alignment is ....

i. Ctrl + L
ii. Ctrl + E
iii. CTRL + V
iv. CTRL + C

i. A PowerPoint presentation can begin from the current slide by pressing .... keys.

i. Shift + F5
ii. F5
iii. Esc
iv. None of the above

j. .... is spreadsheet software.

i. Google Sheet
ii. OpenOfficeCalc
iii. MS-Excel
iv. All of the above

k. A workbook in MS-Excel has .... spreadsheets by default.

i. Two
ii. Three
iii. Four
iv. Five

l. The cell address D5 represents the cell formed by intersecting ....

i. Column A and row 5   ii. Row 5 and column D

iii. Column 5 and Row D.   iv. None of the above

4. Answer the following questions:

a. List two-two uses of smartphone and computer.

b. List any two harmful effects due to smartphone.

c. List any two preventing measures that you should follow while using smartphone and computer.

d. Define computer hardware and software.

e. Define input device and output device along with their examples.

f. Define storage device. List any two storage devices.

g. What is word processor? List any two popular word processors.

h. What is multimedia? List any two presentation software.

i. What is spreadsheet? List any two spreadsheet software.

j. List any two uses of spreadsheet software.

k. What is data sorting?

5. Study the given figures. Identify them and write their major use/ function.

6. Differentiate between :

a. Input device and output device

c. Hardware and software

c. Smartphone and computer

7. Describe the importance of mobile and computer in present days.

UNIT 3

Organisms and Their Structure

Estimated teaching periods : 15

Before You Begin

The things having life are called living things. They include different types of plants and animals. Lotus, rose, spirogyra, grass, crops, fruits, vegetables, insects, birds, fishes, snakes, etc. are examples of living beings. Growth, reproduction, respiration, digestion, excretion, etc. are the basic properties of living beings. Living beings are broadly classified into plants and animals. They may be unicellular or multicellular and aquatic or terrestrial.

Animals and plants are found in different habitat and climatic conditions. They have different structures and characteristics according to their habitat. The living beings that live in water differ from the living beings that live on land. Similarly, the living beings that live in cold places are different from those that live in hot places.

Living beings are broadly classified into the Plant Kingdom and the Animal Kingdom. The Plant Kingdom includes different types of plants like spirogyra, mushroom, moss, fern, cycas, maize, grass, mango, orange, etc. Both flowering plants and non-flowering plants are kept in the Plant Kingdom. The Animal Kingdom includes different types of animals like amoeba, hydra, tapeworm, butterfly, roundworm, earthworm, snail, starfish, fishes, frogs, snakes, birds, mammals, etc. The animals having backbone or vertebral column are called vertebrates.

Learning Objectives

After completing the study of this unit, students will be able to:

- introduce living organisms.
- introduce adaptation with examples.
- explain the adaptational characteristics of plants and animals with examples and identify organs that help in adaptation.
- classify animals on the basis of their food.
- introduce non-flowering and flowering plants.
- describe the characteristics of non-flowering plants and flowering plants.
- introduce vertebrates and describe the characteristics of vertebrates with examples.

Syllabus

- Adaptation of organisms-Introduction
- Adaptational characteristics of aquatic and terrestrial organisms
- Classification of animals on the basis of food
- Non-flowering plants
- Flowering plants
- Vertebrate animals

Syllabus

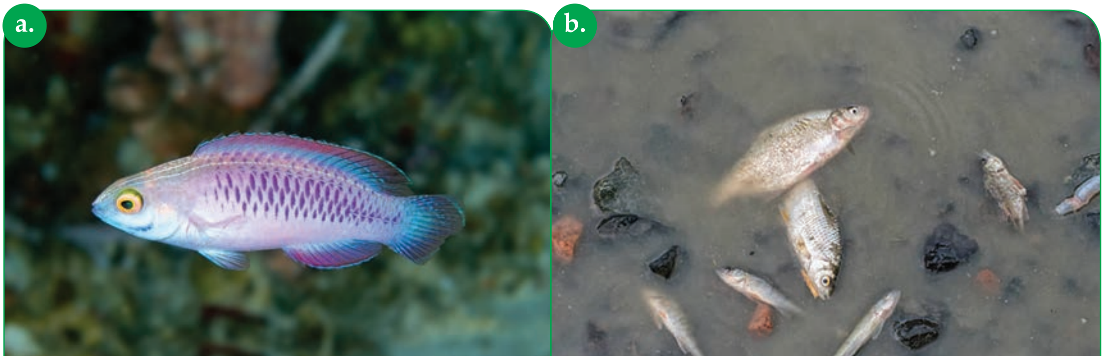
adaptation	:	the process of change by which an organism or species becomes better suited to its environment
adhesive	:	able to stick fast to a surface or object; sticky
aquatic	:	relating to water
bryophyte	:	a small flowerless green plant of the division Bryophyta, which comprises the mosses and liverworts
carnivore	:	an animal that feeds on other animals
emergent	:	of or denoting a plant which is taller than the surrounding vegetation
gymnosperms	:	a plant of a group that comprises those that have seeds unprotected by an ovary or fruit
herbivore	:	an animal that feeds on plants
hydrophytes	:	a plant which grows only in or on water
mammal	:	a warm-blooded vertebrate with hair or fur, females that secrete milk for the nourishment of the young, and (typically) the birth of live young.
omnivore	:	an animal or person that eats a variety of food of both plant and animal origin
reptile	:	a vertebrate animal of a class that includes snakes, lizards, crocodiles, turtles, and tortoises
spongy	:	like a sponge, especially in being porous, compressible, or absorbent
submerge	:	cause (something) to be under water
streamlined	:	having a form that presents very little resistance to a flow of air or water
thallophyte	:	a plant that consists of a thallus

3.1 Adaptation of Organisms

3.1.1 Introduction to Adaptation

In our surroundings, different types of plants and animals are found. Some of them live in water whereas others live on land. All kinds of plants and animals have special characteristics in their bodies due to which they can adapt in their habitat. These characteristics are called adaptational characteristics. Similarly, the ability of an organism to adjust itself in its habitat is called adaptation.

A fish can adapt in water but cannot adapt on land. On the other hand, a cow can adapt on land but cannot adapt in water. If living beings cannot adapt in their habitat, they disappear. In this unit, we will study about adaptational characteristics of plants and animals.



a. *Fish can survive in water*

b. *Fish cannot survive on land*

Fig. 3.1

3.1.2 Aquatic Adaptation

Some aquatic organisms

Fig. 3.2

A variety of plants and animals live in water. The animals that live in water are called aquatic animals. Examples, fish, dolphin, octopus, etc. The plants that live in water are called aquatic plants. They are also called hydrophytes. Aquatic plants and animals have ability to get food and respiratory gases from water.

a. Hydrophytes

The plants that live in water are called hydrophytes. Pistia, hydrilla, lotus, water lily, etc. are some examples of hydrophytes.

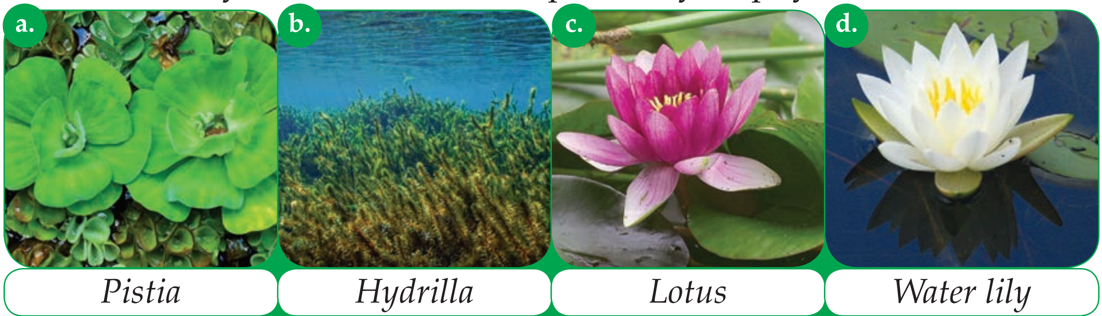


Fig. 3.3 Some hyrophytes

Adaptational characteristics of hydrophytes or aquatic plants

1. Aquatic plants (hydrophytes) have very less developed root system. Some hydrophytes do not have roots.
2. Hydrophytes have long, soft and spongy stem.
3. The body of hydrophytes remains covered with waxy substance. It prevents them form decaying in water.
4. Floating hydrophytes have air filled sacs which help them to float in water.
5. The leaves of submerged hydrophytes (e.g. hydrilla) are narrow and thin.
6. The leaves of floating and emergent hydrophytes (e.g. lotus) are broad and large.

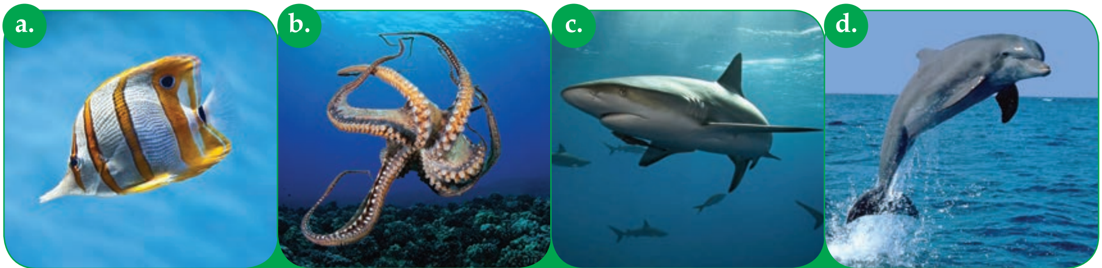
Activity 1

- Visit a nearby pond, lake or river along with science teacher.
- Observe aquatic plants and observe their special organs.
- Study their adaptational characteristics.
- Draw figure of those plants and lable the special organs that help in adaptation.
- Fill in the given table after your observation.

S.N.	Name of aquatic plant	Special organs that help in adaptation	Adaptational characteristics
1.			
2.			
3.			
4.			
5.			

b. Aquatic Animals

The animals that live in water are called aquatic animals. Fish, octopus, dolphin, shark, eel, etc. are some common examples of aquatic animals. These animals have special organs adapted to live in water.



Fish *Octopus* *Shark* *Dholphin*

Fig. 3.4 Some aquatic animals

Adaptational characteristics of aquatic animals

1. Aquatic animals have boat-shaped or streamlined body which helps them to swim in water.

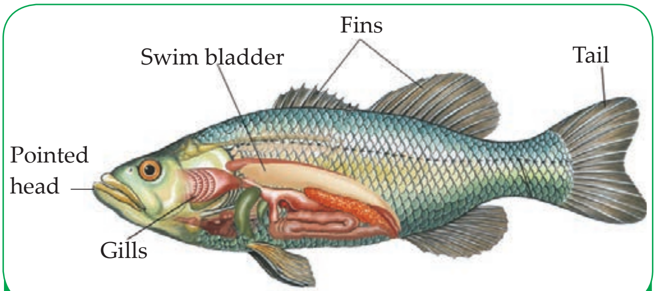


Fig. 3.5 Structure of a fish

2. Aquatic animals have pointed head, smooth body and powerful tail. These features help them to swim easily in water.
3. The body of aquatic animals consists of air filled sacs which help them to float in water.

4. Aquatic animals have fins and tail to help them to swim in water they also help them to change to direction in water.
5. Most aquatic animals have gills adapted to breathe in water.
6. The body of aquatic animals remains covered with water. proof scales or mucous coat which prevents the body from decaying.

Activity 2

- Take a chart paper. Draw a neat figure of fish and highlight the special organs that help in adaptation.
- Demonstrate the chart paper in the classroom.

3.1.3 Terrestrial adaptation

Different types of plants and animals are found on land. The organisms that live on land are called terrestrial organisms. They obtain food, respiratory gas (oxygen) and shelter from land. Terrestrial organisms are divided into terrestrials plants and terrestrial animals.

a. Adaptational characteristics of terrestrial plants

The plants that live on land are called terrestrial plants. Mango, rose, apple, cactus, *Aloe vera*, etc. are some examples of terrestrial plants. The major adaptational characteristics of terrestrial plants are given below:

1. Terrestrial plants have strong and well developed root system.
2. Climber plants like cucumber, gourd, pumpkin, etc. have tendrils, hooks and aerial roots for support.
3. Xerophytes like cactus, *Aloe vera*, opuntia, etc have long and well developed root system adapted to absorb maximum water from the soil.

Cactus | *Opuntia* | *Aloe vera*

Fig. 3.6 Some xerophytes

4. Desert plants are stunted and having thick barks.
5. The leaves of xerophytes are reduced into thorns to reduce the loss of water through transpiration.
6. Desert plants have thick and fleshy stem modified to store water.

b. Adaptational characteristics of terrestrial animals

The animals that live on land are called terrestrial animals. Cow, goat, tiger, lion, horse, giraffe, monkey, squirrel, camel, etc. are some examples of terrestrial animals. Different types of reptiles, birds and mammals live on land.

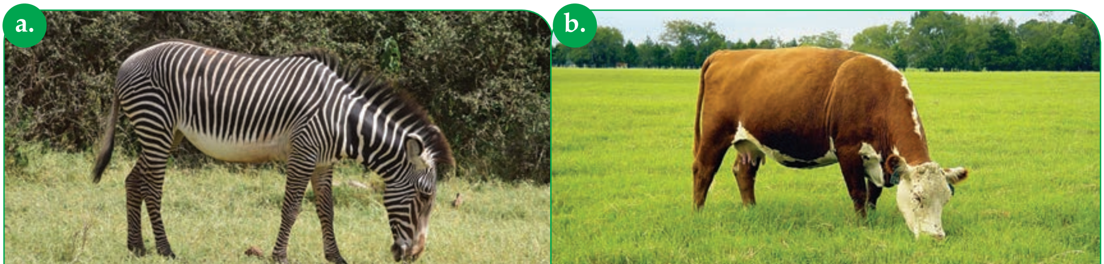
a. *Tiger* b. *Lion* c. *Horse*

Fig. 3.7 Some terrestrial animals

The major adaptational characteristics of terrestrial animals are given below:

1. The limbs of terrestrial animals are modified according to their habit and habitat. They have long and strong legs adapted for walking, jumping, etc.

   Some animals like zebra, horse, donkey, etc. have non-lobed hoof whereas animals like cow, buffalo, sheep, goat, etc. have bilobed hoof.



a. *Zebra* b. *Cow*

Fig. 3.8

Activity 3

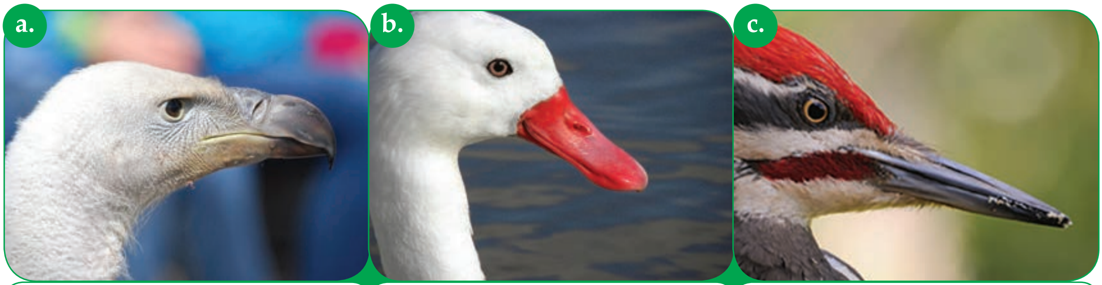
- Observe the following animals in your locality. Study their adaptational characteristics and fill in the given table.

S.N.	Name of animals	Special organs	Adaptatonal characteristics
1.	Cow		
2.	Goat		
3.	Rabbit		
4.	Sheep		
5.	Horse		

2. Birds are adapted for aerial mode of life. They have streamlined body adapted for reducing air resistance while flying. Their fore limbs are modified in the form of wings for flying. They have light bones and toothless beak to reduce the body weight. Numerous air-sacs are found in the body which help them to fly easily.

Fig. 3.9 Peacock

The beaks of birds are also modified according to their feeding habit.



a. *Beak of vulture* b. *Beak of duck* c. *Beak of woodpecker*

Fig. 3.10

Beak of a vulture is pointed and curved adapted for tearing flesh. Duck has a spoon-shaped beak adapted fro searching insects. Woodpecker has a long and strong beak adapted for boring into wood.

Different types of birds gave different types of claws modified according to their habit and habitat. For example, birds like eagle, hawk, etc. have sharp and pointed claws adapted for grasping their prey. Ducks have webbed feet adapted for swimming in water.

3. Desert animals (like camel) have special tissues adapted for storing water. They have thick skin to prevent loss of water through perspiration. They have a hump on their back to store food in the form of fat.

Fig. 3.11

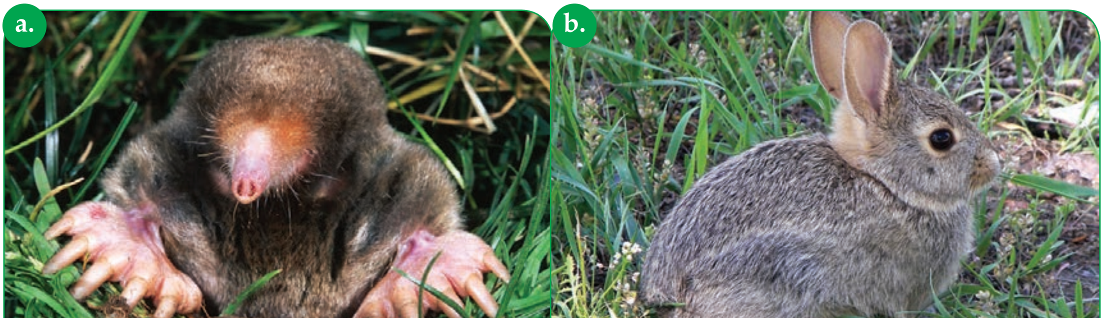
4. Animals like house-wall lizards have adhesive pads on their digits. The digits of house-wall lizards contain many hooks. These hooks create suction pressure on the wall. As a result, house wall lizard can climb on walls without falling downwards. The house wall lizard also releases its tail to protect itself from enemies.

Fig. 3.12 (b)

5. Climbing animals like monkeys have strong muscles and limbs with long digits adapted for jumping, climbing and holding tree branches.

Fig. 3.13

6. Burrowing animals like mole, rabbit, rat, etc. have pointed snout. They have strong fore limbed with pointed digits adapted for making burrows.



a. *Mole*

b. *Rabbit*

Fig. 3.14 Some burrowing animals

Key Concepts

1. All kinds of plants and animals have special characteristics in their bodies due to which they can adapt in their habitat. These characteristics are called adaptational characteristics. The ability of an organism to adjust itself in its habitat is called adaptation.
2. The animals that live in water are called aquatic animals. Examples, fish, dolphin, octopus, etc.
3. The plants that live in water are called aquatic plants. They are also called hydrophytes.
4. Aquatic plants (hydrophytes) have very less developed root system. Some hydrophytes do not have roots.
5. The body of hydrophytes remains covered with waxy substance. It prevents them form decaying in water.
6. Aquatic animals have boat-shaped or streamlined body which helps them to swim in water.
7. Aquatic animals have pointed head, smooth body and powerful tail. These features help them to swim easily in water.
8. Aquatic animals have fins and tail to help them to swim in water they also help them to change to direction in water.
9. The body of aquatic animals remains covered with water proof scales or mucous coat which prevents the body from decaying.
10. The organisms that live on land are called terrestrial organisms. They obtain food, respiratory gas (oxygen) and shelter from land.
11. Xerophytes like cactus, Aloe vera, oputia, etc have long and well developed root system adapted to absorb maximum water from the soil.
12. The leaves of xerophytes are reduced into thorns to reduce the loss of water through transpiration.
13. The limbs of terrestrial animals are modified according to their habit and habitat. They have long and strong legs adapted for walking, jumping, running, etc.
14. Birds are adapted for aerial mode of life. They have streamlined body adapted for reducing air resistance while flying.

15. Desert animals (like camel) have special tissues adapted for storing water. They have thick skin to prevent loss of water through perspiration.

16. Climbing animals like monkey have strong muscles and limbs with long digits adapted for jumping, climbing and holding tree branches.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. Aquatic plants have developed root system. ☐

b. Most aquatic animals breathe through gills. ☐

c. Cow and buffalo have sharp and pointed canines. ☐

d. Desert plants have hollow stem. ☐

e. For limbs of birds are modified into wings. ☐

2. Fill in the blanks using appropriate words.

a. The stem of aquatic plants is covered with .... substance.

b. The animals that live on land are called ....

c . Camel has a .... on its back to store food.

d. The stem of .... plants is covered with waxy substance.

e. House wall lizards have .... in their feet.

3. Tick (√) the best answer from the given alternatives.

a. The animals that live on trees and cliffs are called .... animals.

☐ aquatic ☐ aerial ☐ arborial ☐ desert

b. Which of the following is a desert animal?

☐ tiger ☐ zebra ☐ camel ☐ cow

c. Which of the given animals has a layer of fat under the skin?

☐ goat ☐ elephant ☐ yak ☐ rhinoceros

d. Which of the given plants is not a xerophyte?

☐ cactus ☐ lotus ☐ opuntia ☐ Aloe vera

e. Which of the given plants has less developed root system?

☐ hydrilla ☐ mustard ☐ bamboo ☐ onion

4. Answer the following questions.

a. What is adaptation?

b. What are adaptational characteristics? Give any three examples.

c. Define hydrophytes. Write any three adaptational characteristics of aquatic plants.

d. Write any three adaptational characteristics of lotus.

e. What are xerophytes? Give any three examples.

f. Write any three characteristics of xerophytes.

g. Define aquatic animals with any three examples.

h. Write any three adaptational characteristics of aquatic animals.

i. What are terrestrial animals ? Give any five examples.

j. Write any four adaptational characteristics of terrestrial animals?

k. What are aerial animals? Write any four examples.

l. Write any three adaptational characteristics of aerial animals.

m. Define arboreal animals with any three examples.

n. Write any two adaptational characteristics of desert animals.

5. Write down two adaptational characteristics of each of the given organisms.

6. **Differentiate between (on the basis of adaptation).**

a. Lotus and cactus

b. Fish and frog

c. Duck and peacock

7. **A leopard can kill its pray but a horse cannot, why?**

8. **Write any two adaptational characteristics of the animals that live in burrows.**

9. **Write any two adaptational characteristics of each hawk and house wall lizard.**

10. **How do given organs help in adaptation? Describe.**

11. **Why does a fish die when taken out of water? give suitable reason.**

12. **A hawk can kill other birds easily but a hen cannot, why?**

3.2 Classification of Animals

3.2.1 Classification of Animals on the basis of Food

The earth is the common home of different types of plants and animals. All green plants have chlorophyll. So, they can synthesize their own food in the presence of sunlight. All plants and animals need suitable environment to grow, survive and reproduce.

Fig. 3.15

All living organisms need energy to survive. They obtain energy required to survive from the food. All animals depend on green plants directly or indirectly to get food. Food provides energy to living beings and they perform various metabolic activities.

a. Cow is grazing

b. Cat is drinking milk

c. Tiger is eating deer

Fig. 3.16

Some animals like cow, goat, sheep, horse, elephant, rabbit, etc. feed only on green plants. Some animals like tiger, lion, eagle, hawk, etc. other animals. Some animals feed both plants and animals. For example, a cat feeds on rat, milk, rice, etc. A fox feeds on insects, flesh and fruits. On the basis of type of food they eat, animals are divided into following three groups.

1. Herbivores
2. Carnivores
3. Omnivores

1. Herbivores

Animals like cow, goat, sheep, elephant, rabbit, etc. feed only on plants. These animals are called herbivores. Buffalo, deer, rhinoceros, zebra, etc. are some examples of herbivores. Herbivores have thick and flat teeth modified for chewing food. These teeth help to chew leaves, grains and seeds. Herbivores have long intestine in their digestive system.

Fig. 3.17 Some harbivores

Activity 4

- Observe the feeding habit of the animals that you have kept at your home.
- Name the animals that feed only on plants.

2. Carnivores

The animals that feed only on flesh of other animals are called carnivores. Tiger, lion, leopard, vulture, eagle, kingfisher, etc. are some examples of carnivores.

Tiger and lion kill other animals and feed them. These animals have strong fore limbs with sharp and pointed claws to catch their prey. Similarly, they have sharp and pointed teeth to tear the flesh.

Carnivorous birds like vulture, eagle, hawk, etc. have sharp and pointed claws and strong beak for eating flesh. The alimentary canal consists of short intestine.


a. *Leopard*


b. *Tiger*


c. *Lion*


d. *Vulture*


e. *Eagle*


f. *Hawk*

Fig. 3.18

Activity 5

- Take a chart paper. Draw a neat figure of a carnivore that you have seen and display in your classroom.

3. Omnivores

Some animals like fox, crow, bear, human, dog, cat, etc. feed on both plants and animals. These animals are called omnivores. So, the animals that feed on both plants and flesh are called omnivores. These animals have strong teeth modified for eating plants and flesh of animals.


a. *Bear*


b. *Fox*


c. *Cat*

d. *Crow* e. *Dog* f. *Human*

Fig. 3.19

Activity 6

- Observe different types of animals present in your surroundings and fill in the given table.

Types of animals	Name	Food they eat	Special organs
Herbivores	1		
	2		
	3		
	4		
	5		
Carnivores	1		
	2		
	3		
	4		
	5		
Omnivores	1		
	2		
	3		
	4		
	5		

Key Concepts

1. The earth is the common home of different types of plants and animals.
2. All plants and animals need suitable environment to grow, survive and reproduce.
3. All living organisms need energy to survive. They obtain energy required to survive from the food.
4. On the basis of type of food they eat, animals are divided into following three groups.

   a. Herbivores b. Carnivores c. Omnivores

5. Animals like cow, goat, sheep, elephant, rabbit, etc. feed only on plants. These animals are called herbivores.
6. The animals that feed only on flesh of other animals are called carnivores. Examples: tiger, leopard, lion, hawk, etc.
7. The animals that feed on both plants and flesh are called omnivores. Examples: cat, dog, bear, fox, crow, etc.

Exercise

1. Tick (√) the best answer from the given alternatives.

a. .... is the common home for plants and animals.

☐ sun ☐ moon ☐ earth ☐ river

b. Which of the following is a herbivore?

☐ cat ☐ crow ☐ tiger ☐ deer

c. Which of the following is a carnivore?

☐ lion ☐ sheep ☐ dog ☐ parrot

d. Which of the following is an omnivore?

☐ man ☐ fox ☐ bear ☐ all of them

2. **Fill in the blanks using appropriate words.**

a. The animals that feed only on plants are called ....

b. Cat, dog and fox are examples of ....

c. Tiger feeds on ....of other animals.

d. ....feed on both plants and animals.

e. The teeth of .... are long and pointed.

3. **Answer the following questions.**

a. What are three groups of organisms on the basis of their food?

b. Define herbivores with any five examples.

c. What are carnivores? Give any three examples.

d. What are omnivores? Give any four examples.

e. Write any two characteristics of each herbivores, carnivores and omnivores.

4. **Classify the given animals in terms of herbivores, carnivores and omnivores.**

cow	goat	tiger	vulture	snake	rat	buffalo
crow	rabbit	sheep	bear	eagle	kingfisher	

5. **Write any two differences between given animals on the basis of their food and characteristics.**

a.


b.


6. **Write any two differences between:**

a. Herbivores and Carnivores b. Carnivores and Omnivores

7. **Crow is called an omnivorous animal. Justify this statement.**

8. **Name any two herbivores, two carnivores and two omnivores that you have seen in your locality.**

3.3 Classification of Plants

3.3.1 Non-flowering and Flowering Plants

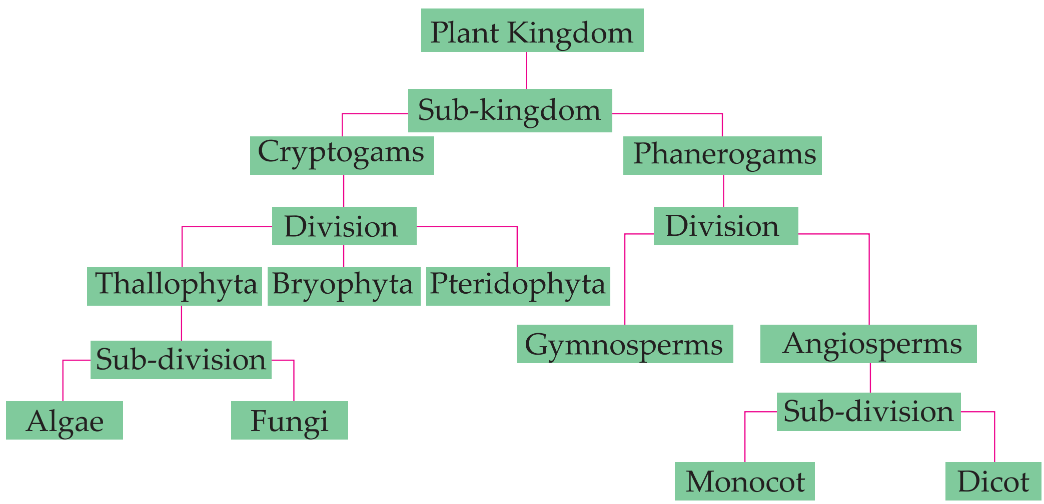
Different types of plants are found on the earth. Some may be microscopic and some may be very large in size. Algae are small and trees are large. Some plants produce flowers and some do not.

Mushroom *Rose* *Fern* *Marigold*

Fig. 3.20

On the basis of absence or presence of flowers, plants are divided into two sub-kingdoms. They are as follows:

1. Sub-kingdom Cryptogams (non flowering plants)
2. Sub-kingdom Phanerogams (flowering plants)



Activity 7

- Observe different types of plants in your surroundings.
- Observe whether they have flowers and fruits or not.
- Classify these plants into non-flowering or flowering plants.

S.N.	Plants collected (observed)	Non-flowering plants	Flowering plants
1.			
2.			
3.			
4.			
5.			

a. Sub-kingdom Cryptogams

This sub kingdom consists of non-flowering plants. They are less developed than flowering plants. On the basis of structure and development, sub kingdom cryptogams is divided into three divisions. They are as follows:

1. Division Thallophyta 2. Division Bryophyta 3. Division pteridophyta

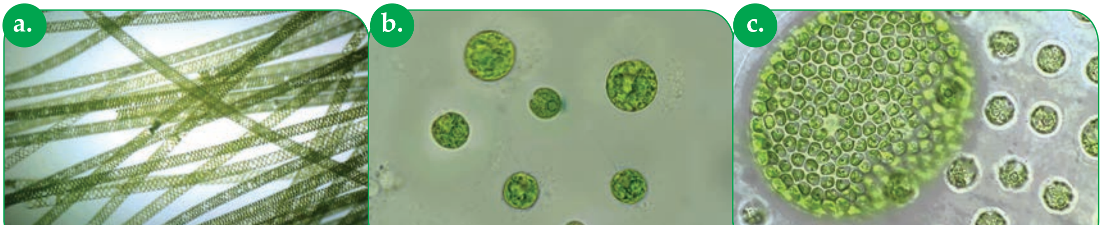
1. Division Thallophyta

This division includes primitive cryptogams without root, stem and leaves. The plant body without root, stem and leaves is called thallus and the plants are called thallophytes.

Thallophytes may be green or non green and unicellular or multicellular. On the basis of absence or presence of chlorophyll, division thallophyta is divided into two sub-divisions. They are (i) Algae and (ii) Fungi.

i. Algae

This sub-division consists of green thallophytes. They are found in water and moist places.



a. *Spirogyra* b. *Chlamydomonas* c. *Volvox*

Fig. 3.21 Some algae

Characteristics

1. The plant body is a green thallus.
2. Chlorophyll is present. So they can prepare their own food by photosynthesis.
3. The cell wall is made of cellulose.
4. They may be unicellular (chlamydomonas) or multicellular (Spirogyra)
5. The mode of nutrition is autotrophic.

Examples: chlamydomonas, spirogyra, volvox, etc.

ii. Fungi

This sub-division consists of non green thallophytes. Most fungi are found on dead and decaying organic matter whereas some live as parasites of plants and animals.

a. *Mushroom* b. *Yeast* c. *Mucor*

Fig. 3.22 Some fungi

Characteristics

1. The plant body is a non-green thallus.
2. Chlorophyll is absent so they cannot prepare their own food.
3. The cell wall is made of fungus cellulose.
4. They may be unicellular (yeast) or multicellular (mushroom).
5. The mode of nutrition may be saprophytic or parasitic.

Examples: mushroom, yeast, mucor, etc.

Differences between Algae and Fungi

Algae	Fungi
1. Chlorophyll is present.	1. Chlorophyll is absent.
2. Cell wall is made of cellulose.	2. Cell wall is made of fungus cellulose.
3. They can prepare their own food by photosynthesis.	3. They cannot prepare their own food.

Activity 8

- Observe different types of algae and fungi in your locality. Collect them and study their characteristics one by one.
- Draw a neat and labelled figure of each.

2. Division Bryophyta

This division includes multicellular non-flowering plants that grow on moist land and need water to reproduce.

Do you know ?

Bryophytes grow on moist and they need water to reproduce. Therefore, bryophytes are also called amphibian plants.

a. *Marchantia* b. *Riccia* c. *Moss*

Fig. 3.23 Some bryophytes

Characteristics

1. The plant body is multicellular which may be thalloid (e.g. liver worts) or leafy (moss).
2. Chlorophyll is present.
3. True root, stem and leaves are absent.
4. They are attached to the soil with the help of rhizoids.
5. Vascular tissues (xylem and phloem) are absent.

Examples: Marchantia (liverworts), Riccia, Moss, etc.

3. Division Pteridophyta

This division consists of well developed cryptogams having feather shaped leaves. Pteridophytes are commonly found in moist, shady and cool places.

Fig. 3.24 Some pteridophytes

Characteristics

1. The plant body can be divided into rhizoids (root), rhizome (stem) and leaves.
2. Feather-shaped leaves are present.
3. Vascular tissues (xylem and phloem) are present.
4. The mode of nutrition is autotrophic.
5. Flowers and seeds are absent.

Examples: Fern, Lycopodium, Horsetail (Equisetum) etc.

Activity 9

- Visit a moist and shady place with your teacher and study the structure and features of following plants.
- Identify the division of these plants on the basis of their features.

S.N.	Name	Features/characteristics	Division
1.	Moss		
2.	Marchantia		
3.	Riccia		
4.	Fern		
5.	Horsetial		

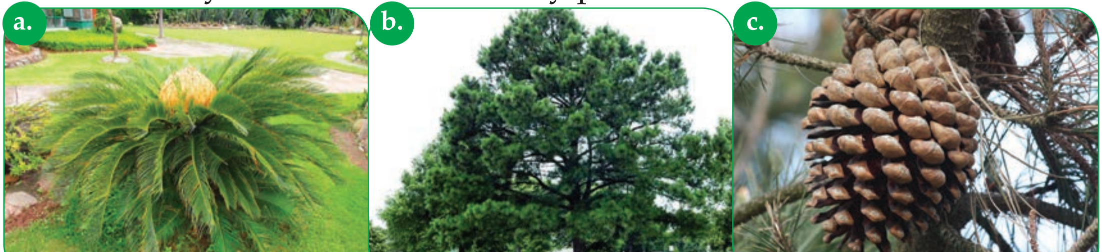
b. Sub-kingdom Phanerogams

This sub-kingdom consists of well developed plants that bear flowers and seeds. Cycas, pine, mango, apple, sal, sunflower, rose, orange, etc are the examples of phanerogams. They may or may not bear fruits. Sub-kingdom phanerogams is divided into two divisions. They are as follows:

1. Division Gymnosperms
2. Division Angiosperms

1. Division Gymnosperms

This division consists of cone–bearing plants having naked seeds. They are commonly found in cold and dry places.



a. *Cycas* b. *Pine* c. *Pine cone*

Fig. 3.25 Some gymnosperms

Characteristics

1. Seeds are naked, i.e. not enclosed inside the fruit wall.
2. Cones are present instead of true flowers.
3. Needle-shaped leaves are present.
4. They do not have fruits due to absence of ovary.
5. Male cones and female cones are separate.

Example: Cycas, pine, cedar, juniper, etc.

2. Division Angiosperms

This division consists of the most developed flowering plants having fruits. They are found on land and in water.

a. *Pea* b. *Maize* c. *Mango* d. *Rose*

Fig. 3.26 Some angiosperms

Characteristics

1. True flowers are present.
2. Seeds are enclosed inside the fruit.
3. They may be herbs, shrubs or trees.
4. Vascular tissues are well developed.
5. These plants may be small to very large in size.

Exmaples: Maize, rose, apple, mustard, sugarcane, onion, garlic, orange, mango, sal, sissoo, simal, etc.

On the basis of number of cotyledons in a seed, division, angiosperms is divided into two sub-divisions. They are as follows:

1. Sub-division Monocotyledons 2. Sub-division Dicotyledons

1. Monocotyledons

This sub division includes flowering plants having only one cotyledon in their seeds.

a. *Maize* b. *Bamboo* c. *Sugarcane* d. *Onion*

Fig. 3.27 Some monocots

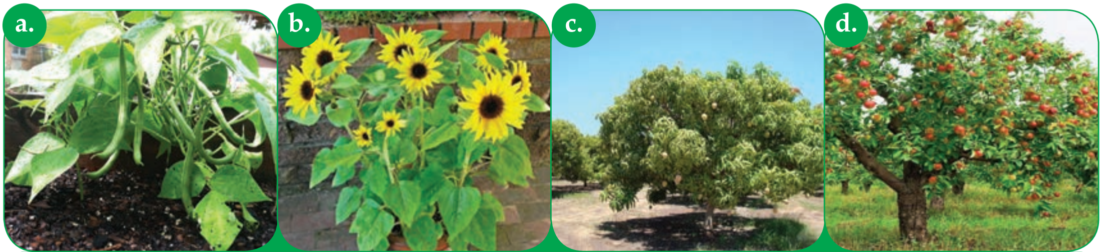
Characteristics

1. A seed contains only one cotyledon.
2. Fibrous root system is present
3. Leaves are elongated having parallel venation.
4. Nodes and internodes are distinct.

Examples: Maize, sugarcane, bamboo, onion, garlic, grass, paddy, wheat, barley, etc.

2. Dicotyledons

This sub-division includes well developed flowering plants having two cotyledons in their seeds.



Beans *Sunflower* *Mango* *Apple*

Fig. 3.28 Some dicots

Characteristics

1. A seed contains two cotyledons.
2. Tap root system is present.
3. Leaves are broad having reticulate venation.
4. Nodes and internodes are not distinct.

Examples: Rose, mango, apple, bean, pea, mustard, orange, lotus, sunflower, etc.

Differences between Gymnosperms and Angiosperms

Gymnosperms	Angiosperms
1. Cones are present.	1. Cones are absent.
2. Fruits are absent.	2. Fruits are present.
3. Seeds are naked.	3. Seeds are enclosed.
4. Leaves are pointed.	4. Leaves are flat and broad.

Differences between Monocot and Dicot

Monocot	Dicot
1. A seed contains only one cotyledon.	1. A seed contains two cotyledons.
2. Fibrous root system is present.	2. Tap root system is present.
3. Leaves are elongated having parallel venation.	3. Leaves are broad having reticulate venation.

Activity 10

- Observe different types of flowering plants in your locality.
- Study their morphology and classify them in terms of gymnosperms, angiosperms, monocot and dicot and fill in the given table.

<table>
<tr><th>Flowering plants</th><th>Gymnosperms</th><th colspan="2">Angiosperms</th></tr>
<tr><td>1.</td><td>1.</td><td colspan="2">1.</td></tr>
<tr><td>2.</td><td>2.</td><td colspan="2">2.</td></tr>
<tr><td>3.</td><td>3.</td><td colspan="2">3.</td></tr>
<tr><td>4.</td><td>4.</td><td colspan="2">4.</td></tr>
<tr><td>5.</td><td></td><td colspan="2">5.</td></tr>
<tr><td>6.</td><td></td><th>Monocot</th><th>Dicot</th></tr>
<tr><td>7.</td><td></td><td>1.</td><td>1.</td></tr>
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Differences between Non-flowering and Flowering plants

Non-flowering plants	Flowering plants
1. They do not bear flowers and seeds.	1. They bear flowers and seeds.
2. They may be green or non–green.	2. All flowering plants are green.
3. They may be unicellular or multicellular.	3. All flowering plants are multicellular
4. They may or may not bear roots, stem and leaves.	4. They bear roots stem and leaves.

Activity 11

Observe any three non–flowering and three flowering plants in your locality. Study their morphology (external structure). Write any three similarities and three differences between them and fill in the given table.

Similarities

S.N.	Non-flowering plants	S.N.	Flowering plants
1.		1.	
2.		2.	
3.		3.	

Differences

S.N.	Non-flowering plants	S.N.	Flowering plants
1.		1.	
2.		2.	
3.		3.	

Activity 12

- Visit a nearby garden or cropfield.
- Uproot a flowering plant such as marigold, pea, mustard, soyabean, etc.
- Observe the plant and identify its various parts.
- Draw a neat and labelled figure of the plant on your practical file and submit to your science teacher.

Key Concepts

1. On the basis of structure and development, sub kingdom cryptogams is divided into three divisions. They are as follows: a. Division Thallophyta b. Division Bryophyta c. Division Pteridophyta.
2. Division Thallophyta includes primitive cryptogams without root, stem and leaves.
3. Most fungi are found on dead and decaying organic matter whereas some live as parasites of plants and animals.
4. Bryophytes grow on moist and they need water to reproduce. Therefore, bryophytes are also called amphibian plants.
5. Division Pteridophyta consists of well developed cryptogams having feather shaped leaves.
6. The plants that bear flowers, fruits and seeds are called flowering plants.
7. Division gymnosperms consists of cone–bearing plants having naked seeds.
8. Division angiosperms consists of the most developed flowering plants having fruits. They are found on land and in water.
9. Sub division monocot includes flowering plants having only one cotyledon in their seeds.
10. Sub-division dicot includes well developed flowering plants having two cotyledons in their seeds.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. The plants that do not bear flowers are called cryptogams. ☐

b. All thallophytes have chlorophyll. ☐

c. Bryophytes are called amphibian plants. ☐

d. True flowers are present in cycas. ☐

e. Monocots have only one cotyledon in the seed. ☐

f. Dicots have tap root system. ☐

2. Fill in the blanks using appropriate words.

a. The plants that do not bear flowers are called ....

b. Cones are present in ....

c. Fern plant has .... shaped leaves.

d. .... have naked seeds.

e. The plants having two cotyledons in their seeds are called ....

3. Tick (√) the best answer from the given alternatives.

a. Chlorophyll is absent in ....

☐ mushroom ☐ moss ☐ fern ☐ riccia

b. Which of the following is an amphibian plant?

☐ Mushroom ☐ Moss ☐ Spirogyra ☐ Mango

c. Which of the given plants does not have chlorophyll?

☐ Moss ☐ Yeast ☐ Spirogyra ☐ Fern

d. Which of the given plants has tap root system?

☐ onion ☐ maize ☐ pea ☐ bamboo

e. Which of the following is a dicot plant?

☐ Maize ☐ Bamboo ☐ Sugarcane ☐ Apple

4. Answer the following questions:

a. What are cryptogams? Give any three examples.

b. Name three divisions of cryptogams.

c. What are thallophytes? Give any two examples.

d. What are bryophytes? Write any two characteristics of pteridophyts.

e. What are phanerogams? Give any five examples.

f. Write any two characteristics of the plants belonging to division angiosperms?

g. What are monocots? Give any two examples.

h. What are dicots? Give any two examples.

5. **Differentiate between:**

   a. Cryptogams and Phanerogams

   b. Algae and Fungi

   c. Grymnosperms and Angiosperms

   d. Monocot and Dicot

6. **Give reason:**

   a. Algae are called autotrophs.

   b. Bryophytes are called amphibian plants.

   c. Maize is called a monocot.

   d. Mango is called a dicot plant.

7. **Write any two salient features of:**

a.

b.

c.

d.

e.

f.


8. **Match the following.**

Group A	Group B
Spirogyra	Monocot
Mushroom	Gymnosperm
Moss	Algae
Fern	Dicot
Cycas	Fungi
Maize	Pteridophyta
Mango	Bryophyta

9. **Cycas and Rose both are flowering plants. But cycas is kept in gymnosperms and rose is kept in angiosperms, why?**

3.4 Classification of Vertebrates

3.4.1 Introduction to Vertebrates

Animals like fish, frog, snake, bird, cow, etc. have backbone or vertebral column in their bodies. These animals are called vertebrates. So, the animals having backbone or vertebral column are called vertebrates. They are found in water and on land. The vertebrates that live in water include fish, shark, whale, dolphin, turtle, etc. whereas vertebrates like snake, lizard, parrot, crow, peacock, horse, rhinoceros, elephant, human beings, etc live on land. However, some vertebrates like frog, toad, salamander, etc. can live in water and on land. These vertebrates are called amphibians.

Vertebral column of human beings

Fig. 3.29

The body of vertebrates is well developed having head, trunk and tail with paired fins or limbs. They have well developed nervous system with a brain and spinal cord. They breathe through gills or lungs.

Activity 13

- Write the name of any ten animals that are found in your locality.
- Study their structure and find out whether they have vertebral column or not.
- Classify these animals as invertebrates and vertebrates.

3.4.2. Cold-blooded and Warm-blooded vertebrates

Some vertebrates can change their body temperature according to the temperature of surroundings and others cannot. On this basis, vertebrates have been classified into two categories. They are:

1. Cold-blooded vertebrates
2. Warm-blooded vertebrates

1. Cold-blooded vertebrates

The vertebrates whose body temperature changes according to the temperature of the surroundings are called cold-blooded vertebrates.

Fishes, amphibians (frogs, toads, etc.) and reptiles (snake, lizard, crocodile, etc) are cold blooded vertebrates. These animals go for hibernation as they cannot withstand extreme cold or extreme hot temperature.

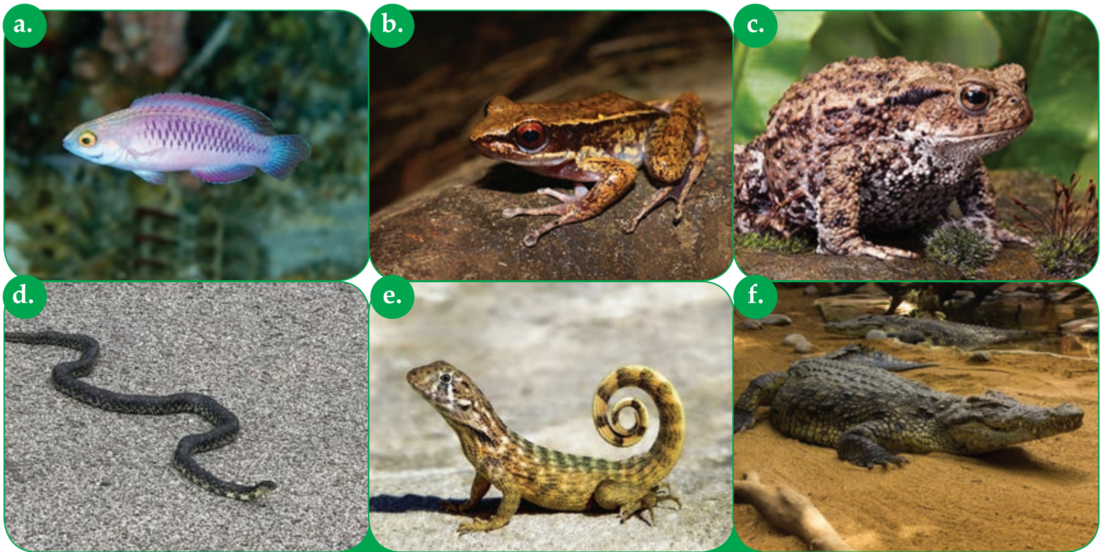


Fig. 3.30 Some cold-blooded vertebrates

2. Warm-blooded vertebrates

The vertebrates whose body temperature does not change with the temperature of surroundings are called warm blooded vertebrates. Birds and mammals are warm-blooded animals. These animals do not go for hibernation. Human beings, cow, elephant, dog, crow, parrot, pigeon, dove, etc. are called warm blooded animals as their body temperature remains constant.

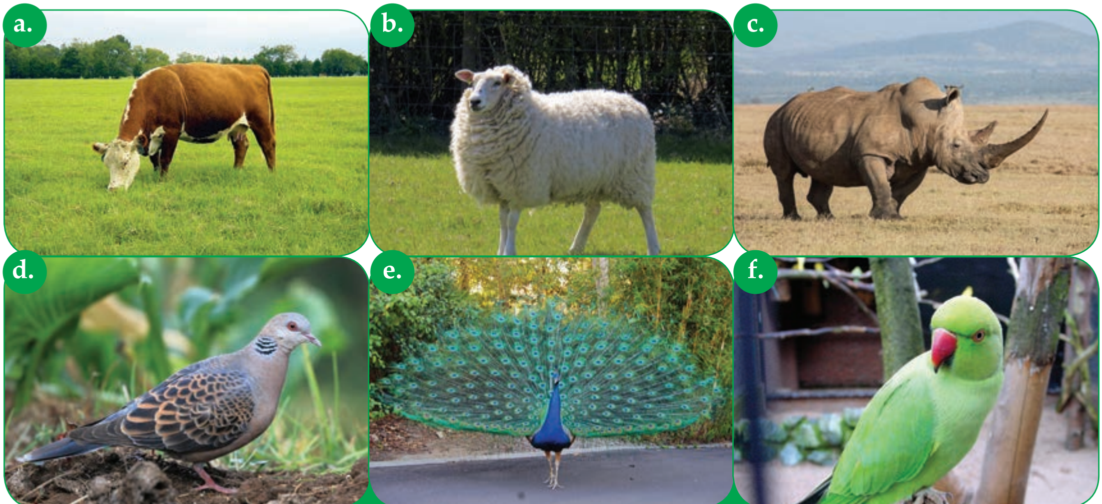


Fig. 3.31 Some warm-blooded vertebrates

3.4.3. Classification of Vertebrates

Vertebrates are divided into following five classes on the basis of their characteristics.

1. Pisces
2. Amphibia
3. Reptile
4. Aves
5. Mammalia

Do you know ?

The normal body temperature of human beings is 37°C or 98.6°F. When we fall sick, the body temperature may increase or decrease.

1. Class Pisces

This class consist of aquatic cold blooded vertebrates which are commonly known as fishes. They live in water.

Shark | *Rohu* | *Sea horse*

Fig. 3.32 Some pisces

Characteristics

1. Their body is boat-shaped or streamlined.
2. Their body is covered with waterproof scales.
3. They breathe through gills.
4. They move with the help of fins.
5. They have two chambered heart.
6. They lay eggs. So they are called oviparous animals.
7. Fertilization is external.
8. Their body can be divided into head, trunk and tail.

Examples: Shark, Rohu, Carp, Asla, Sea horse, Katla, etc.

2. Class Amphibia

This class includes the vertebrates that can live in water and on land. Most amphibians lay eggs in water.

Fig. 3.33 Some amphibians

Characteristics

1. Their body is covered with smooth or rough skin.
2. They breathe through lungs on land and through skin in water.
3. Their heart is three-chambered.
4. They move with the help of limbs.
5. They lay eggs. So they are called oviparous animals.
6. Their body can be divided into head and trunk. Neck and tail are absent.

Examples: Frog, toad, salamander, etc.

3. Class Reptilia

This class consists of cold-blooded vertebrates that crawl or creep on ground. They are commonly known as reptiles. Most reptiles live on land. Different types of snakes, lizards and crocodiles belong to class reptilia.

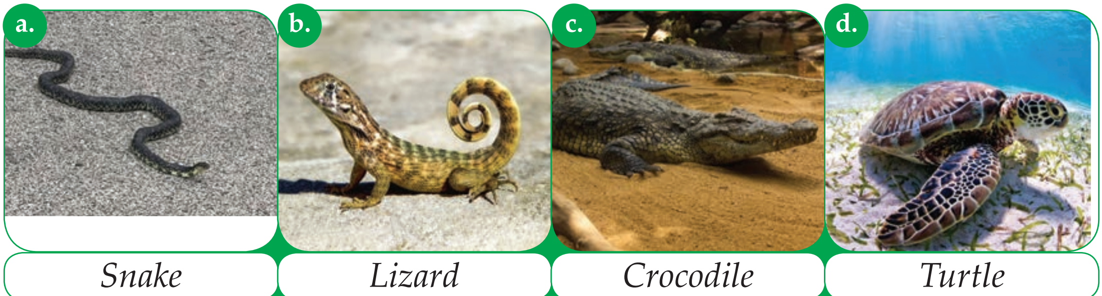


Fig. 3.34 Some reptiles

Characteristics

1. The body of reptiles is covered with hard, and dry scales.
2. They have three chambered heart.

Do you know?

- Reptiles are commonly known as crawlers or creepers.
- All reptiles have three chambered heart but crocodiles have four chambered heart.

3. They lay eggs and fertilization is internal.
4. Their body can be divided into head, neck, trunk and tail.
5. Breathing takes place with the help of lungs.
6. Two pairs of limbs are present but limbs are absent in snakes and some lizards.

Examples: snakes (cobra, python) lizards (garden lizard, house wall lizard, monitor lizard), crocodiles, alligators, tortoise, turtle, etc.

4. Class Aves

This class consists of warm blooded flying vertebrates which are commonly known as bird.

Fig. 3.35 Some birds

Characteristics

1. The body is boat shaped which is covered with feathers.
2. Fore limbs are modified in the form of wings.
3. They have four chambered heart.
4. Breathing takes place with the help of lungs.
5. They lay eggs and fertilization is internal.
6. Their body can be divided into head, neck, trunk and tail.

Examples: Crow, dove, parrot, pigeon, peacock, hornbill, koel, ostrich, penguin, etc.

5. Class Mammalia

This class includes the most developed warm blooded vertebrates that suckle their young ones. Most of the mammals live on land and a few live in water.

Do you know?

Most mammals directly give birth to their young ones. But two mammals. i.e duck billed platypus and spiny ant eater lay eggs.

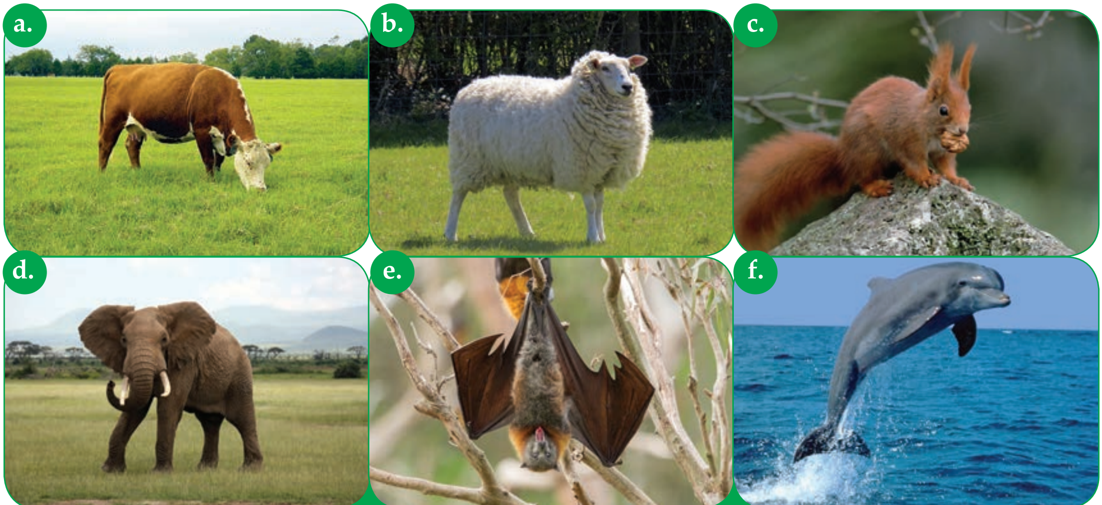


Fig. 3.36 Some mammals

Characteristics

1. Mammary glands, i.e. milk producing glands are present.
2. They directly give birth to their young ones. Females suckle their babies.

3. Body is covered with hair
4. External ears, i.e. pinnae are present.
5. They have four chambered heart.
6. Breathing takes place through lungs.
7. Their body can be divided into head, neck, trunk and tail.
8. They are viviparous and fertilization is internal.
9. They have two pairs of limbs for locomotion.

Examples: Human beings, sheep, goat, tiger, elephant, monkey, bat, dolphin, whale, rhinoceros, red panda, leopard, rat, cat, dog, etc.

Activity 14

- Name any ten vertebrates that are found in your locality.
- Study their characteristics and find out their class and fill in the given table.

S.No.	Pisces	Amphiba	Reptilia	Aves	Mammalia
1.					
2.					
3.					

Key Concepts

1. The animals having backbone or vertebral column are called vertebrates.
2. The body of vertebrates is well developed having head, trunk and tail with paired fins or limbs.
3. The vertebrates whose body temperature changes according to the temperature of the surroundings are called cold-blooded vertebrates.
4. The vertebrates whose body temperature does not change with the temperature of surroundings are called warm blooded vertebrates.
5. Class pieces consist of aquatic cold blooded vertebrates which are commonly known as fishes.
6. Different types of snakes, lizards and crocodiles belong to class reptilia.

7. Class mammalia includes the most developed warm blooded vertebrates that suckle their young ones.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. The animals having backbones are called vertebrates.

b. Cow and elephant are cold-blooded animals.

c. Crocodile belongs to class reptilia.

d. In frogs, fertilization is internal.

e. Bat is an aquatic mammal.

f. Reptiles are crawling cold-blooded vertebrates.

2. Fill in the blanks using appropriate words.

a. In .... animals, body temperature changes according to the surrounding temperature.

b. In ...., fore limbs are modified into wings.

c. .... directly give birth to their young ones.

d. In fishes, breathing takes place through ....

e. .... can breathe on land and in water.

3. Answer the following questions:

a. What are vertebrates? Give any five examples.

b. Define cold-blooded and warm-blooded animals with any two examples of each.

c. Name the five classes of vertebrates.

d. Write any two salient features and two examples of

i. pisces ii. amphibia iii. aves iv. mammalia

e. What are reptiles? Give any two examples.

f. What are amphibians? Give any two examples.

g. Write any two salient features of aves.

h. What are mammals? Write any three salient features of mammals.

4. **Differentiate between:**
   a. Fish and frog
   b. Warm-blooded and Cold-blooded animals
   c. Frog and Snake
   d. Reptiles and mammals
   e. Bat and Bird

5. **Name the class and any two salient features of the following vertebrates.**

a.

b.

c.

d.

e.

f.


6. **Parrot is kept in class Aves but bat is kept in class mammalia, why?**

7. **Frog is called cold-blooded but cow is called warm-blooded animal, why?**

UNIT

4

Biodiversity and Environment

Estimated teaching periods : 15

Before You Begin

Biodiversity is the existence of different types of plants and animals on the earth. A variety of living organisms, viz. plants and animals are found around us. They differ in habitat, structure, shape, size, colour, behaviour, life cycle, reproduction, etc. In simple words, biodiversity is the biological diversity. It refers to the genetic variation, ecosystem variation and species variation on the earth.

Environment is the natural world around us where plants and animals live. Environment consists of the physical world us well as the biological world. The earth is the common habitat for all plants and animals. Living beings get air, water, food, habitat, etc. from the earth. Environment is made of the abiotic and the biotic components. The abiotic components of the environment include sunlight, air, water, soil, temperature, pressure, rainfall, etc. Similarly, the biotic components of an environment include different types of plants and animals.

Learning Objectives

After completing the study of this unit, students will be able to:

- introduce biodiversity and environment.
- explain environment and its balance.
- describe the components of environment with examples.
- explain environment-friendly behaviour.
- describe the relation among plants, animals and micro-organisms.
- introduce ecosystem and describe the abiotic and biotic components of the ecosystem.
- explain forest ecosystem in brief.

Syllabus

- Introduction to biodiversity and environment
- Environment and its balance
- Components of environment
- Environment conservation and environment-friendly behaviour
- Interrelation between plants, animals and micro-organisms
- Ecosystem
- A biotic factors and biotic factors of ecosystem
- Types of ecosystem
- Forest ecosystem

Glossary

abiotic	:	physical rather than biological; not derived from living organisms
biotic	:	relating to or resulting from living organisms
biodiversity	:	the existence of large number of plants and animals
conservation	:	the protection of animals, plants and natural resources
conservation	:	a careful preservation and protection of something, planned management of natural resources to prevent exploitation, destruction, etc.
degradation	:	the damage or disturbance in any aspect of something
ecosystem	:	the structural, functional and self-sustaining unit made of living beings and non-living things
extinction	:	a situation in which a plant, an animal, etc. stops existing
environment	:	the natural world around us where plants and animals live
genetic	:	heritable, relating to or determined by the origin
habitat	:	a place where plants and animals live and reproduce
medicinal	:	tending or used to cure disease or relieve pain
microorganism	:	a microscopic organism, especially a bacterium, virus, or fungus
monument	:	a building, column, statue, etc.
mutual	:	shared between two or more people or groups
pathogenic	:	related to things that cause diseases
perpetual	:	everlasting or continuing forever
saprophyte	:	a plant, fungus, or microorganism that lives on dead or decaying organic matter
species	:	a group of closely related organisms which can interbreed freely to produce fertile offspring
sustainable	:	capable of being sustained, able to be used without being completely used up or destroyed

4.1 Introduction to Environment


Fig. 4.1

The totality of our surrounding that consists of both living beings and non-living things is called environment. Environment includes various components like animals, plants, air, water, land, atmosphere, sunlight, socio-cultural aspects, etc. The combination of all these components forms environment around us. The interaction between/among various living beings and non-living things form the natural environment. Living beings like animals and plants and non-living things like air, water, land, sunlight, climate, temperature, etc. are the components of natural environment.

Both living beings and non-living things exist in environment. Thus, environment is essential for all components for their existence. Living beings get food and shelter in environment. Moreover, one type of component of environment depends on other types of environmental components. For example, animals depend on plants for their food and shelter. Plants depend on non-living components like air, water, soil, sunlight, minerals. etc. for their food. Thus, there is a continuous interaction between/among different living beings and non-living things in environment. The major importance of environment for both animals and plants is given below:

i. Animals and plants obtain food and shelter from environment.
ii. Living beings get oxygen from environment for respiration.
iii. Plants get carbon dioxide, minerals, water, sunlight, etc. to prepare their food by photosynthesis.
iv. Human beings grow crops in environment (land) to get food.
v. Human beings obtain various materials (water, soil, timber, etc.) from environment to meet their requirements.
vi. Animals and plants get water from various water resources for their survival.

vii. Human beings carry out various developmental activities in the environment by mobilizing various natural resources.

Balanced environment is essential for the proper growth and development of all living beings in environment. Excessive use of natural resources degrade and pollute environment.

Activity 1

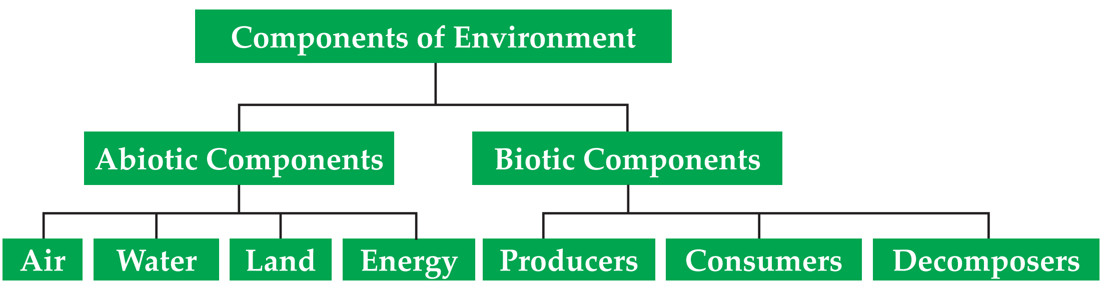
- Observe the environment around your home or school.
- List the living components and non-living components present there and fill the given table.

Living components		Non-living components
Plants	Animals	
1.	1.	1. ....
2.	2.	2. ....
3.	3.	3. ....
4.	4.	4. ....
5.	5.	5. ....

- How these components are inter-related? Discuss in your class.
- Prepare a short report and submit to your science teacher.

1.1.1 Components of Environment

Various components of environment are broadly categorized into biotic components and abiotic components. All living beings are biotic components of environment. For example, micro-organisms, animals, plants, etc. The non-living things found in environment are abiotic components of environment. For example, air, water, soil, sunlight, humidity, temperature, rainfall, etc.



A brief description of abiotic components and biotic components is presented below.

a. Abiotic Components of Environment

Air

Air is one of the fundamental abiotic components of environment. It is the mixture of various gases. It consists of 78% nitrogen, 21% oxygen and 1% other gases. The other gases include carbon dioxide, helium, neon, etc. The earth is surrounded by a layer of air. This layer is called atmosphere. Besides, humidity and dust particles are also found in the air.

> **Do your know?**
> The oxygen present in atmosphere is very important as it is a life-supporting gas.

Air is basic life component for both animals and plants. Both plants and animals take oxygen in and throw carbon dioxide out during respiration. Green plants need carbon dioxide during photosynthesis. Oxygen is the byproduct of photosynthesis. In this way, there is regular flow of carbon dioxide and oxygen in environment.

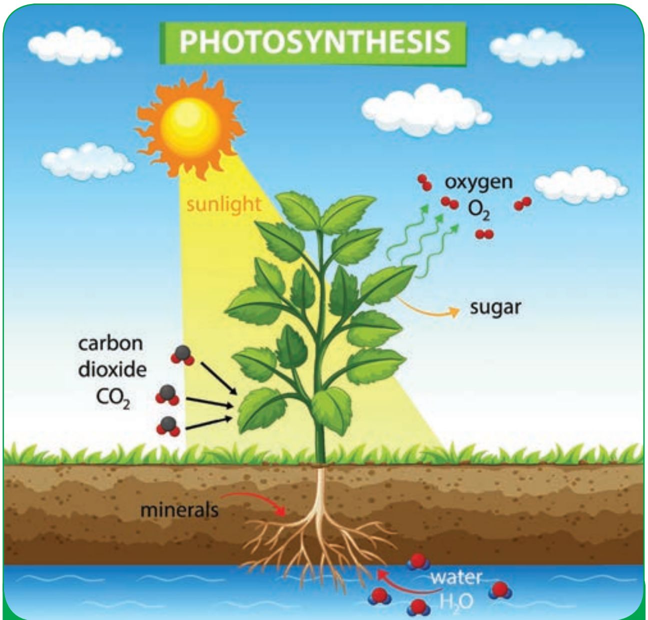


Fig. 4.2

Air is necessary to maintain the balance of carbon dioxide and oxygen in the environment for the survival of both animals and plants. There might be shortage of oxygen in the environment on decreasing green plants. Absence of oxygen result in difficulty for survival of animals. The imbalance in the amount of gases in environment results in air pollution. Air pollution is harmful for both animals and plants.

Water

Water is one of the fundamental abiotic component of environment. It is essential for the survival of all living beings. Water can be found on the earth surface and under the earth surface. Various types of water bodies like river, streams, ponds, lakes, wetlands, watersheds, etc. are the sources of water. Two-thirds parts of the earth is occupied by water bodies.

Do you know ?

About 71% of the earth is covered with water and 29% with land.

Sources of water are broadly classified into surface water, under ground water and rain water. There should be proper balance among these three sources of water. Surface water evaporates due to the sun light. It takes the form of cloud in the sky and falls on the earth in the form of rain. This rain is the form of rain fall. This rain fall is the source of surface water and underground water.

Fig. 4.3 Sources of water

Surface water and underground water is used for various purposes like drinking, washing, cleaning, irrigating, transportation, industrial activities, etc. Underground water can be taken on the earth surface by digging well, through water pump, etc. Rain water is suitable for agricultural activities. Water is an essential environmental component. Plants and animals cannot survive in the absence of water.

Land

Among various fundamental abiotic components of environment, land is one of them. Land is the combination of soil and rocks. Land is very essential for both animals and plants. All living beings get food and habitat from the land. Terrestrial plants grow on land, animals get their food from land and all land animals including human beings live in land. Thus, land is very important for all living beings.

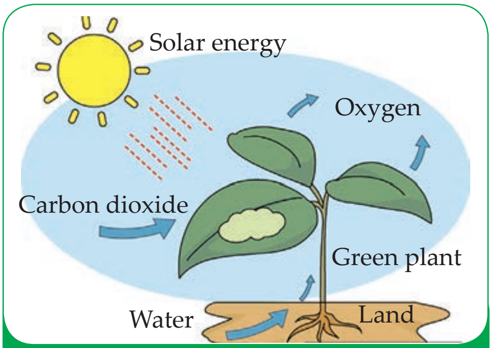
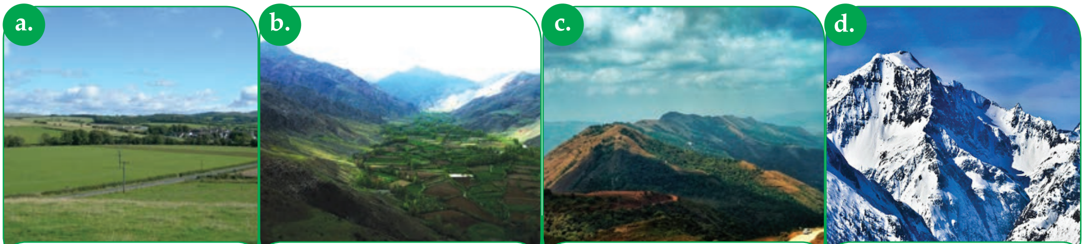


Fig. 4.4

Fig. 4.5 Plants grow on land

The earth has different landforms like plains, hills, valleys, mountains, etc. Land provides basis for survival, growth and development to living organisms. Plants absorb necessary nutrients and water from the soil. We grow fruits, vegetables, crops, medicinal plants, etc. on the land. Different types of animals also live on land.



Plain | Valley | Hill | Mountain

Fig. 4.6 Various landforms

Energy

The sun is the major source of heat and light energy. The sunlight is one of the important abiotic components of environment. The existence of living beings is not possible in the absence of sunlight. Animals get warmth from sunlight. Plants use sunlight to prepare their food by photosynthesis. Rainfall is not possible in the absence of sunlight because it supports water cycle. In the absence of rainfall, the existence of plants and animals is not possible in the environment. Thus, sunlight is an essential component of natural environment for the existence of all living beings.


Fig. 4.7

b. Biotic Components of Environment

Various living beings (microorganisms, animals and plants) are biotic components of environment. The living beings of an environment are called abiotic components of environment. The biotic components of an environment are broadly classified as follows :

1. Producers
2. Consumers
3. Decomposers

1. Producers

Green plants of the environment can prepare their own food by using solar energy, carbon dioxide and water. These are called producers since they can produce their food. The process by which green plants prepare their food is called photosynthesis. Thus, green plants are producers. All the small and large green plants around us are producers. All animals depend directly or indirectly on green plants to obtain food.

All animals depend on oxygen released by plants for breathing. Forests provide food and shelter to different animals. Producers are also called autotrophs since they have the ability to prepare their food by capturing solar energy. The roots of plants bind soil particles and prevent soil erosion and landslide. Green plants play a great role to conserve environment as they purify air, conserve soil and provide food to animals. Due to these reasons, producers are very important components of an environment.

Fig. 4.8

2. Consumers

A large section of living beings in the environment depends upon plants directly or indirectly for their food. These living beings are consumers. The living beings which depend on producers for their food are called consumers. Consumers have no ability to prepare their food on their own. For example, human beings, animals like goat, cow, sheep, dog, tiger, etc. are all consumers.

On the basis of consuming food, consumers are broadly categorized into primary consumers, Secondary consumers Tertiary consumers.

i. Primary Consumer   ii. Secondary Consumer iii. Tertiary Consumer

i. Primary Consumers

The consumers that feed on green plants only are called primary consumers. In other words, primary consumers directly depend on green plants for their food. For example, rabbit, elephant, cow, goat, deer, sheep, etc. Primary consumers are herbivores since they feed on the plants only.

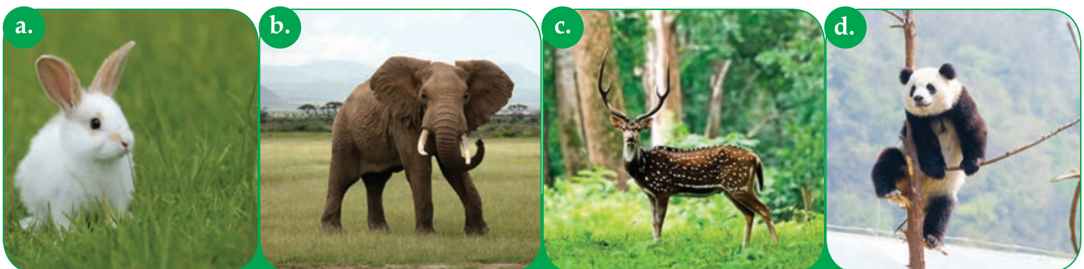


Fig. 4.9

ii. Secondary Consumers

The consumers that feed on primary consumers are called secondary consumers. Secondary consumers directly depend on animals, but indirectly depend on plants. For example, dog cat, fox, crow, frog, etc.

Fig. 4.10

iii. Tertiary Consumers

The consumers that feed on primary consumers and secondary consumers are called tertiary consumer. For example, tiger feed on goat, deer, dog, etc. Some more examples of tertiary consumers are lion, vulture, crocodile, etc. The animals which feed on flesh only are called carnivores. Likewise, the animals that feed on flesh and plants are called omnivores. Tiger, lion, etc. are carnivores and man, dog, bear, fox, cat, dog, etc, are omnivores.

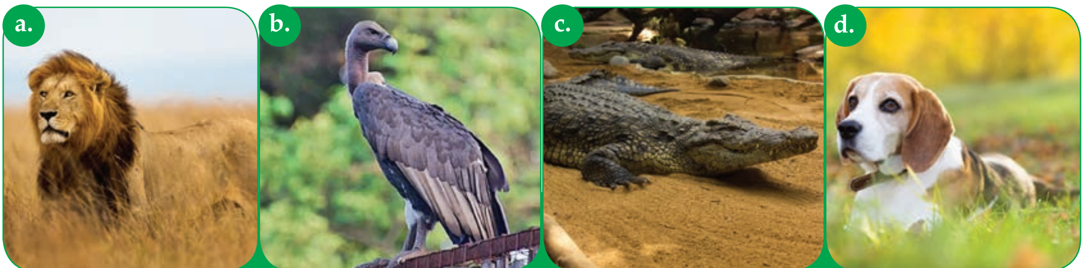


Fig. 4.11

3. Decomposers

The biotic components of environment that break down the remains of dead animals and plants are called decomposers. For example, bacteria, fungi, etc. They decompose dead and decaying bodies into simple substances by acting upon them. Decomposers produce nutrients

Fig. 4.12

from biodegradable materials which is essential for the growth of green plants in environment.

Activity 2

- Visit a nearly forest or grassland or a crop field in your locality. Observe various components of environment. Classify them in terms of abiotic components and different types of biotic components.

Abiotic components	Biotic components				
	Producers	Primary consumers	Secondary consumers	tertiary consumers	Decomposers
1. .... 2. .... 3. .... 4. .... 5.					

Activity 3

Prepare a brief description by showing the relationship between/among various biotic components (producer, consumer and decomposer) in your locality with the emphasis on their importance to maintain balance in environment. Also, present it in your classroom.

4.2. Environment Conservation and Environment Friendly Behaviour

Environment can be conserved by conserving and promoting its various components. Human being are responsible for conserving environment since various activities of human beings result in environmental degradation. Various efforts can be made to save natural environment with its various biotic and abiotic components. It is our responsibility to conserve environment for us and our future generations.

Some of the ways that can be adopted for environmental conservation are generating public awareness, afforestation and protecting forest, wise use of natural resources environmental sanitation, protection and promotion of cultural heritages, etc. The brief description of these efforts is presented below.

a. Generating Public Awareness

Fig. 4.13

Public awareness is one of the most effective methods of conserving environment. All people should have knowledge about the importance of environment for the existence of all living beings and non-living things. Conserving environment is possible by the effort of all human beings who use components of environment for various purposes. It is necessary to generate various awareness programmes in different level to make people aware about conserving environment. Environmental education is necessary to make people aware about protecting and conserving environment.

b. Public Participation


Fig. 4.14

It is not possible to conserve environment by individual effort or effort of few people. More and more people should be involved in conserving environment. Thus, it is essential to increase public participation so that it becomes responsibility of all people to conserve our environment.

c. Integrated Conservation Programmes


Fig. 4.15

The concept of integrated development is one of the effective efforts for conserving environment. Various developmental works like road construction, water supply, electrification, etc. can be conducted together by conserving environmental components. It is helpful to reduce pollution in environment.

d. Conservation of Vegetation and Afforestation

Fig. 4.16

Vegetation is one of the important components of environment responsible for maintaining environmental balance. It is necessary to conserve vegetation by conserving forest. Similarly, it is necessary to increase the area of forest by planting trees in barren and unused land. Green forest helps in maintaining environmental balance by maintaining water cycle and balance between oxygen and carbon dioxide.

4.2.1 Environmental Sanitation

Fig. 4.17

The process of creating clean, healthy and balanced environment around us is called environmental sanitation. Environmental sanitation is essential to maintain congenial environment for both animals and plants. Also, it is necessary to minimize various natural disasters and conserve different components (air, water, soil, etc.) of the environment.

Fig. 4.18

The major way of environmental sanitation is to control pollutants of environment. Proper management and disposal of waste materials is essential to control pollution in environment. Biodegradable and non-biodegradable wastes should be managed properly in order to keep environment clean and healthy. The most effective technique of maintaining environmental sanitation is reducing, reusing and recycling of waste materials.

Reduce

Reduction in use of various materials results in production of less waste. Less waste can be managed easily to maintain environmental sanitation.

Reuse

Reuse of waste materials is one of the effective methods of environmental sanitation. In this method, biodegradable wastes can be decomposed to prepare organic manure. Organic manure can be used for organic farming. Similarly, non-biodegradable wastes can be reused by modifying them into various items required in our daily life.

Fig. 4.19

Recycle

There are various materials which can be recycled to use them again. Such materials are papers, plastics, metals, glasses, etc. These materials can be recycled in factories to prepare various items that can be used again and again. Recycling of waste materials helps maintain environmental sanitation by controlling pollution in environment.

Activity 4

Make a list of biodegradable and non-biodegradable materials available in your surroundings. Discuss the methods of reusing and recycling these materials among your friends in your classroom.

Key Concepts

1. Environment is the natural world around us where plants and animals live. Environment consists of the physical world us well as the biological world.

2. There is a continuous interaction between/among various biotic and abiotic components of environment.
3. The condition of environment where all the components of environment are closely interrelated to one another for their existence and survival is called balanced environment.
4. It is necessary to maintain proper natural relationship between all components of the environment to maintain environmental balance.
5. Various components of environment are broadly categorized into biotic components and abiotic components.
6. Water is one of the fundamental abiotic component of environment. It is essential for the survival of all living beings.
7. It is necessary to conserve land in order to conserve natural environment and maintain environmental balance.
8. Sunlight is an essential component of natural environment for the existence of all living beings.
9. The living beings of an environment are called abiotic components of environment.
10. Green plants of the environment can prepare their own food by using solar energy, carbon dioxide and water. These are called producers since they can produce their food.
11. Some of the ways that can be adopted for environmental conservation are generating public awareness, afforestation and protecting forest, wise use of natural resources environmental sanitation, protection and promotion of cultural heritages, etc.
12. The most effective technique of maintaining environmental sanitation is reducing, reusing and recycling of waste materials.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. The natural world around us is called environment. ☐

b. The components of environment are mainly grouped into three types. ☐

c. Atmosphere is the thick layer of atmosphere.

d. The sun is the main source of energy.

e. Green plants are called producers.

f. Recycling of waste materials helps keep environment clean.

2. Fill in the blanks using appropriate words.

a. Air consists of 78% .... gas and 21 % of .... gas.

b. Two thirds parts of the earth is covered with ....

c. Green plants need sunlight to prepare food by ....

d. The animal that feed only on .... are called primary consumers.

e. The process of creating clean healthy and balanced environment is called ....

3. Answer the following questions:

a. What is environment?

b. What are the components of an environment?

c. List the abiotic and biotic components of an environment.

d. What are producers? Why are they called so?

e. Define primary consumers and secondary consumers with any three examples of each.

f. What are decomposers? Why are they important?

g. What is environment conservation?

4. Write any five measures to be adopted for environmental conservation. And describe any two of them.

5. Differentiate between:

a. Abiotic components and biotic components

b. Producers and consumers

c. Reduce and recycle

6. Classify given components into abiotic components and biotic components.

- land	- cow	- mushroom	- water
- energy	- tiger	- green plants	

7. Write in brief about:

a. producers
b. consumers
c. land
d. water
e. decomposers

8. What is meant by environment friendly behaviour? Write in brief.

9. Study the given figure and write a short note on it.

10. What do you know about "Reduce, Reuse and Recycle"? Write in brief.

4.3 Introduction to Ecosystem

The surface of the earth is formed by soil, stone, rivers, lakes, pond, ocean, etc. The earth is surrounded by a thick layer of atmosphere. The physical nature of earth consists of various components like soil, water, rocks, air, etc.

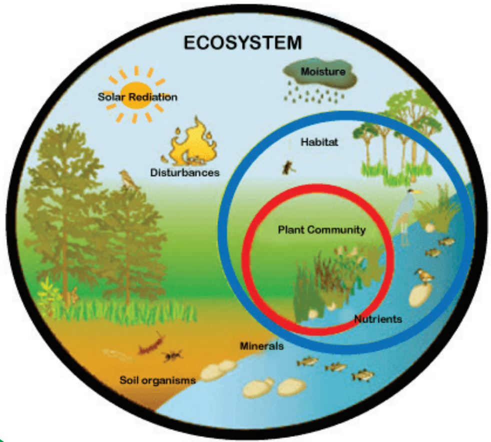


Fig. 4.20

The physical components of the earth have direct or indirect impacts on life style of various living organisms. Thus, there is a close relationship between the components of physical environment and living organisms in the earth. All living beings get food, water, oxygen, carbon dioxide, minerals, etc. form the physical environment. Ecosystem is the self-sustaining unit made of living beings and non-living things.

Different types of animals and plants live on the earth. All living beings (i.e. animals and plants) require favourable environment for their existence. Various communities of living organisms exist in their respective environment. Thus there is a constant interaction between communities of organisms and their surrounding environment. Such a interaction between living organisms (i.e. biotic components) and surrounding environment (i.e. abiotic components) is called ecosystem. The ecosystem contains biotic components like producer, consumer, decomposer, etc. and abiotic components like air, water, light, temperature, soil, rock, etc.

4.3.1. Factors of an Ecosystem

a. Abiotic factors

The non-living factors of ecosystem that include physical environment and climate factors are called abiotic factors. The physical environment includes air, water, soil, etc. The climatic factors include temperature, pressure, rainfall, sunlight, weather, humidity, etc. These various abiotic factors of an ecosystem are interrelated to each other. The brief description of some of the abiotic factors of an ecosystem is presented below.

Air

The mixture of various gases such as nitrogen, oxygen, carbon dioxide, helium, argon, neon, etc. is called air. The layer of air that surrounds the earth is called atmosphere. Besides various gases, air contains molecules of water and water vapour. Living beings inhale oxygen and release carbon dioxide during respiration. Green plants requires carbon dioxide for photosynthesis. Green plants take carbon dioxide during photosynthesis and oxygen is produced as byproduct.

Water

Water is an essential natural resource required for the life processes of animals and plants. Water plays vital role in the growth and development of living being. Living beings cannot exist in the absence of water on the earth. Green plants need water for photosynthesis. All animals including human beings use water from rivers, lakes, ponds, wells, oceans, etc. for various purposes mainly for drinking to remain alive.

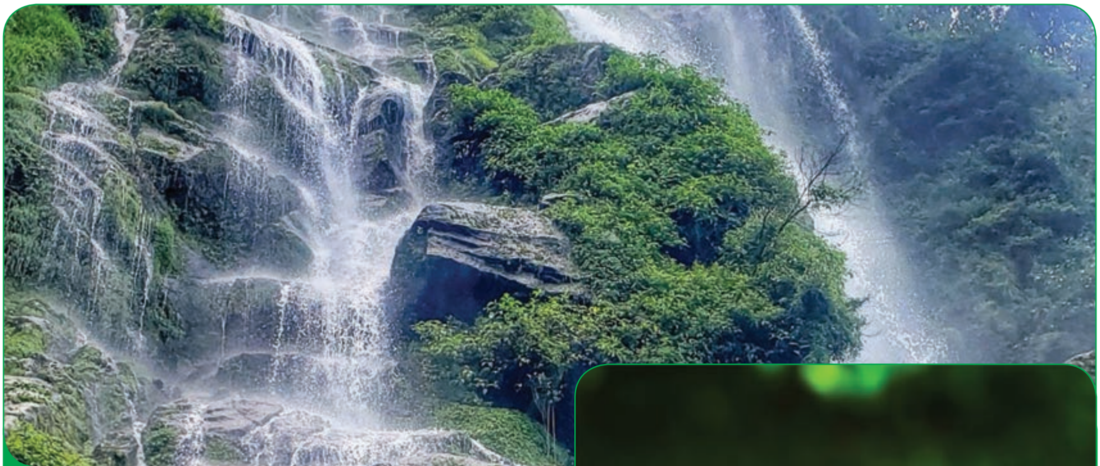


Fig. 4.21

Fig. 4.23

Soil

Soil is formed from humus, minute rock particles and minerals. The structure of soil varies from place to place. The colour of the soil is also different due to the presence of minerals in it. The quality of the soil gets improved due to mixing the decomposed biodegradable materials in it. Soil provides habitat to plants and animals. Plants also absorb water and minerals from the soil.

Solar energy

The sun is the major source of energy. It gives solar energy in the form of heat and light. Solar energy is essential for living beings. Green plants prepare their own food by photosynthesis in the presence of sunlight. Living beings cannot survive in the absence of solar energy.

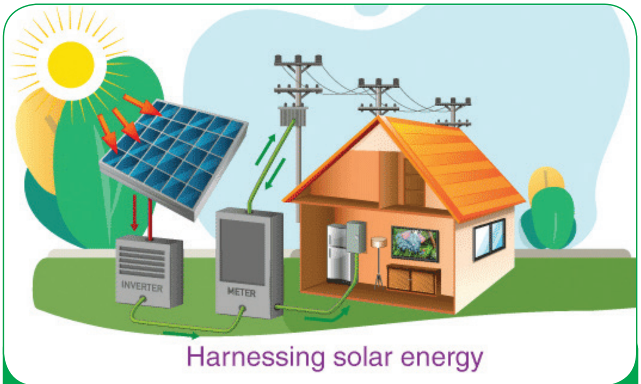


Fig. 4.23

b. Biotic Factors

The living organisms of an ecosystem are called biotic factors. Various organisms in environment are interrelated and interdependent. On the basis of the nutritional relationship, biotic factors are classified into: producers, consumers and decomposers.

a. Producers

The living beings that can prepare their food on their own are called producers. The chlorophyll bearing plants are producers. They produce their own food by photosynthesis. The green plants that can prepare their own food are also called autotrophs since they synthesize their own food other living beings in ecosystem take food from producers.

Do you know?

Green plants are producers as they can synthesize their own food by photosynthesis.

Fig. 4.24

b. Consumers

The living beings which depend on producers for their food directly or indirectly are called consumers. On the basis of nature of the food they take, consumers are classified into: primary consumer, secondary consumer and tertiary consumer.

Do you know?

Consumers may be herbivores, carnivores and omnivores. All consumers depend on producers for food.

i. Primary consumers

The living beings which directly depend on plants for their food are called primary consumers. Primary consumers are called herbivores since they feed on plants. The examples of primary consumers are cow, buffalo, goat, sheep, rabbit, etc.

Fig. 4.25

ii. Secondary consumers

The living beings which depend on primary consumers directly for their food are called secondary consumers. These are carnivorous animals since they feed on flesh of herbivores. Secondary consumers indirectly depend on green plants for their food. Some examples of secondary consumers are dog, fox, frog, snake, birds, etc. Secondary consumers provide food for tertiary consumers.

Fig. 4.26

iii. Tertiary consumers

The living beings which depend on primary consumers and secondary consumers for their food are called tertiary consumers. Tertiary consumers also indirectly depend on green plants for their food. Some examples of tertiary consumers are lion, tiger, crocodile, whale, owl, peacock, hawk, shark, crocodile, vulture, etc.

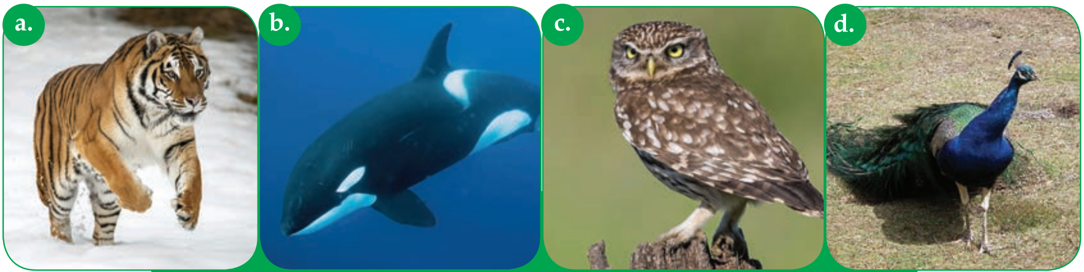


Fig. 4.27

c. Decomposers

The organisms that decompose dead bodies of organisms by decaying them are called decomposers. Decomposers decompose the complex organic compounds present in the dead bodies of the organisms or organic matter into simpler substances. Such soluble minute particles are mixed in the soil and roots of the plants absorb them. In other words, plants get required nutrients from the decomposed materials. The examples of decomposers are bacteria and fungi. They play a vital role in maintaining balance in ecosystem by providing required materials for the growth of plants in the environment.

Fig. 4.28

Relation between Plants, Animals and Micro-organisms

In an ecosystem, animals and plants are interrelated for their food. Green plants prepare complex organic matter by using simple organic matter. All living organisms need nutrients to be alive, grow and develop. The substances that are required to keep living organism alive are called nutrients. Similarly, nutrition is the process by which living organisms obtain food to continue their life processes. On the basis of nutritional relationship, biotic factors of an ecosystem are categorized into autotrophs and heterotrophs.

Activity 5

- Visit a crop field, garden or forest nearby your school along with your science teacher.
- Observe abiotic factors and biotic factors present there and make a list.
- Classify these biotic factors in terms of producers, different types of consumers and decomposers. Fill in the given table.

Producers	Consumers				Decomposers
	Primary	Secondary	Tertiary	Tertiary	
1.	1.	1.	1.	1.	1. ....
2.	2.	2.	2.	2.	2. ....
3.	3.	3.	3.	3.	3. ....
4.	4.	4.	4.	4.	4. ....
5.	5.	5.	5.	5.	5. ....

4.3.2 Types of Ecosystem

On the basis of habitat, there are two types of ecosystem. They are :

1. Terrestrial ecosystem 2. Aquatic ecosystem

a. Terrestrial Ecosystem

Terrestrial ecosystem refers to the ecosystem which exists on land. It is further divided into grassland ecosystem, forest ecosystem, desert ecosystem, etc.

In this lesson, we will study about forest ecosystem in brief. The ecosystem which exists in the forest is called forest ecosystem.

Forest Ecosystem

Fig. 4.29

There are various biotic and abiotic components in the forest ecosystem. Soil, air, water, rocks, sunlight, heat, temperature, humidity and other decayed materials are abiotic components of forest ecosystem. Similarly, various living organisms are the biotic components of forest ecosystem. Biotic components of forest ecosystem are classified into producers, consumers and decomposers.

Producers are all green plants that can prepare their own food. All kinds of green plants like trees, shrubs, herbs, weeds, grasses, etc. are the examples of producers. Producers provide food to various types of consumers that exist in forest ecosystem.

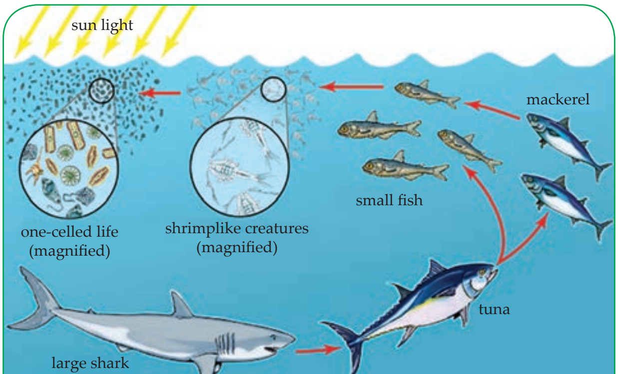
Similarly, the living organisms that depend on producers for their food are called consumers of forest ecosystem. Consumers are further divided into primary, secondary and tertiary. The primary consumers are the living organisms that directly depend on producers for their food. For example, rabbit, goat, monkey, insects, earthworm, mouse, elephant, rhino, deer, etc.

The carnivorous animals that directly depend on the primary consumers for their food are called secondary consumers. For example, birds, frog, wolf, jackal, cat, dog, etc. Similarly, the strong carnivores such as tiger, leopard, vulture, hawk, lion, etc. are tertiary consumers of forest ecosystem. The decomposers of the grassland ecosystem are various types of bacteria and fungi.

Decomposers act dead bodies of organisms and decompose their complex organic matter into simple substances. The minute particles of decomposed materials are the nutrients for green plants.

b. Aquatic Ecosystem

The ecosystem which exists in water is called aquatic ecosystem. Aquatic ecosystem is further classified into freshwater ecosystem and marine water ecosystem. The freshwater ecosystem is further divided into pond or lake ecosystem, river ecosystem, etc.



Aquatic Ecosystem

Fig. 4.30

Ecosystem

- **Terrestrial Ecosystem**
  - Grassland ecosystem
  - Cropfiled ecosystem
  - Forest ecosystem
  - Desert ecosystem
- **Aquatic Ecosystem**
  - Fresh water ecosystem (Pond/lake/river)
  - Marine water ecosystem

4.3.3 Food Circulation Process in an Ecosystem

Energy is essential for continuation of life processes of any living organism. The major source of energy is food stuff or biomass. Green plants can prepare their food by photosynthesis. They are producers in ecosystem and they provide food to consumers. The plants like yeast, mucor, mushroom, etc. are saprophytes since they get their food from dead organisms. Similarly, animals cannot prepare their food and hence they depend on plants directly for their food. Thus, food prepared by green plants circulates through primary consumers, secondary consumers and tertiary consumers. Similarly, decomposers obtain their food from dead and decaying bodies of animals and plants.

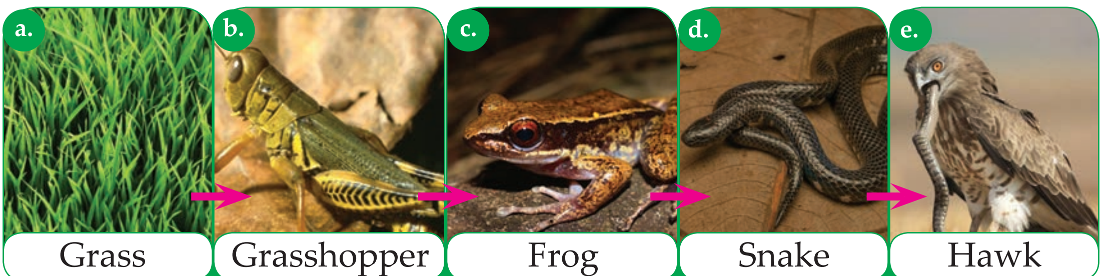


Fig. 4.31

In ecosystem, each living organism obtains food from dead and decaying bodies of animals and plants indirectly. In ecosystem, each living organism obtain food from other source in different forms for their livelihood. Therefore, the process of transfer of food materials from an organism to another creates food chain in an ecosystem.

Key Concepts

1. Environment is the place where plants and animals live.
2. The self-sustaining structural and functional unit of biosphere that includes both biotic communities and abiotic environment is called ecosystem.
3. The non-living factors of ecosystem that mainly include physical environment and climate factors are called abiotic factors.
4. Air is very important abiotic factor for living beings.
5. The sun is the major source of energy. It gives solar energy in the form of heat and light.
6. The living organisms of an ecosystem are called biotic factors.
7. Various organisms in environment are interrelated and inter-dependent.
8. The living beings that can prepare their food on their own are called producers.
9. The living beings which depend on producers for their food directly or indirectly are called consumers.
10. The living beings which directly depend on plants for their food are called primary consumers.
11. The living beings which depend on primary consumers directly for their food are called secondary consumers.
12. The living beings which depend on primary consumers and secondary consumers for their food are called tertiary consumers.
13. The organisms that decompose dead bodies of organisms by decaying them are called decomposers.
14. Terrestrial ecosystem refers to the ecosystem which exists on land. It is further divided into grassland ecosystem, forest ecosystem, desert ecosystem, etc.
15. The ecosystem which exists in water is called aquatic ecosystem. Aquatic ecosystem is further classified into freshwater ecosystem and marine water ecosystem.

Exercise

1. Choose the best answer from the given alternatives.

a. Which of the following is a producer?

☐ Cow ☐ Grass ☐ Mushroom ☐ Rabbit

b. Which one is the decomposer among the following?

☐ Snake ☐ Green plant ☐ Mushroom ☐ Caterpillar

c. Which one is the primary consumer among the following in an ecosystem?

☐ Lion ☐ Snake ☐ Vulture ☐ Cow

d. Which of the following is an abiotic factor?

☐ Air ☐ Soil ☐ Water ☐ All of them

e. Which of the following is a tertiary consumer?

☐ Zebra ☐ Bear ☐ Tiger ☐ Sheep

2. Answer the following questions.

a. What is ecosystem?

b. Define ecological factors. Name any four biotic components of an ecosystem.

c. What are biotic factors and abiotic factors. Give two examples of each.

d. Define decomposers. Explain the importance of decomposers in an ecosystem.

e. Define the forest ecosystem with examples. Explain the role of producers in a grassland ecosystem.

f. Explain food circulation process in an ecosystem with examples.

3. Describe the relationship among plants, animals and micro-organisms in brief.

4. Differentiate between:

a. Producers and consumers

b. Secondary consumers and tertiary consumers

c. Autotrophs and heterotrophs

5. Match the following.

A	B
Grass	Decomposer
Rabbit	Tertiary consumer
Fox	Primary consumer
Lion	Secondary consumer
Mushroom	Producer

6. Give reason:

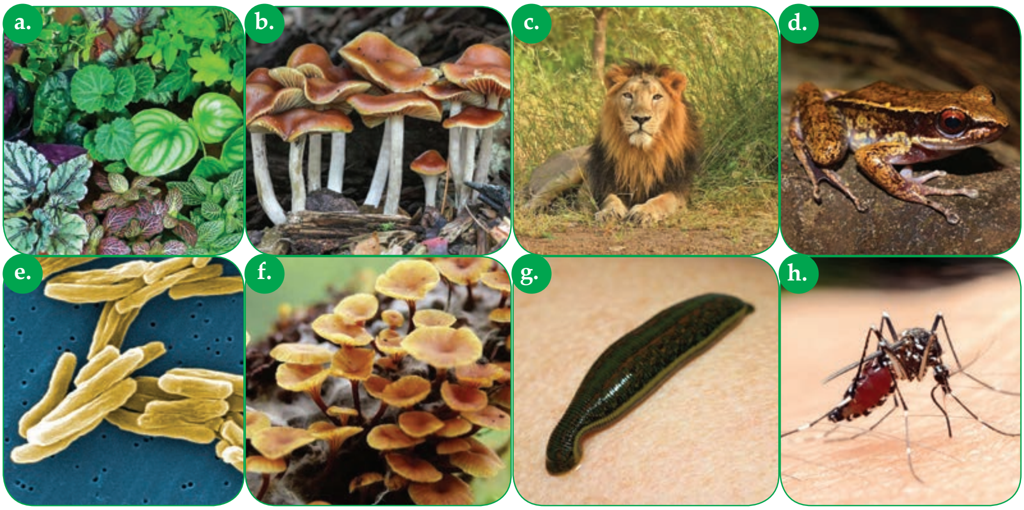
a. Green plants are called producers.

b. Bacteria are called decomposers.

c. Mushroom is a saprophyte.

d. All green plants are autotrophs.

7. Classify the following living beings under the topics of producer, consumer, decomposer, parasite and saprophyte.



7. Draw a well labeled diagram of forest ecosystem including producers, consumers and decomposers in it.

8. If all primary consumers of a forest ecosystems are killed, what effect will occur in that ecosystem. Explain.

UNIT

5

Life Processes

Estimated teaching periods : 10

Before You Begin

Living beings perform various activities like respiration, digestion, excretion, etc. for survival. These activities are called life processes. No organism can survive without life processes. Life is the result of various metabolic activities that occur continuously in living organisms. Life processes are simple in primitive organisms. All life processes occur within a single cell in unicellular organisms. But there are different organs and systems in developed organisms to perform various life processes.

Learning Objectives

After completing the study of this unit, students will be able to:

- introduce life processes with examples.
- explain mode of nutrition of animals.
- define photosynthesis and describe the things essential for photosynthesis.
- explain iodine starch test.
- introduce human digestive system and explain the process of digestion in human beings.

Syllabus

- Introduction to life processes
- Mode of nutrition of animals
- Photosynthesis (Introduction and importance)
- Things essential for photosynthesis
- Iodine starch test
- Human digestive system
- Process of digestion in human beings

Glossary

digestion	:	the process of digesting food.
enzyme	:	a substance produced by a living organism which acts as a catalyst to bring about a specific biochemical reaction
excretion	:	the process of removing waste materials from the body.
gamete	:	a male or female sex cell
life processes	:	those activities which are performed by living beings to survive, e.g. growth, respiration, transport, etc.
parasite	:	an organism that lives in or on an organism of another species (its host)
photosynthesis	:	a process of making food by green plants
reproduction	:	a biological process by which living beings produce their own kinds
respiration	:	the process of releasing energy by breaking down food in the presence of oxygen
shoot	:	the part of a plant above the ground
transpiration	:	the process of losing water in the form of vapour through stomata of leaves
trunk	:	the thick stem of a plant from which branches grow
vascular	:	of or containing veins or tubes that carry liquids around the bodies of plants and animals

5.1 Life Processes

5.1.1 Introduction to Life Processes

Life processes are essential for survival of living beings. Living beings take food. They breathe. They excrete. They transport materials from one part of body to another. Similarly, they reproduce their own kinds. These activities are known as life processes. Growth, nutrition, respiration, digestion, excretion, internal transport, sensitivity, reproduction, etc. are the life processes that occur in living organisms.

a. *Butterfly sucking nectar of flower*

b. *Cat with kittens*

c. *Fish breathing in water*

Fig. 5.1

Life processes are those activities which are performed by living organisms for survival.

When we feel hungry, we take food. All living beings take food to survive. Living beings take food by various ways. You might have observed the feeding habit of different animals. Observe the feeding habit of different animals in your surroundings and complete the given table.

Names of animals	Food they eat
Dog	
Butterfly	
Cow	
Cat	
Tiger	
Monkey	
Rabbit	
Snake	

Some animals feed on grass and leaves of plants. Some animals feed on fruits and seeds of plants. Some animals kill other animals and eat them. Some animals eat both plants and animals. Animals like cow, rabbit, sheep, zebra, goat, etc. feed on grass and leaves of plants. These animals are called herbivores.

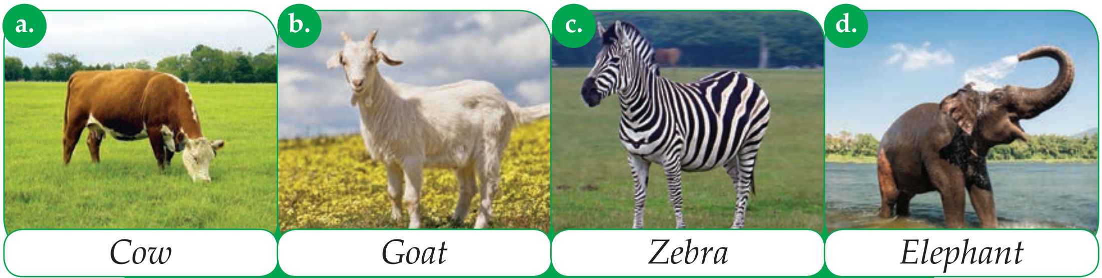


Fig. 5.2 Some Herbivores

Animals like tiger, lion, eagle, hawk, etc. feed on flesh of other animals. These animals are called carnivores.

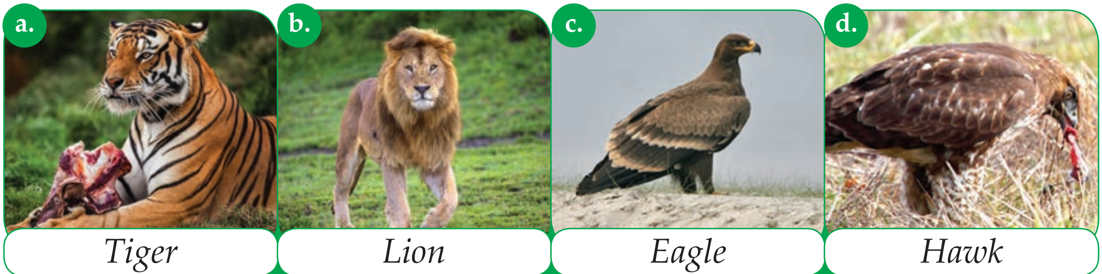


Fig. 5.3 Some Carnivores

Animals like dog, crow, fox, bear, etc. feed on both plants and animals. These animals are called omnivores.

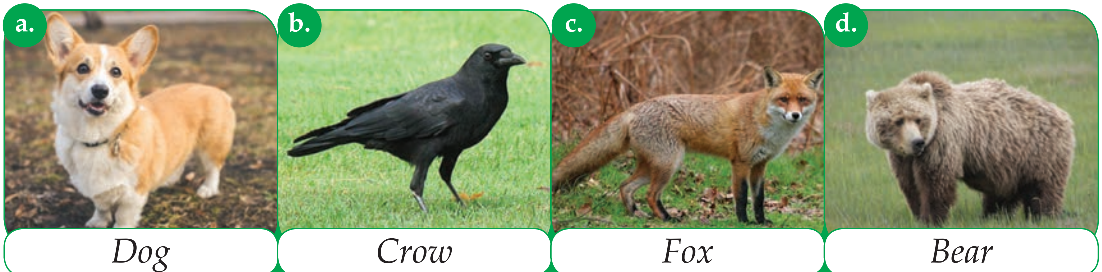


Fig. 5.4 Some Omnivores

Some animals like louse, flea, bedbug, mosquito, etc. have parasitic mode of life.

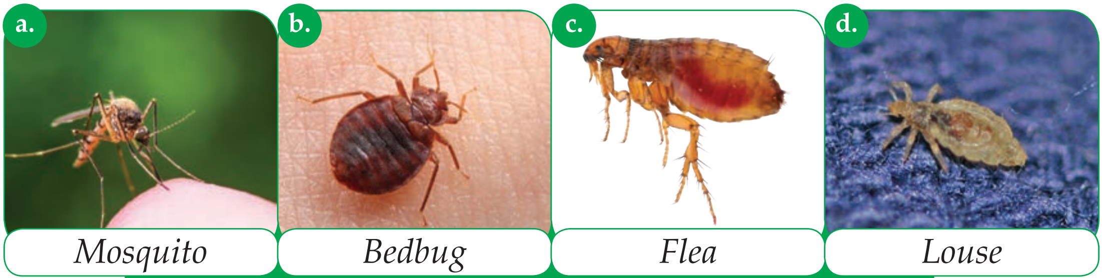


Fig. 5.5 Some Parasitic Animals

Plants provide food to animals directly or indirectly. Can you say that how do plants survive? How do they get food? Green plants can synthesize their own food. This process is called photosynthesis.

5.2 Types of Animals on the Basis of Nutrition

Autotrophs

The organisms that can prepare their own food by photosynthesis are called autotrophs and the mode of nutrition of autotrophs is called autotrophic nutrition. All green plants are autotrophs and their mode of nutrition is autotrophic nutrition or autotrophism. Autotrophs are producers. All green plants are produces since they can prepare then own food by using water, carbon dioxide and sunlight with the help of chlorophyll. All the producers synthesize organic food material by using inorganic matter in the presence of sunlight.

Heterotrophs

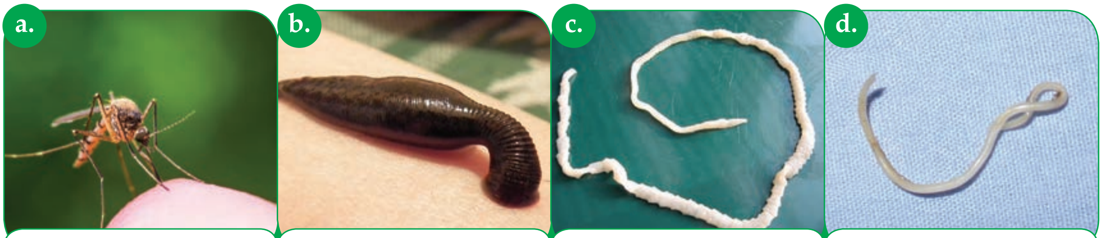
The living organisms that cannot prepare their own food and depend on producers directly or indirectly for their food are called heterotrophs or heterotrophic organisms. The mode of nutrition of heterotrophs is called heterotrophic nutrition or heterophism. All animals and non-green plants are heterotrophs and their mode of nutrition is called heterotrophism. On the basis of mode of nutrition, heterotrophs are classified into parasites, saprophytes and holozoic organisms.

Differences between Autotrophs and Heterotrophs

Autotrophs	Heterotrophs
1. They can synthesize their own food.	1. They cannot synthesize their own food.
2. Chlorophyll is present.	2. Chlorophyll is absent.
3. Most of them are plants.	3. Most of them are animals.

Parasites

The living organisms that get their food and shelter from their hosts are called parasites. Hosts are the living organisms that provide food and shelter to the parasites. The examples of parasitic organisms are leech, mosquito, amoeba, liverfluke, roundworm, tapeworm, etc. Similarly, some examples of parastitic plants are rust (Puccinia) smut (Ustilago), etc.



a. *Mosquito* b. *Leech* c. *Tapeworm* d. *Roundworm*

Fig. 5.6

Saprophytes

The organisms that obtain their food from dead and decaying organic matters by acting upon them are called saprophytes. Saprophytes decompose dead bodies of animals and parts of decaying plants and change them into simple inorganic matters. The common examples of saprophytes are bacteria and fungi.

a. *Mushroom* b. *Yeast*

Fig. 5.7

Activity 1

Make a visit to a grassland nearby your school or home in different groups of the classmates. Observe the producers, primary consumers, secondary consumers, tertiary, consumers. Classify these organisms as autotrophs, heterotrophs, saprophytes and parasites. Prepare a short report on it. Also, discuss it in your classroom.

Key Concepts

1. The organisms that can prepare their own food by photosynthesis are called autotrophs and the mode of nutrition of autotrophs is called autotrophic nutrition.
2. The living organisms that cannot prepare their own food and depend on producers directly or indirectly for their food are called heterotrophs or heterotrophic organisms.
3. The living organisms that get their food and shelter from their hosts are called parasites.
4. The organisms that obtain their food from dead and decaying organic matters by acting upon them are called saprophytes.

5.3 Photosynthesis

The process of making food by green plants in the presence of sunlight is called photosynthesis. Green plants use water and carbon dioxide gas in the presence of sunlight to prepare their food, i.e. starch. The chemical equation involved in photosynthesis is given below.

$$\text{Carbon dioxide} + \text{water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Glucose (starch)} + \text{Oxygen}$$

The process of photosynthesis takes place in the leaves of plants. Green plants can prepare their own food due to the presence of chlorophyll as chlorophyll traps the sunlight. The roots of plants absorb water and minerals from soil and xylem tissue conducts water and minerals to the leaves. Leaves absorb carbon dioxide present in the atmosphere through stomata present on them. *During photosynthesis, green plants use carbon dioxide gas and release oxygen gas.*

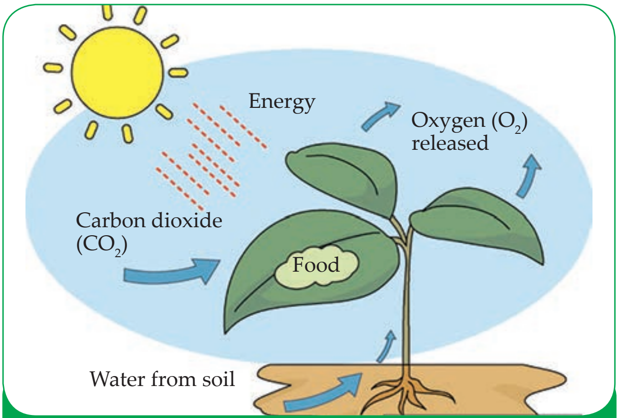


Fig. 5.8

5.3.1 Materials required for Photosynthesis

The materials required for photosynthesis are as follows:

i. Sunlight
ii. Carbon dioxide
iii. Chlorophyll
iv. Water

A brief description of the materials essential for photosynthesis is given below:

i. Sunlight

Sunlight is the most important material required for photosynthesis. Green plants absorb sunlight with the help of chlorophyll present in the leaves. Sunlight acts as the source of energy. Green plants convert solar energy into chemical energy during photosynthesis.

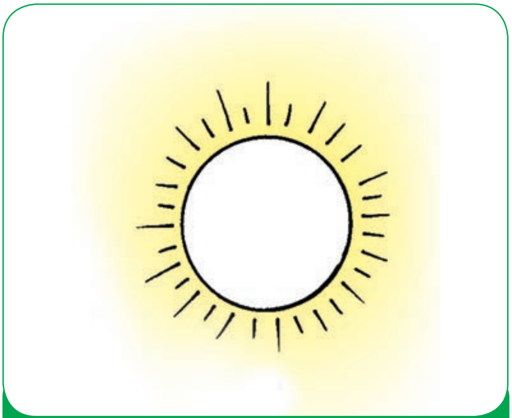


Fig. 5.9 Sun

ii. Carbon dioxide

Carbon dioxide is the raw material required for photosynthesis. Green plants absorb this gas from the atmosphere through stomata present on the leaves. Stomata are tiny pores present in leaves that help plants in exchange of gases.

iii. Chlorophyll

Chlorophyll is the green pigment found in most plants. Only chlorophyll can trap the solar energy. Due to this fact, non-green plants cannot perform photosynthesis.

iv. Water

Water is another raw material essential for photosynthesis. Green plants absorb water from the soil with the help of roots and the stem transports water from roots to leaves.

5.3.2. Experiments on Photosynthesis

Experiment 1

Iodine-starch test: Test of starch present in leaves of green plants

Requirements

Iodine solution, beaker, burner, a fresh green leaf, petri dish, alcohol, test tube, forceps, stand, water

Procedure

- Go to a sunny place and pluck a fresh green leaf from a plant.
- Take a test tube and put some alcohol in it. Now, immerse the leaf in the alcohol.
- Place the test tube in a beaker containing water.
- Heat the water in the beaker with a burner till the alcohol in the test tube boils.

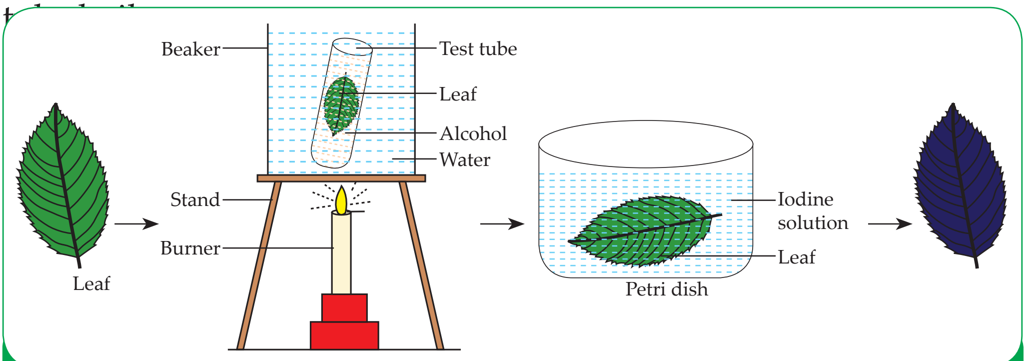


Fig. 5.10

- As the alcohol boils, the chlorophyll dissolves in alcohol and the leaf becomes pale.
- Remove the leaf from the test tube and wash it with warm water.
- Now, put the leaf in a petri dish and put a few drops of iodine and observe the change in colour.

Observation

In iodine solution, the leaf changes into blue-black due to the presence of starch.

Conclusion

This experiment proves that starch is produced during photosynthesis.

Experiment 2

To demonstrate that sunlight is necessary for photosynthesis

Requirements

A potted plant with large leaves, materials for iodine-starch test, black paper, cello tape

Procedure

- Take a potted plant with large leaves and keep it in a dark room for 3-4 days to make the leaf starch free due to absence of photosynthesis.
- Now, select a leaf and cover its both sides with a black paper and cello tape.
- Keep the plant in the sunlight for 4-5 hours.
- After 4-5 hours, pluck the covered leaf and remove the tape.
- Perform iodine-starch test of the experimental leaf and observe the change in colour.

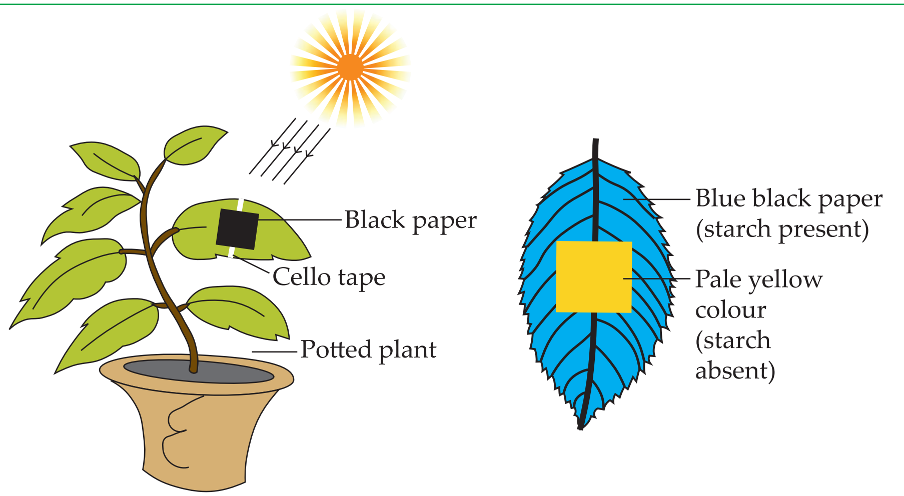


Fig. 5.11

Observation

The uncovered portion of the leaf turns blue-black in iodine solution which shows the presence of the starch whereas the covered portion of the leaf remains pale yellow which shows the absence of starch as it does not get the sunlight.

Conclusion

This experiment shows that sunlight is essential for photosynthesis.

Experiment 3

To prove that carbon dioxide is essential for photosynthesis

Requirements

A potted plant with broad leaves, materials for iodine-starch test, a bottle with a wide mouth, cork, potassium hydroxide solution

Procedure

- Take a potted plant with broad leaves and keep it in a dark room for 3-4 days to make it starch free.
- Take a bottle with a wide mouth and keep some KOH solution as it absorbs carbon dioxide present in the bottle.
- Insert half-portion of the leaf inside the bottle with the help of a cork as shown in the figure. Make the lid of the bottle air tight.

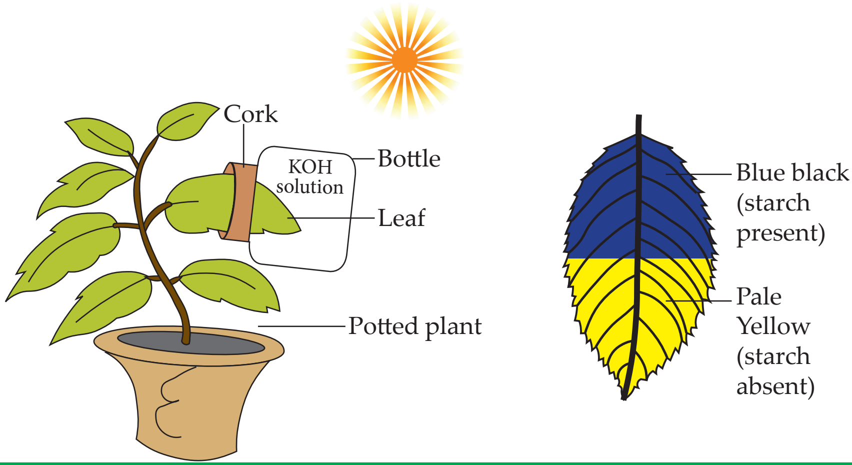


Fig. 5.12

- Now, leave the potted plant in the sunny place for 5-6 hours.
- Remove the experimental leaf and carry out iodine-starch test. Observe the change in colour of the leaf.

Observation

The portion of the experimental leaf that remains outside the bottle changes into blue-black as it gets carbon dioxide. But the portion of the leaf inside the bottle does not show the presence of starch as it does not get carbon dioxide. Please note that KOH solution absorbs carbon dioxide present in the bottle.

Conclusion

This experiment shows that carbon dioxide is essential for photosynthesis.

Experiment 4

To prove that oxygen is released during photosynthesis

Requirements

Beaker, test tube glass funnel, stand, water, fresh twigs of hydrilla, matchbox, sodium bicarbonate.

Procedure

- Take a beaker and fill it with water.
- Take a few twigs of fresh hydrilla and cover the twigs with a glass funnel and arrange the materials as shown in the given figure. Keep some sodium bicarbonate in the beaker as the source of carbon dioxide.
- Leave the apparatus in a sunny place for 3-4 hours.

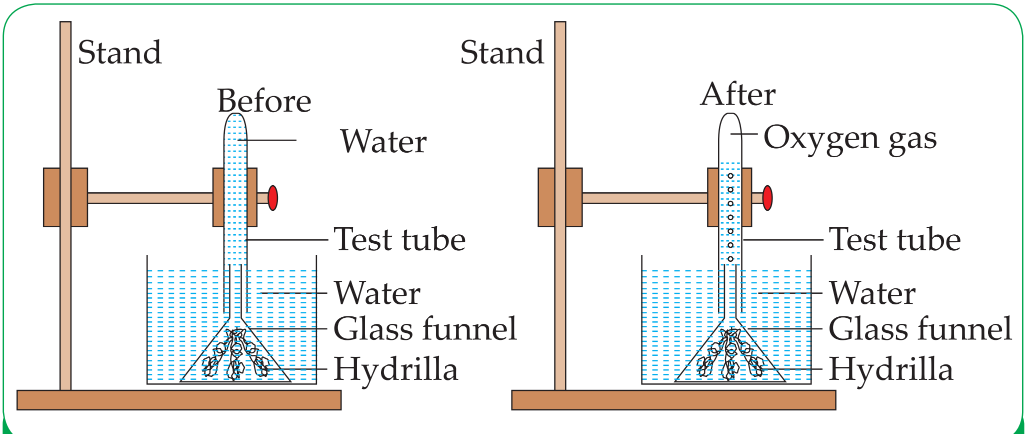


Fig. 5.13

Observation

After a few minutes, a stream of gas bubbles can be seen. This gas gets collected in the test tube by displacing water downwards.

When a burning match stick is inserted inside the test tube, it burns with a brighter flame. It shows that the gas produced is oxygen.

Conclusion

This experiment shows that oxygen is released during photosynthesis.

5.4 Digestive System

5.4.1 Human Digestive System

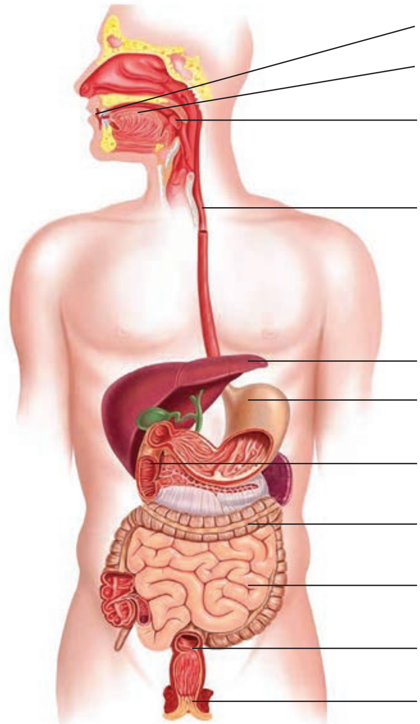


Fig. 5.14 Human digestive system

We need to eat food to get energy. The food that we eat should be digested before it is supplied to different parts of the body. The complex food is broken down into simple absorbable form by a group of organs. This process is called digestion. The system formed by digestive tract and digestive glands which is responsible for digestion of food is called digestive system.

Human digestive system can be divided into two parts, viz. alimentary canal and digestive glands.

i. Alimentary canal

Alimentary canal begins from mouth and end in anus. It consists of mouth, food pipe, stomach, small intestine, large intestine and anus. The diameter of alimentary canal differs from organ to organ.

ii. Digestive glands

Various chemicals are required for digestion of food. These chemicals are called enzymes. Different glands produce different types of enzymes. The glands involved in digestive system are salivary glands liver (gall bladder), pancreas and intestinal glands.

5.4.2 Process of Digestion

Food is taken into mouth and chewed with the help of teeth. Salivary glands secrete saliva which softens the food in mouth. The saliva contains an enzyme called salivary amylase. This enzyme acts on starch and converts it into maltose. After chewing, the food is swallowed into the pharynx which finally reaches the stomach through a food pipe (oesophagus).

The wall of stomach secretes gastric juice which contains hydrochloric acid and two enzymes, viz. pepsin and renin. The hydrochloric acid kills microbes present in the food. In stomach, pepsin acts on proteins and converts them into peptones (smaller protein molecules) renin acts on milk protein (casein) and changes into insoluble curd.

Nearly after two hours of meal, the food proceeds towards duodenum in the form of a thick paste, i.e. chime. In duodenum, bile juice from the liver (gall bladder) and pancreatic juice from the pancreas mix with the food. Bile juice does not contain any enzyme but it helps to digest fat. The pancreatic juice contains three enzymes. They are trypsin, amylase and lipase. Trypsin acts on proteins and converts them into peptones, amylase acts on starch and changes it into maltose and lipase acts on fats and changes them into fatty acid and glycerol.

After digestion in duodenum, the food slowly moves to the ileum where it is acted upon by four enzymes; viz. erepsin, maltase, lactase and sucrase, produced by intestinal glands. Erepsin acts on peptones and peptides and converts them into amino acids. Maltase acts on maltose and converts it into glucose. Sucrase acts on sucrose and changes it into glucose and fructose. Lactase acts on lactose and changes it into glucose and galactose. In this way, proteins, fats and carbohydrates are digested in the small intestine with the help of various enzymes. The digested food is absorbed by the thin walls of small intestine and mixed into blood stream. This process is called absorption. After absorption, digested food is supplied to various cells through blood circulation.

After digestion in small intestine, food proceeds towards large intestine where absorption of water occurs. The undigested solid particles of food form faeces which moves towards rectum and is passed away through the anus. This process is called digestion.

In this way, digestion of food takes place in the human body.

The digestion of food that occurs in different parts of alimentary canal is given below:

Part of alimentary canal	Digestive glands	Secretion	Enzyme	Food acted upon	Food changed into
1. Mouth	Salivary glands	Saliva	Salivary amylase	Starch	Maltose
2. Stomach	Gastric glands	Gastric juice	Pepsin	Protein	Peptones
			Renin	Milk protein (casein)	Insoluble curd
	Liver	Bile juice	No enzyme	Helps to	digest fat
3. Small intestine	Pancreas	Pancreatic juice	Trypsin	Proteins and peptones	Peptides
			Amylase	Starch	Maltose
			Lipase	Fats	Fatty acid and glycerol
	Intestinal glands	Intestinal juice	Erepsin	Peptides	Amino acids
			Maltase	Maltose	Glucose
			Lactase	Lactose	Glucose and galactose
			Sucrase	Sucrose	Glucose and fructose

Activity 2

- Take a chart paper an draw a neat and labelled figure of human digestive system.
- Demonstrate the chart paper in your classroom.

Project Work

- Use clay or dough and prepare of model of human digestive system on a card board.
- Put different colours in different organs.
- Demonstrate the model in the classroom.

Key Concepts

1. Living beings perform various activities like respiration, digestion, excretion, etc. for survival. These activities are called life processes.
2. Life is the result of various metabolic activities that occur continuously in living organisms.
3. Life processes are those activities which are performed by living organisms for survival.
4. The process of making food by green plants in the presence of sunlight is called photosynthesis.
5. The materials required for photosynthesis are as follows:

   i. Sunlight　　ii. Carbon dioxide

   iii. Chlorophyll　　iv. Water
6. The complex food is broken down into simple absorbable form by a group of organs. This process is called digestion.
7. Human digestive system can be divided into two parts, viz. alimentary canal and digestive glands.
8. The wall of stomach secretes gastric juice which contains hydrochloric acid and two enzymes, viz. pepsin and renin.
9. The digested food is absorbed by the thin walls of small intestine and mixed into blood stream. This process is called absorption.
10. The undigested solid particles of food form faeces which moves towards rectum and is passed away through the anus. This process is called digestion.

Exercise

1. Tick (√) the best answer from the given alternatives.

a. Which one of the following is a life process?

☐ respiration ☐ digestion ☐ reproduction ☐ all of them

b. Which of the following animal is a herbivore?

☐ cat ☐ tiger ☐ cow ☐ fox

c. Which of the following animal is a parasite?

☐ lion ☐ goat ☐ cow ☐ live fluke

d. Which of the given gas is released during photosynthesis?

☐ carbon dioxide ☐ oxygen

☐ nitrogen ☐ hydrogen

e. Which of the following enzymes is found in gastric juice?

☐ Renin ☐ Lipase ☐ Trypsin ☐ Sucrase

f. How many enzymes are found in intestinal juice?

☐ one ☐ two ☐ three ☐ four

2. Put a tick (√) for the correct statement and a cross (×) for the incorrect one.

a. No organisms can survive without life processes. ☐

b. All living beings take food by the same method. ☐

c. Omnivores eat only plants. ☐

d. Mushroom and mucor are saprophytes. ☐

e. Carbon dioxide is essential for photosynthesis. ☐

f. Green plants prepare food in the form of starch. ☐

g. Alimentary canal begins from mouth and ends in anus. ☐

h. Gastric juice contains amylase and lipase. ☐

3. Fill in the blanks using appropriate words.

a. The process of making food by green plants is called ....

b. .... provide food to animals directly or indirectly.

c. During photosynthesis, green plants use .... gas and release .... gas.

d. Human digestive system contains two parts. They are .... and ....

e. Green plants are called autotrophs and most animals are called ....

f. Pancreatic juice contains three enzymes. They are trypsin, ... and ....

f. Maltase acts on .... and converts it into ....

4. Answer the following questions:

a. What are life processes? Give any three examples.

b. What are autotrophs and heterotrophs? Write with examples.

c. What are saprophytes and parasites? Give any two examples of each.

d. What is photosynthesis? Name the things essential for photosynthesis.

e. Which gas is released by green plants during photosynthesis?

f. What is iodine-starch test?

g. What is digestive system?

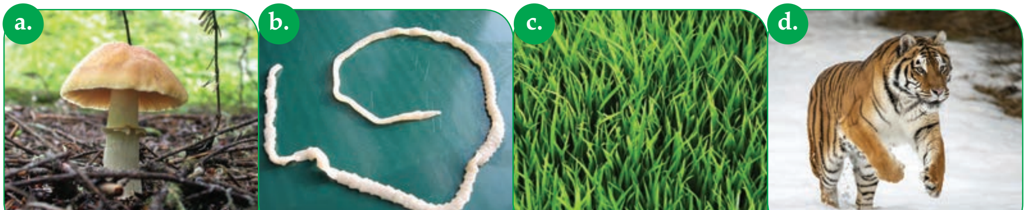
h. Name the enzymes found in gastric juice and intestinal juice.

5. Differentiate between :

a. autotrophs and heterotrophs

b. Saprophytes and parasites

6. Classify given organisms into autotrophs, heterotrophs, saprophytes and parasites.



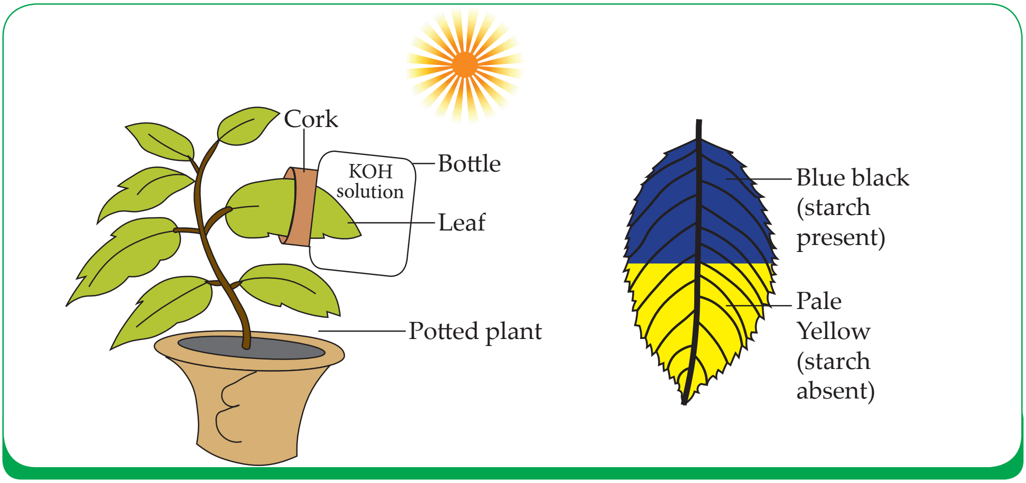
a. *Mushroom* b. *Tapeworm* c. *Grass* d. *Tiger*

7. How is iodine-starch test done? Explain.

8. Describe an experiment to prove that oxygen is released during photosynthesis.

9. **Draw a neat and labelled figure showing human digestive system.**

10. **Which statement can be proved by the given figure?**



11. **Can animals survive on the earth in the absence of green plants? Explain.**

12. **Describe the role of digestive juices in digestion of food.**

UNIT

6

Force and Motion

Estimated teaching periods : 10

Before You Begin

Force can be defined as the pull or push which changes or tends to change the position of a body. In our daily life, force is used for pulling, pushing, pressing, lifting, stretching, twisting, etc. Force can change the shape and size of a body. Force can stop a moving body and change its direction. Similarly, force can bring a body at rest to motion. The SI unit of force is newton (N). Force is a vector quantity as it has both magnitude and direction. A body is said to be in motion when it changes its position with respect to the objects in its surroundings.

We use a variety of machines like knife, scissors, pulley, screw, axe, beam balance, crow-bar, etc. to make our work easier and faster. These machines have simple structure. So they are called simple machines. Simple machines help us to work more efficiently. They help us to perform mechanical work using our muscular energy. Simple machines help to multiply force, change the direction of the force and increase the speed of work. We can make our life easier by using a variety of simple machines.

Learning Objectives

After completing the study of this unit, students will be able to:

1. Introduce to force and motion.
2. explain types of motion with examples.
3. describe the effects of force.
4. introduce transformation of force.
5. define simple machines and state the uses of simple machines in our daily life.

Syllabus

- Introduction to force and motion
- Motion and its types
- Force and effects of force
- Transformation of force
- Simple machine
- Uses of simple machines

Glossary

circular motion	:	the motion of a body in a circular path
convenient	:	easy or quick to do
curvilinear	:	contained by or consisting of a curved line or lines.
effort	:	the force applied on a machine while doing work
motion	:	if the position of a body changes with respect to other objects in its surroundings
force	:	the pull or push which changes or tries to change the position of a body
fulcrum	:	the point on which a lever turns or is supported
ideal	:	perfect, most suitable
inclined	:	leaning or turning away from the vertical or horizontal; sloping
input work	:	the work done on a machine
linear	:	arranged in or extending along a straight or nearly straight line
load	:	the force exerted by a machine after application of effort
machine	:	a piece of equipment with moving parts that is designed to do a particular work
output work	:	the work done by the machine
periodic motion	:	the motion which repeats itself at regular intervals
reference	:	a standard by which something can be compared
screw	:	a modified inclined plane with grooves cut in it
wedge	:	a simple machine having two or more sloping surfaces

6.1 Motion

6.1.1 Concept of rest and motion

If we look around in the classroom, we see a variety of things. All these things do not move, they are said to be at rest. A body is said to be at rest, if it does not change its position with respect to a fixed point taken as reference point in its surroundings. A book lying on a table, walls of a house, blackboard and desk are some examples of body at rest.

a.

Book at rest

b.

Bird in motion

Fig. 6.1

Human beings, animals, birds, insects, etc. move from one place to another. A man running on a road, a bus plying on a road, a bird flying in the sky, etc. keep on changing their position continuously. These are some examples of things in motion. A body is said to be in motion, if it changes its position with respect to a fixed point taken as reference point in its surroundings. However, rest and motion are relative terms.

> **Do you know?**
>
> A reference point is a body at rest with respect to which the state of another body is compared. Reference point may be a certain point, object or place about which the state, i.e. rest or motion, of a body is studied.

Activity 1

- Observe the position (rest or motion) of the objects in your classroom.
- Go on the play ground and observe the position of the objects in your surrounding.
- Go on the road and observe the position of different objects. What is essential to change the position of a body? Discuss.

Rest and motion are relative terms

Fig. 6.2 Moving train

Let us consider that we are sitting in a moving train. We are in motion with respect to the trees or buildings outside the train because our position is changing with respect to them. However, if we compare our position with respect to the things inside the train, i.e. other passengers, seats, fan of the train, walls and roof of the train, etc. They are at rest. Thus, an object can be at rest in relation to one object while it can be in motion in relation to another object at the same instant of time. Therefore, we can say that rest and motion are relative terms.

6.1.3. Types of motion

We observe different types of motion of different objects around us. The motion of different objects can be categorized into two types. They are:

1. Linear motion
2. Curvilinear motion

1. Linear motion

The motion of a body in a straight line is called linear motion.

Examples:

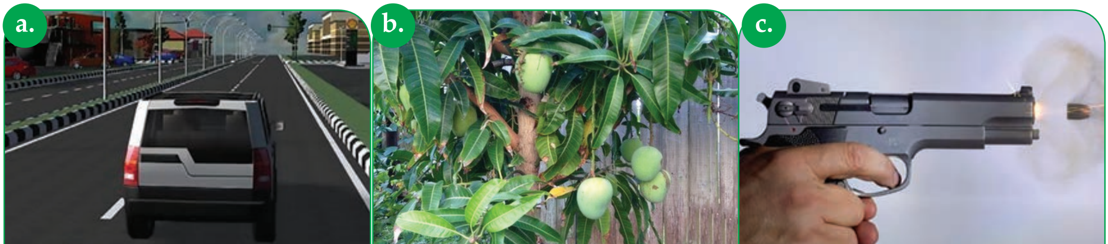
i. The motion of a car in a straight road.

ii. The motion of a mango falling from a tree.

iii. The motion of a bullet fired from a rifle.

iv. The motion of an aeroplane in a straight path.

v. The motion of a ball dropped from a tower, etc.



a. *A car moving in a straight road*

b. *A mango falling from a tree*

c. *A bullet fired from a gun*

Fig. 6.3

Activity 2

- Take a ball and go to the porch of your house or school.
- Drop the ball vertically downwards.
- Observe the motion of the ball. What type of motion is it? Why? Discuss in the classroom.

2. Curvilinear motion

You might have seen the motion of a flying butterfly, motion of a mosquito, motion of a bird, motion of a car in a hilly road and so on. This type of motion is called curvilinear motion. So, the motion of a body in a curved path is called curvilinear motion.

Fig. 6.4

Types of curvilinear motion

The curvilinear motion of different objects can be divided into following types.

a. Circular motion

The motion of a body in a circular path is called circular motion. A car moving in a circular path has circular motion. Similarly, when a ball is tied with a rope and whirled, it shows circular motion.

Do you know ?

When a body moves in a curved path, it is called curvilinear motion.

Examples:

i. A bus moving in a curved road.

ii. A javelin thrown by an athlete.

iii. A boy running in a curved path.

A car moving in a circular road | *Javelin thrown by an athlete* | *A boy running a curved path*

Fig. 6.5

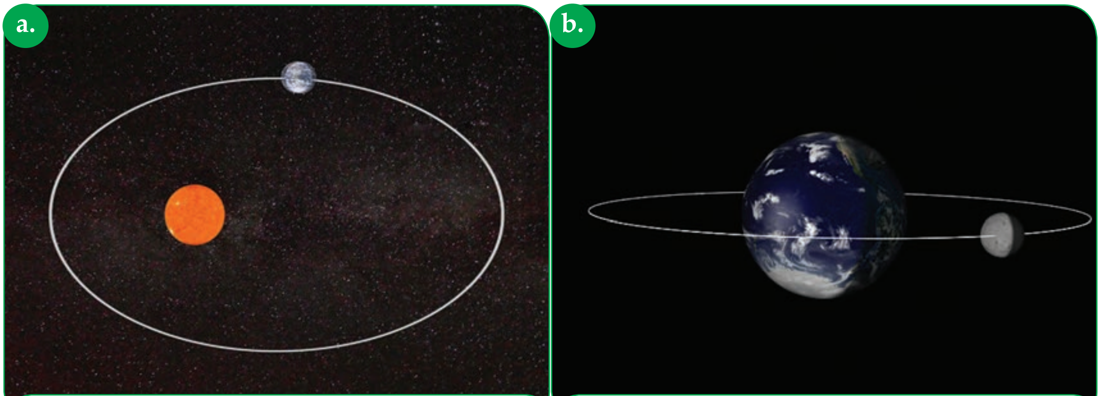
b. Periodic motion

Periodic motion is the motion which repeats itself at regular intervals of time.

Examples:

i. The motion of the planets around the sun.

ii. The motion of the moon around the earth.



Movement of the earth around the sun | *Movement of the moon around the earth*

Fig. 6.6

Activity 3

Observe the motion of the given objects to get the concept of curvilinear motion :

i. Motion of butterflies in the garden.
ii. Motion of mosquitoes.
iii. Motion of flying birds.
iv. Motion of the flying kite.
v. Motion of honey bees.
vi. Motion of hands of clock.
vii. Motion of swing

c. Rotatory motion

If a body moves about an axis without changing its position, the motion is called rotatory motion.

Examples:

i. Motion of a potter's wheel.
ii. Motion of the blades of a fan.
iii. Motion of a spinning top.
iv. Motion of the wheel of a sewing machine.
v. Motion of the earth in its axis.

a. *Motion of a potter's wheel* b. *A spinning top* c. *Moving blades of a fan*

Fig. 6.7

d. Oscillatory motion

When a body moves to-and-fro about its mean position, the motion is called oscillatory motion.

Examples:

i. The motion of a pendulum of a clock.
ii. The motion of a swing.

a. *Motion of a pendulum of a clock* b. *Motion of a swing*

Fig. 6.8

e. Random motion

When a body moves randomly in any direction, the motion is called random motion.

Examples:

i. The motion of a flying kite.

ii. The motion of a flying butterfly and mosquito.

iii. The motion of a football player while playing football.

a. *Football player* b. *Flying kite* c. *Flying butterfly*

Fig. 6.9

Activity 4

- Observe different moving objects in your surroundings.
- Identify different types of motion shown by these moving objects and prepare a short report on it.

6.2. Force

6.2.1 Introduction to Force

We do different activities and works in our daily life. For example, pulling a bucket from the well, opening (pushing) and closing (pulling) door and windows, kicking a football, lifting different loads. We push the door while opening and pull the door while closing.

The pulling or pushing process of an object brings the change in the position and motion. So, the pull or push which changes or tends to change the position of an object from rest to motion or motion to rest is called force. Force is used for pulling, pushing, lifting, pressing, twisting and so on. Force is an external agent which is applied on a body and it has magnitude as well as direction.

a. *Horses are pulling a cart*

b. *A man is pushing a wall*

Fig. 6.10

6.2.2. Effects of Force

Force has many effects. Some major effects of force are as follows:

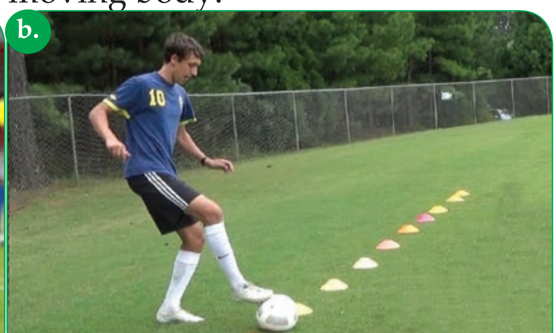
i. Force can change the position of an object.
ii. Force can change the shape and size of an object.
iii. Force can change the direction of a moving object.
iv. Force can change the speed of a moving object.

i. Force can change the position of an object

Force is an external agency which can change the position, i.e. rest or motion of a body. Force can produce motion in a body at rest and stop a body in motion. If we kick a football at rest, the ball moves. Similarly, we can stop a rolling football by applying a force. We should apply force in opposite direction to stop a moving body.

> **Do you know ?**
>
> Force can change the position of a body, i.e. from rest to motion and from motion to rest. However, it is not necessary that a force always makes a body at rest to move, e.g. when we push a wall or a tree, it does not move at all.

a. *Horses are pulling a cart*



b. *A man is pushing a wall*

Fig. 6.11

Activity 5

- Take a football and go to the ground. Keep the football in a place. The football is at rest. Kick the football and observe the motion of the football.
- Now, stop the rolling football by applying force in the opposite direction of the motion of the football.

This activity shows that force can change the position of an object.

ii. Force can change the shape and size of a body

When we stretch an elastic, its shapes and size increase and when we release, its shapes and size decrease. So when force is applied on a body, the shape and size of the body may change. We can change the shape of inflated balloon by pressing it. Similarly, we apply force to change the shape of dough while cooking bread.

Fig. 6.12 Pressing a balloon

Activity 6

- Take a balloon and inflate it. So the size and shape of the balloon change while inflating it.
- Now, press the balloon with hands to change its shape and size. What do you observe?
- Now, take a tube of toothpaste and press it. Can you change the shape of the toothpaste tube.

These activities show that force can change the shape and size of an object.

iii. Force can change the direction of a moving body

Force can change the direction of a moving body. By applying force in the steering, a driver can change the direction of a moving vehicle. Similarly, when we kick a football, we can change its direction of motion. Cricket palyer's also apply force to change the direction of the cricket ball.

Fig. 6.13 Direction change by force

Activity 7

- Take a football and go to the ground. Roll the football in a straight line.
- Now, kick the football to change its direction.

What can you conclude from this activity?

iv. Force can change the speed of a moving body

Force can increase or decrease the speed of a moving body. When we apply force in the direction of the moving body, the speed of the moving body increases. On the other hand, when force is applied in the direction opposite to the motion of the body, the speed decreases. When we rotate the paddle of bicycle, its speed increases.

When we apply force in a swing, its speed increases. On the other hand, if we apply brakes, the speed of a moving vehicle decreases. Can you give some more examples that help to increase or decrease the speed of a moving body?

Fig. 6.14

Activity 8

- Take a bicycle and ask your friend to ride it.
- Now, push the bicycle from the back. What do you find? Does the speed increase? Apply more force and observe the speed of the bicycle. In this case, the speed of bicycle increases.
- Now, pull the bicycle opposite to the motion of the bicycle.
- Does the speed of the bicycle decrease? From this activity, we can conclude that force can increase or decrease the speed of a moving body.

6.2.3 Measurement of Force

Force exerted by a body is measured by using a spring balance. Force is measured in newton (N). In order to measure the weight of a body, we should hang the body on the hook of spring balance. When the spring balance is kept in vertical position, the reading shown by the spring balance is the weight of the body.

Fig. 6.15 Measuring weight of a body

Activity 9

- Take a spring balance and hang it in a support so that it remains in vertical position.
- Take a thin thread to tie the objects while measuring weight given objects one by one.
- Fill in the given table after measuring the weight of these objects.

S.N.	Objects	Weight
1.	Science book	
2.	Science notebook	
3.	Geometry set	
4.	Calculator	
5.	Watch	
6.	Water bottle	

The weight of a body is also a kind of force. It is the force with which a body is pulled towards the earth.

Do you know?

If a body has 1 kg mass, its weight will be 9.8 N on the surface of the earth.

6.2.4. Transformation of force

We perform a variety work in our daily life. We use an axe to chop firewood. Our hands have muscular force. When we hit an axe on firewood, muscular force gets transformed into firewood through the axe. As a result, firewood is chopped.

Splitting firewood with an axe

Fig. 6.16

When we dig a field with a spade, muscular force gets transfered to the land through spade. When we rotate the paddle of a bicycle, muscular force transforms into the bicycle. As a result, bicycle moves forward. When we apply force on brake paddle of a moving vehicle, muscular force transforms into brake shoe. As a result, the vehicle stops.

a. b.

Fig. 6.17

So, when a force applied at a point gets transformed into another point, it is called transformation of force. This process is very essential in our daily life to perform various activities.

Activity 10

- Observe various activities that are being performed in your surroundings. Some of the activities are given below. How does transformation of force occur in the given activities? Observe carefully and fill in the given table.

S.N.	Activities	Transformation of force
1.	Riding a bicycle	
2.	Ploughing the field	
3.	Splitting firewood	
4.	Lifting water from well	
5.	Stopping a moving bus	

6.3 Simple Machines

6.3.1 Introduction to Simple Machines

We use different types of machines in our daily life to make work easier, faster and comfortable. A pulley is used to pull a bucket of water from a well. A crowbar is used to overcome a heavy stone. A knife is used to chop vegetables. A nail cutter is used to cut nails. A bottle opener is used to open the lid of coca cola bottle. A screw driver is used to unscrew or tighten the nuts and so on. So, simple machine is a device having simple structure which makes our work easier, faster and more convienent. Some simple machines are shown in the figures below:

a. *Nail cutter*

b. *Bottle opener*

c. *Knife*

d. *Crowbar*

Fig. 6.18 Some simple machines

Some machines are complex in structure and difficult to operate. Bicycle, motorbike, car etc. are made by combination of several types and numbers of simple machines. So, they are called complex machines.

Fig. 6.19 Some complex machines

The machines which make our work easier, faster and more convenient and simple in structure are called simple machines. For example, pulley, crowbar, nail cutter, bottle opener, screw driver, etc. We use simple machines for different purposes which are as follows:

- to multiply the force applied
- to change the direction of force applied
- to help to apply force at a convenient point.

6.3.2 Types of Simple Machines

Simple machines are classified into following six types on the basis of their structure and use.

1. Lever	3. Wheel and axle	5. Screw
2. Pulley	4. Inclined plane	6. Wedge

1. Lever

A lever is a straight or bent rigid bar which moves freely about a fixed point. The fixed point of a lever is called fulcrum. In a lever, effort is applied at one point to lift a load on another point. A lever consists of three parts like fulcrum, effort and load.

Do you know ?

The work done on a machine is called input work and the useful work done by the machine is called output work.

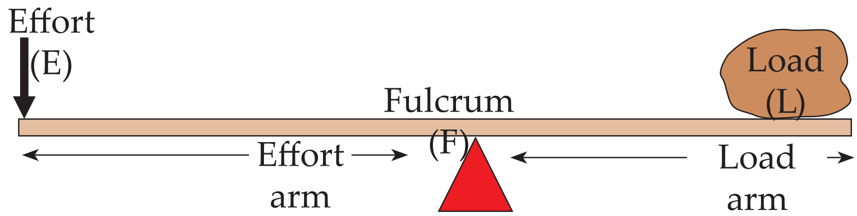


Fig. 6.20

Activity 11

Some common levers that are used in our daily life for various purposes. Identify them and state the use of each.

a.

Scissors

b.

Seesaw

c.

Beam-balance

d.

Wheel-barrow

e.

Nut cracker

f.

Lemon-squeezer

g.

Fire tongs

h.

Fishing rod

i.

Shovel

The distance between the fulcrum and the point where effort is applied is called effort arm or effort distance. The distance between the fulcrum and the point where load acts is called load arm or load distance.

Do you know?

When lever is ideal and in balanced condition, input work is always equal to the output work. It is called principle of lever.

i.e. Input work = output work

or, Effort × Effort arm = Load × Load arm

Activity 12

- Collect different types of lever present at your home.
- Identify load, effort, and fulcrum in these levers one by one.
- Classify these levers in terms of first class, second class and third class.

2. Pulley

Have you seen people lifting water from well using a pulley? Have you observed the structure of a pulley. A pulley consists of a circular disc having a groove over which a rope is passed. A simple machine having a grooved in circular metallic disc or wooden disc over which a rope passes is called pulley. In a pulley, the load is connected to one end of the rope and effort is applied at another end. When the rope moves, the disc rotates.

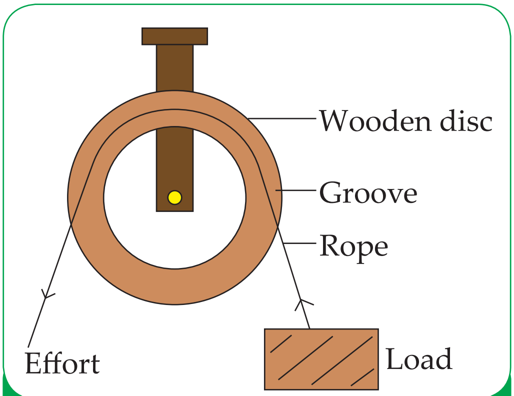


Fig. 6.21

3. Wheel and axle

You might have seen simple machines having two cylinders of different radius like screw driver, knob of a tap, the steering of a car, bobbin of a kite, paddle of bicycle etc. These simple machines are examples of wheel and axle.

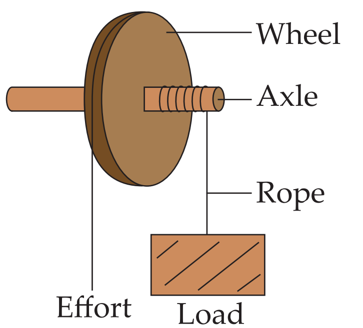
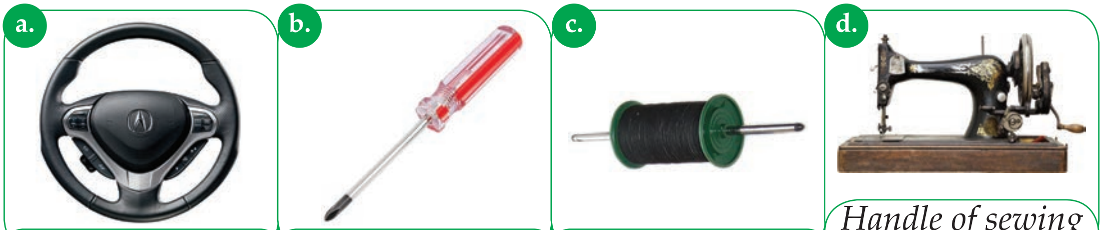


Fig. 6.22



a. Steering of car
b. Screw driver
c. Bobbin of a kite
d. Handle of sewing machine

Fig. 6.23

Wheel and axle is a arrangement of two co-axial cylinders of different radius attached to each other. The cylinder which has longer radius is called a wheel and that having shorter radius is called a axle. The rope is wound around the wheel and axle as shown in the given figure.

If we rotate the wheel, the axle also rotates. When wheel completes one rotation the axle also completes the same. But distance covered by the wheel is more than axle due to different radius. So the effort is applied to the free end of rope wound around the wheel and the load is connected to the free end of the rope wound around the axle. The effort applied on the wheel is magnified and a heavy load of axle will overcome by the small effort applied on wheel.

4. Inclined plane

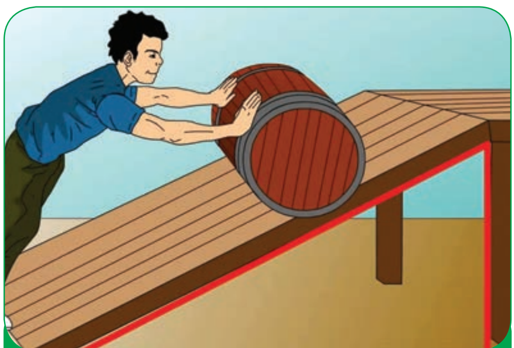


Fig. 6.24 Inclined plane

We know that, it is very difficult to climb up hilly areas by vehicles without winding roads. Similarly, it is very difficult to load a heavy drum of kerosene into a truck. But it can be lifted easily by using a wooden plank. So, a plane surface (a wooden plank) which makes an angle with the horizontal surface and used to push things upward is called inclined plane. It is considered as a simple machine because it makes work easier and comfortable by carrying heavy loads.

a. Ladder b. Steep road c. Children's slide

Fig. 6.25

5. Screw

A screw is a simple machine which is used to lift very heavy loads and tighten the nuts. Actually, screw is modified form of inclined plane with grooves cut in it. It looks like a nail having a winding edges called a thread. The distance between two screw thread is called a pitch. The force is applied to the head of screw with the help of screw driver. Examples: screw nail, driller, jack screw etc are some examples of screws.

a. Jack screw b. Driller c. Screw nails

Fig. 6.26

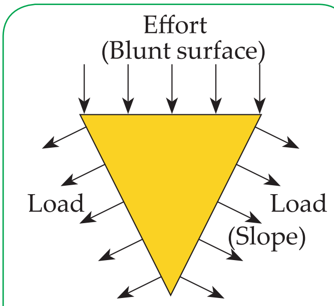
6. Wedge

A wedge is a simple machine which has two or more sloping surfaces that taper to form a sharp edges or pointed edges. Examples: axe, knife, sickle, nail etc.

a. Axe b. Knife c. Sickle

Fig. 6.27

Wedges are used for splitting, cutting and drilling holes. A wedge consists of a blunt and a sharp or pointed end. We should apply effort to the blunt end of the wedge to work with the sharp or pointed end.



Structure of a wedge

Fig. 6.28

6.3.3. Importance of Simple Machine

We do different types of work in our day to day activities. Some works are easy and some works are difficult. We use more effort in difficult works. Such type of work can be done by using simple machines. Simple machines make our work easier, faster, comfortable and help to multiply the force applied.

Activity 13

Identify the given simple machines. Write down their names, types and uses.

S.N.	Name of simple machines	Types	Uses

Write down the conclusion of your activity.

6.8 Utilities of Simple Machines

Some common simple machines that are commonly used in our daily life with their uses are given below:

1. Beam balance is used to measure the mass of different objects.
2. Scissors are used to cut papers and clothes.
3. Nut-cracker is used to crack different types of nuts.
4. Wheel barrow is used to carry loads.
5. Crow bar is used to lift heavy loads.
6. Screw driver is used to tighten and unscrew nuts.
7. Pulley is used to lift heavy loads and draw water from well.
8. Knife is used to chop vegetables and fruits.
9. Axe is used to chop firewood.
10. Fishing rod is used to catch fishes.

Key Concepts

1. An object can be at rest in relation to one object while it can be in motion in relation to another object at the same instant of time. Therefore, we can say that rest and motion are relative terms.
2. The motion of a body in a straight line is called linear motion.
3. The motion of a body in a curved path is called curvilinear motion.
4. Periodic motion is the motion which repeats itself at regular intervals of time.
5. If a body moves about an axis without changing its position, the motion is called rotatory motion.
6. When a body moves to-and-fro about its mean position, the motion is called oscillatory motion.
7. When a body moves randomly in any direction, the motion is called random motion.
8. The pull or push which changes or tends to change the position of an object from rest to motion or motion to rest is called force.
9. Force can produce motion in a body at rest and stop a body in motion.

10. The machine which makes our work easier, faster and convenient and is simple in structure is called simple machine.
11. The machine which is complex in structure and made by combination of several simple machines is called complex machine.
12. Simple machine is used to change the direction of force applied, multiply the force applied and to apply force at a convenient point.
13. A lever is a rigid bar which moves freely about a fixed point called fulcrum.
14. Pulley is a simple machine having a groove in a circular metallic disc or wooden disc over which a rope passes.
15. Inclined plane is a plane which makes an angle with the horizontal and is used to push things upward.
16. Screw is a modified form of inclined plane with groove cuts in edges.
17. Wedge is a simple machine having two or more sloping surfaces that tapers either to form a sharp edge or pointed edge.
18. We use a variety of simple machines in our daily life to make work easier and faster.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. A potter's wheel shows curvilinear motion. ☐
b. The motion of the earth around the sun is called linear motion. ☐
c. Force is the pull or push which can change the position of a body. ☐
d. Force cannot change the shape of a body. ☐
e. Simple machines make our work easier and faster. ☐
f. Wheel-barrow is an example of a lever. ☐
g. An axe is an example of wedge. ☐

2. **Fill in the blanks using appropriate words.**

a. Rest and motion are .... terms.

b. There are two types of motion. They are .... and ....

c. The motion of a body in a straight line is called ....

d. The motion of a snake is called .... motion.

e. .... can change the speed of a moving body.

f. Beam balance is an example of ....

g. .... is a fixed point about which a lever can rotate.

h. A .... is a simple machine which changes the direction of applied force.

i. Knife and axe are examples of ....

3. **Tick (√) the best answer from the given alternatives.**

a. The motion of the bullet fired from a gun is .... motion.

☐ circular ☐ linear ☐ rotatory ☐ oscillatory

b. The SI unit of force is ....

☐ newton ☐ kilogram ☐ gram ☐ second

c. Force can change ....

☐ position of a body ☐ speed of a moving body
☐ direction of a moving body ☐ All of above

d. Which of the following is a simple machine?

☐ beam balance ☐ pulley
☐ axe ☐ all of them

e. The point from which lever can rotate is called ....

☐ load ☐ effort
☐ fulcrum ☐ all of the above

f. Which of the following is a complex machine?

☐ scissors ☐ paddle of bicycle
☐ knife ☐ car

4. **Answer the following questions.**

a. Define the terms "rest" and "motion".

b. What are different types of motion? Name them.

c. Define linear motion and curvilinear motion with one example of each.

d. What is a periodic motion? Give one example.

e. Define force and write its SI unit.

f. Mention any four effects of force with one example of each.

g. What types of motion does a flying mosquito show?

h. Define simple machine with any five examples.

i. What is a lever? Write the name of various types of lever.

j. Write down the principle of lever.

k. What is a pulley? Why is it used in our daily life?

l. What is a wheel and axle? Write any three examples.

m. What is an inclined plane? Write any three examples.

n. What is a screw? Write any three examples.

o. What is a wedge? Write any three examples.

5. **Differentiate between:**

a. Rest and Motion

b. Linear motion and Curvilinear motion

c . Simple machine and Complex machine

6. **Identify the types of motion from the following.**

7. **Match the following:**

A	**B**
Complex machine	Axe
Lever	Bicycle paddle
Wedge	Wheel-barrow
Inclined plane	Steep road
Wheel and axle	Car

8. **Give reason.**
   a. Rest and motion are called relative terms.
   b. The motion of a swing is called a curvilinear motion.
   c. A beam balance is called first class lever.
   d. An axe is called a wedge.
   e. A pulley is called a simple machine.
9. **Describe the importance of simple machines in our daily life.**
10. **A beam balance is called a simple machine but a motor cycle is called a complex machine, why?**
11. **Force is very important in our day to life. Explain this statement with suitable examples.**
12. **How does transformation of force takes place when :**
    a. We chop firewood using an axe.
    b. We apply brakes to stop a moving bus.

UNIT

7

Energy in Daily Life

Estimated teaching periods : 20

Before You Begin

If a person can do a lot of work, we say the person is very energetic. Energy of a body is the capacity or ability of a body to do work. Living beings cannot survive in the absence of energy. Similarly, energy is required to operate machines in industries, to run automobiles and so on.

Heat is a form of energy which gives the sensation of hotness or coldness. In SI system, heat is measured in joule (J) and in CGS system, it is measured in calorie (cal.). When we touch a burning candle, we feel hot. On the other hand, when we touch an ice cube, heat flows from our body to the ice cube and we feel cold. So, when heat flows into our body, we feel hot and when heat flows outside from our body, we feel cold.

Light is a form of energy which makes things visible. We are able to see things in our surroundings due to the presence of light. In a dark room, we cannot see anything due to the absence of light. Light is produced from extremely hot objects. The sun, fire, burning candle, lantern, torchlight, electric bulb, kerosene lamp, etc. are the sources of light. Among these sources, the sun is the most important source of light on the earth. Living beings cannot survive in the absence of light from the sun because green plants need sunlight for making food by photosynthesis. All animals depend on plants for food. Human beings depend on light to get food, fuel, oxygen, etc. Similarly, light is essential for doing work, reading, writing, etc.

In our surroundings, we observe different things that produce sound. When materials vibrate, sound is produced. So, sound is a form of energy which is produced due to vibration of a material medium. Sound produces sensation of hearing. The substances that produce sound are called sources of sound. Temple bell, horn of vehicles, loudspeaker, guitar, television, etc. are some sources of sound. Sound waves are produced when a material vibrates. Sound propagates through these waves.

Learning Objectives

After completing the study of this unit, students will be able to:

- Introduce energy and define potential energy and kinetic energy with examples.
- Explain the factors affecting potential energy and kinetic energy.
- Describe transformation of energy with examples.
- State law of conservation of energy.
- Introduce heat and describe its effects.
- Describe absorption of heat and explain the factors affecting absorption of heat.
- Introduce light and explain rectilinear propagation.
- Define ray and beam of light with examples.

- Introduce pin hole camera and explain its working.
- Introduce shadow and describe its types.
- Demonstrate that the size of a shadow changes in the morning, noon and afternoon.
- Describe sundial and state its use in the past.
- Introduce sound and wave and sources of sound.
- Describe origin and propagation of sound wave in different media.

Syllabus

- Energy and its types
- Transformation of energy
- Heat and absorption of heat
- Factors affecting absorption of heat
- Light and its transmission
- Ray and beam of light
- Pin hole camera-structure and working
- Shadow and its types
- Sundial
- Introduction to sound and wave
- Sources of sound
- Origin and propagation of sound wave
- Propagation of sound wave in different media (solid, liquid and gas)

Glossary

beam	:	a collection of rays of light
calorimeter	:	the device which is used to measure the heat of a body
conduction	:	the process of transfer of heat from one particle to another without actual movement of particles
energy	:	the capacity of doing work
echo	:	the repetition of sound caused by reflection
expansion	:	the process of becoming larger or increasing in volume
frequency	:	the number of complete cycles made in one second
image	:	a picture of something/somebody seen in a mirror
luminous	:	an object having own source of light for shining
opaque	:	that does not allow light to pass through
pitch	:	the shrillness of a sound
ray	:	a very narrow path of light
rectilinear	:	in a straight line
reverberation	:	the prolongation of the original sound
sound	:	a form of energy which is produced due to vibration of a body
transformation	:	conversion of one form of a substance into another
translucent	:	that allows only a part of light to pass through
vibration	:	a continuous shaking movement
wave motion	:	a periodic disturbance travelling through a medium which is produced by a vibrating body
work	:	the product of force and displacement

7.1 Energy

7.1.1 Introduction to Energy

We cannot operate automobiles without fuel. The fuel burns in the engine of these automobiles and provides energy to move them. Similarly, we cannot work for a long time without food. We get energy from the food that we eat. The capacity or ability of a body to do work is called energy. Living beings get energy from the food. So plants and animals cannot survive without food. In the SI system, energy is measured in joule (J). Energy is a scalar quantity.

Fig. 7.1

Energy provides force to do work. The object having no energy cannot do work. Whenever work is done, energy is consumed.

Activity 1

- Observe various activities that are taking place in your surrounding.
- Note down any five activities that need energy to do them.

7.1.2 Types of Energy

There are different forms of energy in nature. They are as follows: (i) Mechanical energy, (ii) Chemical energy, (iii) Sound energy, (iv) Heat energy, (v) Light energy, (vi) Electrical energy, (vii) Nuclear energy and (viii) Magnetic energy.

1. Mechanical energy

Mechanical energy is the energy possessed by a body due to its state of motion or of position. It is of two types:

a. Kinetic energy (KE) b. Potential energy (PE)

a. Kinetic energy

A moving hammer has kinetic energy. So it can do work on a nail it strikes. Similarly, running water has kinetic energy so it can rotate a turbine. The energy possessed by a body by virtue of its motion is called kinetic energy. Running water, blowing air, the bullet fired from a gun, moving vehicle, rolling ball, etc. possess kinetic energy.

Do you know ?

Running water and blowing air have kinetic energy. So we can rotate a turbine with the help of running water and blowing air to generate electricity.

a. *Bullet fired from a gun* b. *Moving car* c. *Moving wind mill*

Fig. 7.2

Following formula is used to calculate the kinetic energy of a moving body.

$$\text{Kinetic energy (KE)} = \frac{1}{2} mv^2$$

Where, m = mass of a moving body

v = velocity of a moving body

From the above relation, it becomes clear that kinetic energy of a moving body is equal to the product of half of its mass and square of its velocity.

Factors Affecting Kinetic Energy (KE)

1. **Mass of the body:** When the mass of the moving body increases, the KE of the body also increases and vice-versa.
2. **Velocity of the body:** When the velocity of the moving body increases, its KE also increases. The reverse of this is also true.

Activity 2

- Take a volleyball. Throw it slowly and ask your friend to catch the ball. Repeat this activity by increasing the speed of the ball while throwing. Ask your friend to say the difference while catching the ball in both cases. More force is required to catch the ball thrown at a high speed than that in low speed.
- Repeat above activity with a tennis ball. The mass of a volleyball is more than that of a tennis ball. So less force is required to catch a tennis ball than that to catch a volleyball thrown at the same speed. This activity proves that kinetic energy increases with increase in mass and velocity of the moving body and vice-versa.

Worked out Numerical Problem

A metal ball of a mass of 5 kg is moving with the velocity of 25 m/s. Calculate the kinetic energy.

Given,

Mass of the metal ball (m) = 5 kg

Velocity (v) = 25 m/s

Kinetic energy (KE) = ?

$$KE = \frac{1}{2}mv^2$$

$$= \frac{1}{2} \times 5 \times (25)^2$$

$$= 1562.5 \text{ J}$$

$\therefore$ Kinetic energy (KE) = 1562.5 J

b. Potential energy

The water stored in a dam possesses potential energy. When this energy is released, it can rotate the turbine. The potential energy of a body is defined as the energy possessed by the body by virtue of its position or configuration (change in shape or size). The energy stored in the stone lifted from the ground, stored water

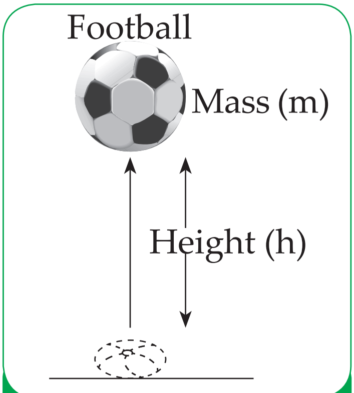


Fig. 7.3

in a dam, stretched spring, stretched elastic, etc. are some examples of the objects having potential energy. Football at a certain height from the ground possesses potential energy.


Fig. 7.4

Following formula is used to calculate the potential energy (PE) of a body.

$\therefore$ $\boxed{PE = mgh}$

Where, m = mass of a body

g = acceleration due to gravity ($g = 9.8\ m/s^2$)

h = height from the surface of the ground

From the above relation, it becomes clear that potential energy increases due to increase in the mass of the body (m), value of acceleration due to gravity (g) and height (h) of the body from the earth's surface.

Worked out Numerical Problem

A stone of a mass of 25 kg is located at a height of 15 m from the ground. Calculate the potential energy stored in the stone. [Take $g = 9.8\ m/s^2$.]

Given,

Mass (m) = 25 kg

Height (h) = 15 m

Acceleration due to gravity (g) = $9.8\ m/s^2$

Potential energy (PE) = ?

We know,

$$\begin{aligned} PE &= mgh \\ &= 25 \times 9.8 \times 15 \\ &= 3675\ J \end{aligned}$$

$\therefore$ Potential energy (PE) = 3675 J

Activity 3

- Take a catapult. Stretch the elastic of the catapult and throw a pebble in an open place. Be careful while throwing the pebble as it may hit birds, animals or people. Which energy helps to throw the pebble? Name the type of energy present in the stretched elastic of the catapult.

Difference between Potential energy and Kinetic energy

Potential energy	Kinetic energy
1. Potential energy is the energy possessed by a body by virtue of its position or configuration.	1. Kinetic energy is the energy possessed by a body by virtue of its motion.
2. Potential energy is given by PE = mgh.	2. Kinetic energy is given by $KE = \frac{1}{2}mv^2$.

2. Chemical energy

When petrol is burnt in the engine of a car, the chemical energy stored in petrol is used to run the car. The energy stored in a matter is called chemical energy. Bread, coal, petrol, diesel, battery, wood, oil, etc. have chemical energy stored in them. Chemical energy is released when chemical change takes place. Some sources of chemical energy are given below:

a.

Bread

b.

Kerosene

c.

Cell

Fig. 7.5

3. Sound energy

Sound energy is a form of energy which is produced due to the vibration of a material medium. A vibrating body possesses sound energy. Loudspeaker, radio, television, horn of vehicles, temple bell, etc. are some sources of sound energy.

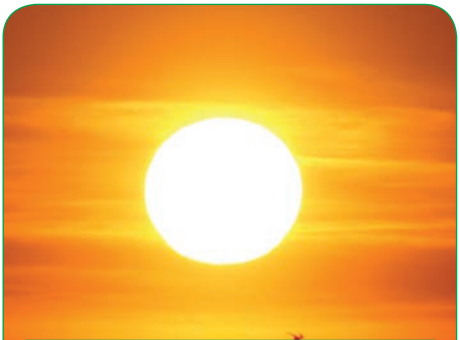
Sound can be experienced as a form of energy when the window panes shatter due to an explosion or loud sound produced by a low-flying aeroplane.

Loudspeaker produces sound

Fig. 7.6

4. Light energy

Light is a form of energy which makes things visible. Light is produced by extremely hot objects. The sun, lantern, torch light, electric bulb, kerosene lamp, etc. are some sources of light energy. The sun is the main source of light energy for the earth.



The sun

Fig. 7.7

5. Electrical energy

The form of energy which is produced due to continuous flow of electrons is called electrical energy. Cell, photocell, battery, generator, etc. are the sources of electrical energy. Electrical energy is used to rotate fans, drive trains, light bulbs, operate equipment like television, computer, camera, mobile phone, etc.

Lighting CFL

Fig. 7.8

6. Heat energy

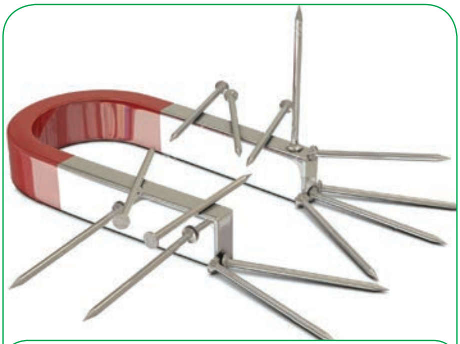
The form of energy which gives the sensation of warmth is called heat energy. Electric heater, sun, burning coal, etc. are some sources of heat energy. The burning of diesel in a truck engine provides the energy needed to run the truck. Similarly the heat energy produced from burning fire is used to cook food, etc.

Burning coal

Fig. 7.9

7. Magnetic energy

The energy obtained from a magnet is called magnetic energy. It is used in electric bell, loudspeaker, mobile phone, television, radio, etc. Similarly, magnetic energy is used to generate electricity.



Magnet attracting iron nails

Fig. 7.10

8. Nuclear energy

The energy obtained from the nucleus of an atom is called nuclear energy. This energy can produce a large amount of heat and light energy. Nuclear energy is used in atomic power plants to produce electricity. Similarly, nuclear energy is used for making atom bomb, hydrogen bomb, etc.

Bomb explosion

Fig. 7.11

Activity 4

- Observe various sources of energy kept at your home and school. Identify the type of energy that we get from these objects. Fill in the given table after your observation.

S.N.	Sources of energy (name)	Type of energy
1.	Battery	Chemical energy
2.		
3.		
4.		
5.		

7.1. 3 Transformation of Energy

The process in which one form of energy is converted into another is called transformation of energy. An electric bulb converts electrical energy into light and heat energy, a solar cell converts light energy into electrical energy and a loudspeaker converts electrical energy into sound energy. These are some examples of transformation of energy.

Fig. 7.12

Some examples of energy transformation and the devices required are as follows:

S.N.	Devices	Energy transformation
1.	Electric bulb	Electrical energy → Light energy and heat energy
2.	Cell or battery	Chemical energy → Electrical energy
3.	Loud speaker	Electrical energy → Sound energy
4.	Microphone	Sound energy → Electrical energy
5.	Television	Electrical energy → Light and sound energy

6.	Electric motor	Electrical energy → Mechanical energy
7.	Dynamo or generator	Mechanical energy → Electrical energy
8.	Electromagnet	Electrical energy → Magnetic energy
9.	Solar cell / panel	Light energy → Electrical energy
10.	Heater	Electrical energy → Heat energy

7.1.4. Law of conservation of Energy

According to law of conservation of energy, "Energy can neither be created nor be destroyed. Energy can only be changed from one form to another."

Activity 5

- Take a cell, two pieces of copper wire, a bulb and a bulb holder.
- Connect these materials to light the bulb.
- What type of transformation of energy occurs here? Discuss in your class.

Key Concepts

1. The capacity or ability of a body to do work is called energy.
2. Mechanical energy is the energy possessed by a body due to its state of motion or of position.
3. The energy possessed by a body by virtue of its motion is called kinetic energy.
4. The potential energy of a body is defined as the energy possessed by the body by virtue of its position or configuration (change in shape or size).
5. Sound energy is a form of energy which is produced due to the vibration of a material medium.
6. Light is a form of energy which makes things visible.
7. The form of energy which is produced due to continuous flow of electrons is called electrical energy.
8. The form of energy which gives the sensation of warmth is called heat energy.

9. The energy obtained from a magnet is called magnetic energy.
10. The energy obtained from the nucleus of an atom is called nuclear energy.
11. The process in which one form of energy is converted into another is called transformation of energy.

Exercise

1. Tick (√) the best answer from the given alternatives.

a. Which of the following is the source of heat energy?

☐ heater ☐ moon ☐ bread ☐ candle

b. .... energy is produced due to vibration of material medium.

☐ heat ☐ light ☐ sound ☐ chemical

c. Which of the following is the main source of light energy?

☐ sun ☐ moon ☐ bulb ☐ candle

d. Which of the given devices converts electrical energy into heat energy?

☐ television ☐ battery ☐ heater ☐ bulb

2. Put a tick (√) for the correct statement and a cross (×) for the incorrect one.

a. The capacity of a body to do work is called energy. ☐
b. The PE of a body kept on the earth's surface is zero. ☐
d. Loud speaker converts sound energy into electrical energy. ☐
e. Energy can neither be created nor destroyed. ☐
f. The SI unit of energy is joule. ☐
g. Running water consists of potential energy. ☐
h. Burning coal consists of heat energy. ☐

3. Fill in the blanks using appropriate words.

a. The SI unit of energy is ....
b. The formula to calculate kinetic energy is ....

c. Electric bulb converts .... into ....

d. Solar cell converts .... into ....

e. Energy can neither be .... nor be ....

4. Answer the following questions:

a. What is energy? Write down its SI unit.

b. Name any five types of energy.

c. Define mechanical energy with any two examples.

d. What is a potential energy? Write down the formula to calculate potential energy.

e. Define kinetic energy with any two examples.

f. What is chemical energy? Name any three objects having chemical energy.

g. Define heat energy and light energy.

h. What is nuclear energy? Write its one use.

5. Name the form of energy present in the given objects/devices.

a. Fire	b. Bread
c. Running water	d. Water stored in a pond
e. Burning coal	f. Bullet fired from a gun
g. Lighting bulb	h. Ringing bell

6. State the factors that affect the KE and PE.

7. Describe an activity to prove that KE of a body increases with increase in mass.

8. Out of two motorcycles of the same mass, one is moving with the velocity of 20m/s and another with 10m/s, which will have more KE? Why?

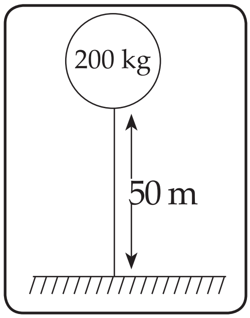
9. A bicycle and a motorcycle are moving with the same velocity. Which one will have more kinetic energy? Why?

10. **How does transformation energy take place in the given activities/ events? Write.**

11. **Numerical Problems.**

a. Calculate the potential energy stored in a metal ball of a mass of 80 kg kept at the height of 15 m from the earth's surface. [Take g = 9.8 m/s^2]
[Ans: 11760 J]

b. Study the given figure and calculate the potential energy. [Take g = 9.8 m/s^2]
[Ans: 98000 J]



c. A ball of a mass of 1.5 kg is moving with the velocity of 20 m/s. Calculate the kinetic energy. [Ans: 300 J]

7.2 Heat

7.2.1 Introduction to Heat

The form of energy which gives the sensation of hotness or coldness is called heat. It is measured in joule (J), kilojoule (kJ), calorie (cal.), kilocalorie (kcal.), etc. In SI system, heat is measured in joule (J).

Fire

Fig. 7.13

We can feel heat energy by rubbing our palms against each other. We use heat for warming our body, cooking food, drying wet clothes, drying grains, running engines, heating water, etc. Living beings need heat energy to survive. We can transform heat energy into another form and other forms of energy can also be transformed into heat energy. Heat energy flows from a hot body to a cold body. The sun is the main source of heat for the earth.

7.2.2 Sources of Heat

The objects from which we get heat energy are called sources of heat. There are many sources of heat such as the sun, fire, heater, bio-fuel, fossil fuel (petrol, diesel, coal, kerosene, etc.), electricity, etc. In this unit, we learn about four main sources of heat energy, viz. sun, bio-fuel, fossil fuel, and electricity in brief.

Sun

Fig. 7.14

1. Sun

Among all the sources of heat energy, the sun is considered as the main source. All other forms of heat energy depend directly or indirectly on heat energy. Animals and plants get heat energy from the sun. Animals and plants cannot survive in the absence of heat of the sun.

2. Bio-fuel

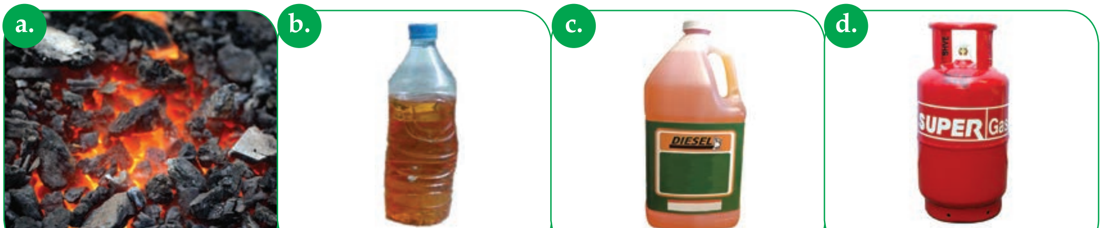
We get heat energy by burning firewood, dung-cakes, gobar gas, etc. The fuel obtained from these objects is called bio-fuel. So, bio-fuel can be defined as the fuel obtained from gobar gas (bio-gas), firewood, dung cakes, etc.

a. Dung cakes
b. Bio-brickets
c. Burning firewood

Fig. 7.15

3. Fossil fuel

Fossils are the dead remains of plants and animals which are found under the surface of the earth. The fuel obtained from the fossils is called fossil fuel. Petrol, diesel, coal, kerosene, natural gas, etc. are examples of fossil fuels. Fossil fuels are widely used in industries, automobiles, houses, etc.



a. Coal
b. Petrol
c. Diesel
d. L.P. gas

Fig. 7.16

4. Electricity

Electricity is the form of energy which is produced due to continuous flow of electrons. Electricity can be converted into heat energy. We use electric heater to convert electrical energy into heat energy. The heat energy produced from electricity is used to heat water, cook food and make the room warm.

a. Electric heater

b. Immersion rod for heating water

Fig. 7.17

Activity 6

- Make a list of various sources of heat that are kept at your home. Also, write down the main use of each.

S.N.	Source of heat	Main use
1.		
2.		
3.		
4.		
5.		

7.2.3 Effects of Heat

There are many effects of heat. Some of them are given below.

i. Heat changes the state of a substance.

ii. Heat changes the volume of a substance.

iii. Heat changes the temperature of a substance.

Do you know ?

Nepal is the second richest country in water potential in the world. So we can generate a large amount of hydroelectricity from running water resources. It can be used for getting heat and light, running industries, operating electric vehicles, etc.

i. Heat changes the state of a substance

One state of a substance changes into its another state by heating. When ice (solid) is heated, it changes into water (liquid) and when water (liquid) is heated, it changes into vapour (gas). Similarly, when wax (solid) is heated, it changes into liquid wax. It shows that heat changes the state of matter.

Burning candle

Fig. 7.18

$$\text{Ice (Solid)} \xrightarrow{\text{heat}} \text{Water (liquid)} \xrightarrow{\text{heat}} \text{Vapour (gas)}$$

$$\text{Solid wax} \xrightarrow{\text{heat}} \text{Liquid wax}$$

Metals like iron, copper, silver, gold, etc. exist in solid state. They can be changed into their liquid state by heating.

Similarly, wax, ice, butter, ghee, plastic, etc. also melt and change into liquid state on heating. On the other hand, when heat is removed from them, these liquids change into solid state again.

Activity 7

- Take a beaker and keep some ice cubes into it.
- Keep the beaker on a tripod stand and heat the beaker with a burner or spirit lamp. Observe these ice cubes. Do they melt on heating?
- After some time, all ice cubes melt and form water in the beaker. It shows that solid water (ice) changes into liquid (water) on heating.
- Heat the beaker continuously. You can see the vapour issuing from water. It shows that water (liquid) changes into gas (vapour) on heating.
- From this activity, it can be concluded that heat changes the state of matter.

ii. Heat changes the volume of a substance

The volume of a substance increases on heating and decreases on cooling. When solids are heated, they change into the liquid state. Similarly, when liquids are heated, their volume increases. When we heat milk, its volume increases which may overflow from the container. This example proves that the volume of a substance increases on heating. The volume of solid, liquid and gas increases on heating and decreases on cooling.

Activity 8

- Take some milk in a beaker.
- Mark the initial level of milk in the beaker with a marker.
- Heat the milk in the beaker using a Bunsen burner or a spirit lamp.
- Observe the level of milk in the beaker carefully. Can you see the increase in the volume of the milk on heating?
- Write down the conclusion of this activity.

7.2.4 Expansion of Solids

Solids are substances having a fixed shape, size and volume. Examples: brick, wood, plastic, ice, stone, etc. Solids expand when they are heated. It means that the volume of solids increases when they are heated.

a. *Melting of ice in the Himalayas*

b. *Overhead electric cables become loose in hot summer days*

Fig. 7.19

Have you seen melting ghee? Have you seen melting wax? When wax, ghee and ice are heated, they melt and change into liquid state. When a solid substance changes into liquid state, it expands due to the increase in volume. In the Himalayas, ice or snow melts due to the heat of the sun and changes into water. Similarly, in hot summer days, overhead electric cables and telephone cables become loose due to expansion. It also shows that solids expand on heating.

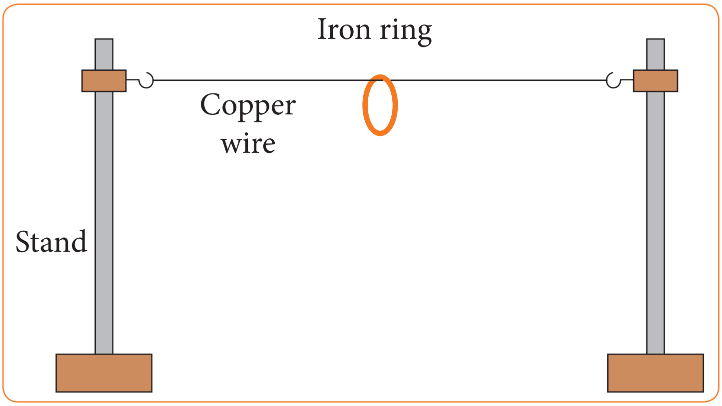
Experiment 1

To demonstrate that solids expand on heating

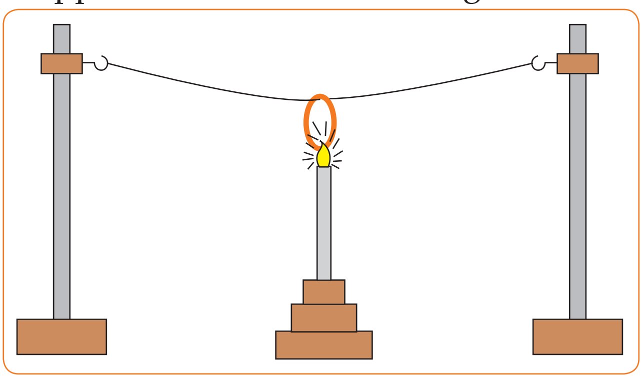
Requirements : Two stands, thin copper wire, iron ring, burner or spirit lamp.

Procedure

- Take two stands and a thin copper wire.
- Insert a ring of iron in the wire and adjust the copper wire between two stands as shown in the figure.



Be sure that the copper wire is stretched straight between two stands.



- Now, heat the copper wire for 10-15 minutes with the help of a bunsen burner or a spirit lamp. What do you observe? Does the wire become loose after heating.

Observation : When the copper wire is heated for 10-15 minutes, the length of wire increases due to expansion and the wire becomes loose which is clearly indicated by iron ring.

Conclusion : This experiment demonstrates that solid expands on heating.

7.2.5 Expansion of Liquids

Liquids are the substances having a fixed volume but not a fixed shapes. Examples: water, milk, petrol, diesel, juice, kerosene, paraffin, etc. When liquids are heated, they expand. The heat energy increases the space among the molecules of liquids. As a result, liquids expand. The rate of expansion of liquids is more than that in solids because the molecules are loosely arranged in liquids.

Boiling milk

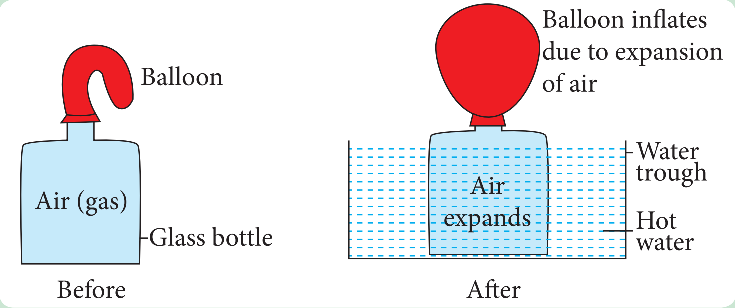
Fig. 7.20

7.2.6 Expansion of Gases

Gases are the substances which neither have a fixed shape nor a fixed volume. Nitrogen, oxygen, carbon dioxide, argon, neon, water vapour, etc. exist in gaseous state. When gases are heated, they expand. Gases expand the most as compared to liquids and solids because the intermolecular force of attraction is very less in gases.

Activity 9

- Take a balloon and fit it to the neck of glass bottle.
- Take a water trough and put some hot water into it.



- Now, place the bottle in the hot water. Please note that more than two thirds of the bottle should be immersed into the hot water. Observe the balloon after sometime.

- When the bottle is kept in hot water, the air present inside the bottle expands. Due to this, the balloon fitted in the neck of the bottle gets inflated.
- This activity proves that gases expand on heating.

7.2.7 Absorption of Heat

In hot summer days, we wear white clothes and in winter we wear black clothes. Why? If we wear black clothes in hot summer days, we feel very hot because black clothes absorb heat faster than the white clothes. White clothes absorb heat slowly and we feel less hot. Therefore, we wear white clothes in hot summer days.

All substances absorb heat. But some absorb heat fast and some absorb heat slowly. The rate of absorption of heat of a body depends on the nature and colour of that body. Black and rough objects absorb heat faster than the white and smooth object.

Factors Affecting Absorption of Heat

Following factors affect the heat absorbing capacity of different objects.

1. Surface area of the object

The heat absorbing capacity of objects is affected by area of the surface that receives the heat. The heat absorbing capacity of an object increases when the surface area of the object increases. Similarly, the heat absorbing capacity of an object decreases when the surface area decreases.

Above fact is utilized in our day to day activities as follows:

1. We spread wet or washed clothes while drying in the sun.

Fig. 7.21

2. We spread cereals over a large area for drying.

Fig. 7.22

3. The surface of solar cooker is made very large.

Fig. 7.23

4. We spread fingers in cold while basking fire or heater.

Fig. 7.24

5. The lower surface of cooking utensils is made broad.

Fig. 7.25

Activity 10

- Take a steel bowl and large steel plate.
- Take some water in a pot and measure its temperature by using a thermometer.
- Pour one glass of water in each bowl and plate. Leave both containers in a sunny place for 30 minutes.
- Measure the temperature of water in both containers after 30 minutes. What do you find? Write down the conclusion of this activity.

Fig. 7.26

2. Colour of the object

The heat absorbing capacity of different objects is also affected by colour of the object. The objects of black colour absorb more heat and objects of white colour absorb less heat. Above fact is utilized in our day to day life as follows.

1. We wear black clothes in winter season and white clothes in hot summer season.
2. The surface of solar heater is painted black.
3. The basal surface of cooking utensils is painted black.

Activity 11

- Take some cardboard papers of different colours (black, red, white, green, yellow, etc.)
- Make a small bag of each of the papers.
- Take some thermometers and insert the bulb of thermometer in each paper bag.
- Now, leave all the paper bags in a sunny place.
- Record the initial reading in all thermometers one by one.
- Record the rise in temperature after 20 minutes.
- What do you observe?
- Write down the conclusion of this activity.

7.2.8 Uses of Heat

The major uses of heat are given below.

1. For cooking food

Heat energy is used for cooking food. In urban areas, people use LP gas and electric heater for cooking food. When we burn LP gas, we get heat energy which is used for cooking food. Similarly, electric heater changes electrical energy into heat energy which is used for cooking food. In rural areas, people get heat energy by burning firewood, bio-gas (gobar gas) dungcake, straw, kerosene stove, etc.

a. *Cooking food on firewood*

b. *Cooking food by using LP gas*

c. *Cooking food in electric heater*

Fig. 7.27

2. For drying clothes

Wet clothes dry faster in a sunny day than in a humid or cloudy day, Why? It is because the heat of the sun changes water into vapour from wet clothes and they dry faster. But in a humid or cloudy day, water from wet clothes evaporates very slowly. As a result, they dry slowly. The heat energy of the sun is used to dry wet clothes.

a. *People basking in the sun*

b. *Heater is used to keep our body warm*

c. *People getting heat by burning firewood*

Fig. 7.28

3. For drying various food items

Heat is used to dry various food items like cereals, pulses, fruits, vegetable, fish, meat, etc. before their storage.

a. *Grains drying on a sunny day*

b. *Vegetables drying on a sunny day*

c. *Meat drying on a sunny day*

Fig. 7.29

4. For purifying water

Heat is used to boil water. When water is boiled for 5-10 minutes, it kills the germs present in water. So, heat is utilized for purifying water.

5. For producing various substances in industries

In industries, heat energy is obtained by burning coal, firewood, LP gas, petrol, diesel, etc. which is used to produce various substances like iron rods, cement, plastics, biscuits, chocolates, etc.

Key Concepts

1. The form of energy which gives the sensation of hotness or coldness is called heat.
2. Heat energy flows from a hot body to a cold body. The sun is the main source of heat for the earth.
3. The objects from which we get heat energy are called sources of heat.
4. Animals and plants cannot survive in the absence of heat of the sun.
5. The fuel obtained from the fossils is called fossil fuel. Petrol, diesel, coal, kerosene, natural gas, etc. are examples of fossil fuels.
6. One state of a substance can be changed into its another state by heating.
7. The volume of solid, liquid and gas increases on heating and decreases on cooling.
8. The rate of absorption of heat of a body depends on the nature and colour of that body.

Exercise

1. Tick (√) the correct statement and cross (X) the incorrect one.

a. Heat is a form of energy which produces the sensation of warmth. ☐

b. The sun is the major source of heat energy for the earth. ☐

c. Firewood and dungcake are the sources of heat. ☐

d. Solids do not expand on heating. ☐

e. Heat is used for purifying water. ☐

2. Fill in the blanks using appropriate words.

a. The SI unit of heat is ....

b. .... converts electrical energy.

c. Liquids .... on heating.

d. Black clothes absorb heat .... than white clothes.

e. When water is ...., it changes into vapour.

3. **Tick (√) the best answer from the given alternatives.**

a. Heat is a form of energy which gives the sensation of ....

- [ ] warmth
- [ ] light
- [ ] sound
- [ ] vision

b. Which of the following is the main source of heat in rural areas?

- [ ] diesel
- [ ] LP gas
- [ ] petrol
- [ ] firewood

c. .... is an example of fossil fuel.

- [ ] coal
- [ ] bio-gas
- [ ] firewood
- [ ] dungcake

d. The heat of .... is used to dry wet clothes.

- [ ] heater
- [ ] coal
- [ ] sun
- [ ] firewood

4. **Answer the following questions.**

a. Define heat and write its SI unit.

b. Define sources of heat with any three examples.

c. Why is the sun called the main source of heat energy?

d. What is meant by biofuel? Write any three sources of bio-fuel energy?

e. Define fossil fuels with any three examples.

f. What is electricity? Name the device that converts electrical energy into heat energy.

g. Write any two effects of heat energy.

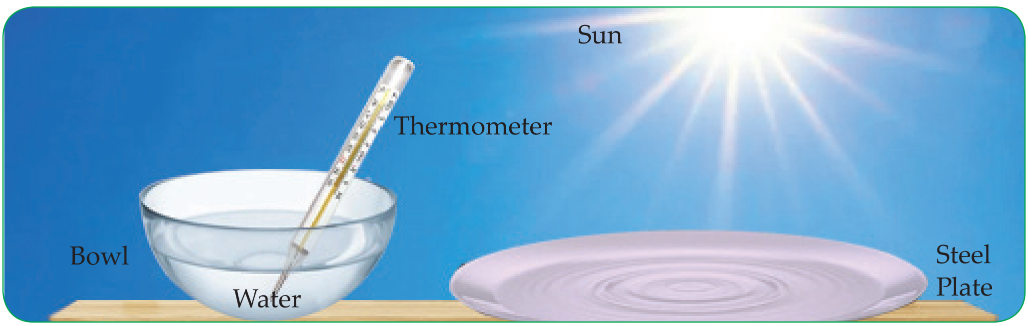
h. Write any three uses of heat energy.

5. **Describe an experiment to prove that:**

a. Solids expand on heating

b. Gases expand on heating.

6. **Study the given figure and write the fact that can be proved from it.**



7. **Heat is a very important source of energy for human beings. Justify this statement.**

8. **The sun is considered as the main source of heat energy for the earth. Justify this statement.**

7.3 Light

7.3.1 Light and Sources of Light

Light is a form of energy which makes things visible. We cannot see the things around us in the absence of light. The sun, torch light, burning candle, lighting bulb, etc. emit light. These objects are called sources of light. So, the objects which emit light are called the sources of light. Among different sources of light, we will discuss the sun, moon, electricity and lamp in brief.

i. Sun

The sun is the natural source of light. Among many sources of light, the sun is considered as the main source of light for the earth. We see things around us during the day time due to the presence of sunlight. Green plants use sunlight to prepare their own food by photosynthesis.

Sun

Fig. 7.30

ii. Moon

The moon is also a natural source of light. However, it makes things visible only in the nights of bright half. The moon does not have its own source of light for shining. It reflects the heat of the sun. The moon gives maximum light at the full moon night.

Moon

Fig. 7.31

iii. Electricity

Electricity is also a source of light as electrical energy can be converted into light energy. Electric bulb, CFL, tube light, etc. are the devices that convert electrical energy into light energy. In urban areas, electricity is the main source of light at night.

Electric bulb

Fig. 7.32

iv. Lamp

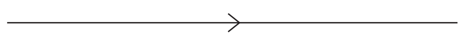
Burning candle, torch light, kerosene lamp, lantern, etc. are the sources of light. During load shedding, we use candle, lantern, torch light, kerosene lamp, etc. to get light. People of rural areas use these sources to get light.

a. *Lantern* b. *Burning candle* c. *Torch light*

Fig. 7.33

7.3.2 Ray and Beam of Light

A ray of light is the direction of the path followed by light. It is represented by a straight line with an arrowhead. The arrowhead shows the direction in which light is traveling.



Ray of light

Fig. 7.34

A group of light rays moving in the same direction is called a beam of light. The light rays from far-off objects (such as the sun) are almost parallel to each other. It is called a parallel beam of light. The sun produces a parallel beam of light.

Parallel beam of light

Fig. 7.35

7.3.3 Luminous and Non-luminous Objects

Luminous objects are those objects having their own source of light for shining. The sun, star, lighting bulb, fire, burning candle, etc. are the examples of luminous objects. The sun has its own source of light for shining. So it is called a luminous object.

a.	b.	c.	d.
Sun	*Star*	*Lighting bulb*	*Burning candle*

Fig. 7.36

Non-luminous objects are those objects which do not have their own source of light for shining. Moon, earth, brick, book, pen, glass, stone, wood, plastic, etc. are the examples of non-luminous objects.

Activity 12

- Observe any five sources of light and name them.
- Observe different types of things in your surroundings and identify luminous and non-luminous objects from them.

There are three types of non-luminous objects which are as follows:

1. Transparent object
2. Translucent objects
3. Opaque objects

1. Transparent objects

The objects which allow light to pass through them are called transparent objects. Glass, air, clean water, thin plastic, etc. are the examples of transparent objects. Glass is transparent. So we can see outside through the glass pane. We can see things clearly while viewing through transparent objects.

2. Translucent objects

The objects which allow only a part of light to pass through them are called translucent objects. Ground glass, tracing paper, colourd plastic, paper immersed in kerosene, etc. are examples of translucent objects. When we view through translucent objects, we cannot see things clearly.

3. Opaque objects

Objects like book, wood, thick plastic, soil, stone, metal sheet, etc. do not allow light to pass through them. These objects are called opaque objects. The objects which do not allow light to pass through them are called opaque objects. These objects cast shadow behind them when they block light coming from the source.

Activity 13

- Observe the different objects kept in your classroom and school bag like book, pen, scale, plastic, wood, blackboard, duster chalk box, etc.
- Identify which of them allow light to pass through and which of them do not.
- Classify these objects in terms of transparent, translucent and opaque objects.

7.3.4 Rectilinear Propagation of Light

Light always travels in a straight path so long as it travels in the same medium. This process is called rectilinear propagation of light.

Fig. 7.37

Experiment 2

To demonstrate that light always travels in a straight line when it travels in the same medium.

Requirements : Cardboard papers, cardboard paper holder, scissors, iron nail, candle, match box, marker, pencil.

Procedure

- Take thick sheet of cardboard paper.

Cut these cardboard sheets of equal size using scissors.

- Place these cardboards one above another and make a small hole in these cardboards simultaneously in the same position with the help of an iron nail.
- Arrange the cardboards in the stand as shown in the figure. Place a burning candle in front of holes of these cardboards.

- Look at the candle through the holes of cardboard. Can you see the burning candle or not.
- When all the holes of cardboard lie in a straight line, we can see the burning candle.

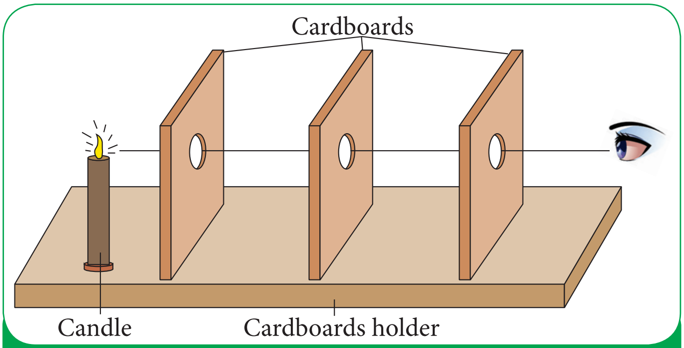


Fig. 7.38

- Now, move any one cardboard slightly right or left and look through the hole. Can you see the burning candle?
- When we move any one cardboard, we cannot see the burning candle. It shows light does not travel in a curved line.

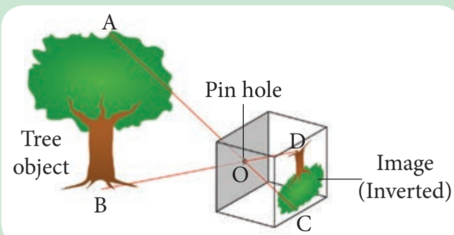
Conclusion : From this experiment, we can demonstrate that light always travels in a straight line as long as it travels in the same medium.

7.3.5. Pin Hole Camera

Activity 14

Prepare your own Pin Hole Camera

- Take a cardboard box or tin with one end open and another and covered. In the open end secure a tracing paper using a tape or rubber bands. This forms the screen.
- Make a hole at the centre of the closed end and paste a black paper over this hole. Use a sharp pin to make a small hole in the paper. The hole allows light to come in. Stand in a dark room and point the hole outside from an open window,



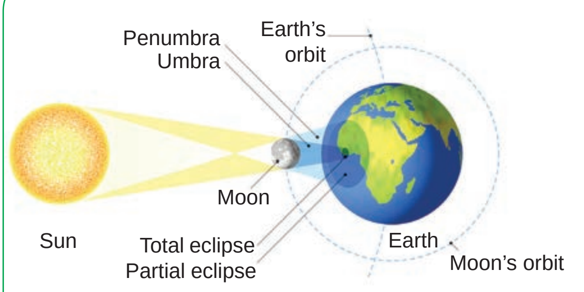
- You can see images of trees or people outside on the screen. However, all images will be inverted.

A light ray from the top of a tree, A, falls on the screen at C after passing through the pin hole O. A ray from the bottom, B, fall at D. Similarly, rays of light from each point in the tree fall on the screen after passing through the pin hole. Together these points of light make up the image. You can clearly see that the image CD will be inverted.

The pin hole camera can be used to measure the heights of the objects like trees. By measuring the height of the image, the distance of the tree from the pin hole and the distance of the image from the pin hole (i.e. the length of the box, the height of the tree can be calculated.

7.3.6. Shadow and Its Types

When the light coming from a source is blocked by an opaque object, a dark patch is formed behind the object. This dark patch is called shadow.



Formation of shadow

Fig. 7.39

Luminous objects like the sun, torchlight, burning candle, etc. spread light around them. When an opaque object is kept in front of the source of light, two types of shadows are formed behind the object. They are umbra and penumbra.

Umbra

Umbra is the completely dark patch of the shadow. It is formed at the centre of the shadow. Umbra appears completely dark as it does not get any light. Umbra is surrounded by penumbra.

Penumbra

Penumbra is the lighter patch of the shadow that surrounds the umbra. It does not appear completely dark as it receives some light. It can be seen around the umbra.

Activity 15

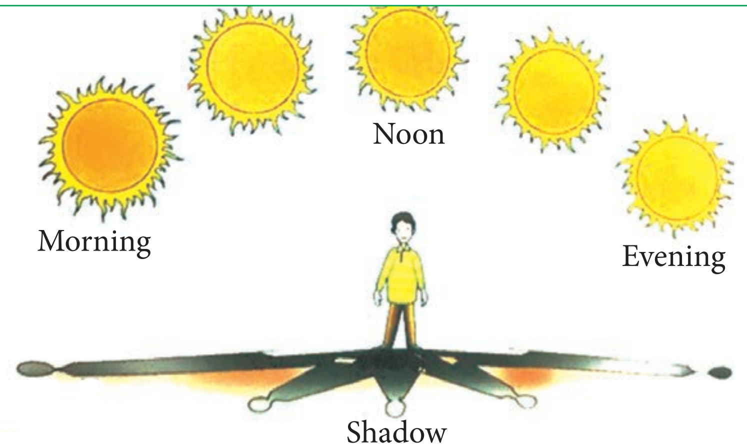
- Take a torch light and go in a dark room.
- Keep an opaque object on a table and turn on the torch light.
- Observe the shadow behind the opaque object.
- Identify umbra and penumbra in the shadow.

Activity 16

- Let the light of a torch fall on a table. Place a book between the torch and the table. What do you notice?

The shape of the shadow depends on the shape of object, the position of the source of light and the size of the source of light. No matter what the colour of the object, the colour of the shadow cast by it is always black, however, some portion of the shadow may be grey. Other than its shape, the details of the object cannot be seen on the shadow.

The shadow in sunlight changes in length and direction during the day as the sun changes its position in the sky.



Shadow change in their lengths and direction during the day

Fig. 7.40

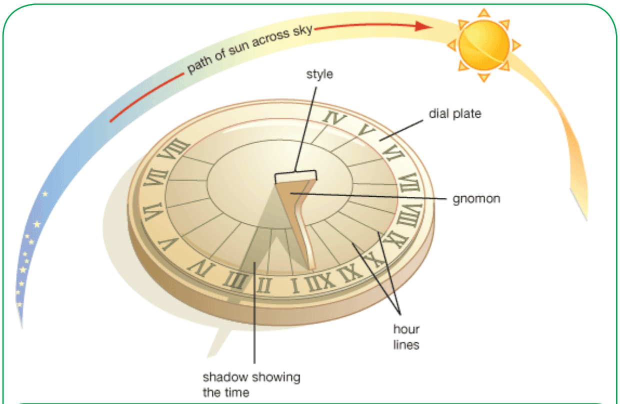
Activity 17

- Observe the shape and size of your own shadow in the morning, noon and evening. What do you find? What can you conclude from this activity?

7.3.7 Sundial

A sundial is a device that tells the time of day when there is sunlight by the apparent position of the sun in th e sky.

A sundial consists of a flat plate (the dial) and a gnomon, which casts a shadow onto the dial. As the sun appears to move across the sky, the shadow aligns with different hour-lines, which are marked on the dial to indicate the time of the day. The gnomon may be a rod, wire or any other vertical object. The gnomon casts a broad shadow, the shadow of the style shows the time. The style must be parallel to the axis of the earth's rotation for the sundial to be accurate throughout the year.



Sundial

Fig. 7.41

Activity 18

- Make your own sundial and demonstrate it in your class.

Key Concepts

1. Light is a form of energy which makes things visible. We are able to see things in our surroundings due to the presence of light.
2. The objects which emit light are called the sources of light.
3. A ray of light is the direction of the path followed by light.
4. A group of light rays moving in the same direction is called a beam of light.
5. Luminous objects have their own source of light for shining.
6. Non-luminous objects are those objects which do not have their own source of light for shining.
7. The objects which allow light to pass through them are called transparent objects.

8. The objects which allow only a part of light to pass through them are called translucent objects.
9. The objects which do not allow light to pass through them are called opaque objects.
10. Light always travels in a straight path so long as it travels in a straight line. This process is called rectilinear propagation of light.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. Light is a form of energy which makes things visible. ☐

b. Green plants do not need sunlight. ☐

c. Moon is a luminous object. ☐

d. Glass and air are transparent objects. ☐

e. Light always propagates in a straight line. ☐

2. Fill in the blanks using appropriate words.

a. The object which emits light is called ....

b. .... provides maximum light on the earth.

c. .... converts electrical energy into light energy.

d. .... objects do not have their own source of light for shining.

e. .... do not allow light to pass through them.

3. Tick (√) the best answer from the given alternatives.

a. .... is a form of energy which makes things visible.

☐ heat ☐ light ☐ sound ☐ electricity

b. .... is the natural source of light.

☐ moon ☐ torchlight ☐ lantern ☐ bulb

c. .... is a luminous body.

☐ moon ☐ book ☐ sun ☐ brick

d. Which of the following is a transparent object?

☐ glass ☐ brick ☐ wood ☐ tracing paper

4. Answer the following questions.

a. Define light. What type of objects emit light?
b. Define sources of light with any three examples.
c. What is the ray of light?
d. What is meant by the beam of light?
e. Define luminous and non-luminous objects with any three examples of each.
f. What are transparent objects? Give any two examples.
g. What are translucent objects? Give any three examples.
h. Define opaque objects with any three examples.
i. Why is air called a transparent object?
j. Why is ground glass called a translucent object?
k. What is meant by rectilinear propagation of light?
l. What is pinhole camera? Write its use.
m. What is sundial? Write its use.

5. Give reason.

a. The sun is considered as the major source of light.
b. Burning candle is called a luminous object.
c. Moon is called a non-luminous object.
d. Glass is called a transparent object.
e. Wood is called an opaque object.

6. Differentiate between:

a. Ray and Beam of light
b. Luminous and Non-luminous object
c. Transparent and Opaque object

7. Describe an activity to demonstrate that light always travels in a straight path as long as it travels in the same medium.

8. How is pin-hole camera constructed? Describe in brief with figure.

7.4 Sound

7.4.1 Introduction to Sound

Sound is a form of energy which is produced due to vibration of a material medium. Sound produces sensation of hearing in our ears. When we talk, sing or shout, sound is produced. Similarly, sound is produced while ringing a bell or playing a guitar. We communicate with our friends by producing sound.

7.4.2 Sources of sound

The object which produces sound is known as the source of sound. Guitar, radio, television, horn of vehicle, drum, cassette player, bell, etc. are the sources of sound.

Do you know ?

A vibration is a rapid back and forth motion of a particle about its mean position. A vibrating body is a source of sound.

a. *Guitar* b. *Loud speaker* c. *Television* d. *Horn of vehicle*

Fig. 7.42

When a body vibrates, it produces sound. So sound is produced due to vibration of a material medium. The material medium can be solid, liquid or gas. Sound can propagate in any direction. However, it requires material medium for propagation.

Activity 19

- Take a drum and keep it on a table so that its skin remains horizontal.
- Keep small pieces of paper on the skin of the drum and bang gently on the skin. Observe the skin and the pieces of paper carefully.
- Do you observe vibration in the pieces of paper while the sound is produced ?

This activity proves that sound is produced due to vibration of a medium.

Activity 20

- Take a guitar and pluck its string. Observe the string carefully. Does it vibrate while producing sound?
- When the string of the guitar is plucked, it vibrates and produces sound. This activity also proves that sound is produced due to vibration of a body.

7.4.3 Pitch of Sound

Pitch of sound is defined as the shrillness of the sound. Pitch of a sound is the characteristic due to which we can distinguish a grave (hoarse) sound from a sharp (shrill) sound. We can feel the pitch of a sound but cannot measure it. The voice of a girl is shrill but that of a boy is grave. Similarly, the sound produced by thin string of guitar is shrill but that of thick string is grave.

Activity 21

- Take a guitar and observe its string. You can see the strings of different thickness.
- Now, pluck the strings of different thickness and listen to the sound produced.
- What is the relation between thickness of string and pitch of the sound produced? Write down the conclusion of this activity.

7.4.4 Loudness of sound

The property of sound by which a loud sound can be distinguished from a faint sound is called loudness of sound. It depends on the energy carried by a sound wave.

We use more energy while shouting. So a loud sound is produced. Similarly, we use less energy while whispering, so faint sound is produced.

Loudness of a sound also depends on the surface area of a vibrating body. A large speaker produces a louder sound than that of a small speaker. It is because the vibrating area is more in a large speaker than in small one.

Activity 22

- Take a large temple bell and a small temple bell.
- Ring both bells with the same effort one by one. Which bell produces louder sound ? Why ? What can you conclude from this activity?

Loudness of sound also depends on the distance between the source of sound and the listener. Sound is heard louder on decreasing the distance between the sources of the sound and the listener.

Activity 23

- Take a tape recorder and go to the school ground along with your classmates.
- Keep the tape recorder on a chair.
- Draw a straight line on the ground and ask the students to stand at the distance of 10m each from the tape recorder.
- Now, tune the tape recorder in low volume. Ask your friends to raise their hands if they hear the sound of the tape recorder clearly.
- Now, increase the volume and repeat the above activity.
- What can you conclude from this activity?

7.4.5 Wave Motion

Wave motion can be defined as the periodic disturbance travelling through a medium produced by a vibrating body. When a body vibrates, it produces sound which requires a material medium for its propagation. Sound wave can propagate through solid, liquid and gas.

Fig. 7.43

When a piece of stone is thrown in a pond, ripples are produced in all directions on the surface of water. It shows that a wave motion travels in all directions. However, particles of the medium do not move from one place to another. We can observe this phenomenon by placing a leaf on the water surface. The leaf moves up and down at the same place but does not move along with the waves. Ripples are produced in water when the energy carried by the stone disturbs the water molecules close to it. Waves are of two types. They are transverse wave and longitudinal wave. Sound wave is a longitudinal wave. The wave that vibrates in the direction of propagation is called longitudinal wave.

Activity 24

- Take a large water trough and fill it with water.
- Drop a small stone into the water and observe the ripples produced on the surface of water.
- Do ripples propagate in all directions? Observe carefully.
- Now, place a piece of paper on the ripples. Does the piece of paper move with the ripples?
- What can you conclude from this activity?

7.4.6 Propagation of Sound

The process of transmission of sound from one place to another is called propagation of sound. A vibrating body produces sound and it travels in all directions from the source. But sound requires a material medium for propagation. Sound can propagate through solids, liquids and gases. But it cannot propagate through vacuum due to absence of material medium.

Sound travels through gases or air. In air medium, the speed of sound is 332m/s. Atmosphere is absent on the surface of the moon. So we cannot do conversation on the surface of the moon by speaking. But we can do conversation on the earth due to the presence of air or atmosphere.

Do you know?

Sound requires a material medium for propagation. It cannot propagate in a vacuum. There is no atmosphere on the surface of the moon. So we need a special hearing device to communicate on the moon.

Sound also propagates through liquids and solids.

The speed of sound in water is 1500m/s. The speed of sound in different solids is also different. For example, the speed of sound in steel is 5200m/s and that in glass is 5000m/s. It shows that the speed of sound is maximum in solids and minimum in gases.

Activity 25

To demonstrate sound can propagate through air (gas) medium

- Take a hammer and school bell and go to the school ground.
- Ask your friends to disperse in the ground.
- Ring the bell with the hammer.
- Now ask your friends whether they listened to the sound of the bell or not.

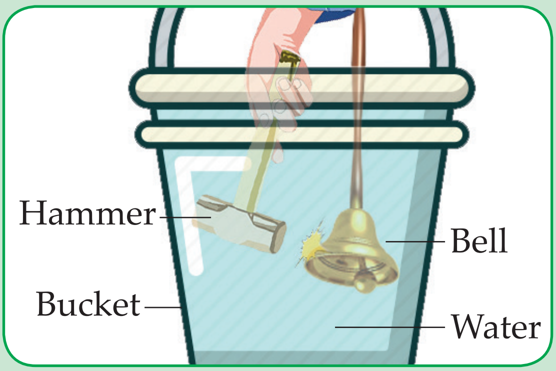
When we ring the bell, the sound propagates through air and then reaches our ears. As a result, we hear the sound.

This activity proves that sound can propagate through air or gas.

Activity 26

To demonstrate that sound propagates through liquid (water) medium.

- Take a bell, hammer and a bucket.
- Fill the bucket with water.
- Immerse a bell inside the water and hit the bell with a hammer. Do not touch the wall of the bucket with the bell and hammer. Can you hear the sound or not? Sound can be heard clearly while the bell is hit inside the water.



This activity proves that sound propagates through liquid or water medium.

Activity 27

To demonstrate that sound propagates through solid medium

- Take two small empty tin cans or plastic cans. Make a hole at the bottom of each can using an iron nail and hammer.
- Take long and thick thread and insert the one end of the thread through the hole of the can and tie a knot in such a way that the thread does not slip back through the hole.
- Now, you hold one tin can and ask your friend to hold another tin can.
- Move far away from each other so that the thread is held tight.
- Now, ask your friend to keep the tin can near the ears and you speak some word, softly. Ask whether your friend hears the sound as it propagates through the thread.

- Now, ask another friend to cut the thread at the middle. Now, repeat the above activity. In this case, your friend does not listen to the sound as the thread has been cut.

This activity proves that sound propagates through solid.

Key Concepts

1. Sound is a form of energy which is produced due to vibration of a material medium.
2. The object which produces sound is known as the source of sound.
3. Sound can propagate in any direction. However, it requires material medium for propagation.
4. Pitch of sound is defined as the shrillness of the sound.
5. The property of sound by which a loud sound can be distinguished from a faint sound is called loudness of sound.

6. Wave motion can be defined as the periodic disturbance travelling through a medium produced by a vibrating body.
7. Sound wave is a longitudinal wave. The wave that vibrates in the direction of propagation is called longitudinal wave.
8. The process of transmission of sound from one place to another is called propagation of sound.
9. The speed of sound is maximum in solids and minimum in gases.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. Sound is a form of energy which produces the sensation of hearing. ☐

b. Sound can propagate through vacuum. ☐

c. The pitch of the sound of a girl is higher than that of a boy. ☐

d. The speed of sound is more in water than that in steel . ☐

e. Sound wave is a longitudinal wave. ☐

2. Fill in the blanks using appropriate words.

a. A .... body is the source of sound.

b. Sound cannot propagate through ....

c. The sound produced by a large bell is .... than that produced by a small bell.

d. The speed of sound in air is ....

e. Waves are of .... types

3. Tick (√) the best answer from the given alternatives.

a. A vibrating body produces …………………..

☐ heat ☐ light ☐ sound ☐ noise

b. The speed of sound is maximum in …………………..

☐ steel ☐ air ☐ glass ☐ water

c. Sound cannot propagate through ....

- [ ] air
- [ ] water
- [ ] steel
- [ ] vacuum

d. The speed of sound in glass medium is ....

- [ ] 5100m/s
- [ ] 5200m/s
- [ ] 332m/s
- [ ] 1500m/s

4. Answer the following questions.

a. Define sound. How is sound produced?

b. What are the sources of sound? Give any three examples.

c. Define pitch of a sound.

d. What is meant by loudness of sound?

e. Name any two factors that affect loudness of sound.

f. Define wave motion and write its types.

g. What is longitudinal wave?

h. What is meant by propagation of sound?

i. Differentiate between pitch and loudness of sound.

5. Describe an activity to demonstrate that sound can propagate through solid medium.

6. Which fact can be proved from the given figure? Explain.

7. Describe an activity to demonstrate that sound can propagate through liquid medium.

8. We need special hearing devices on the surface of the moon to talk. Justify this statement.

UNIT

8

Electricity and Magnetism

Estimated teaching periods : 15

Before You Begin

The form of energy which is produced due to the continuous flow of electrons or flow of charges is called electricity. It is of two types, viz. static electricity and current electricity. The electricity which is produced due to the continuous flow of electrons through a conductor is called current electricity. Cell and battery are the sources of electricity. We can convert electrical energy into heat energy, light energy, mechanical energy, sound energy, etc. Therefore, electricity is the most important form of energy.

The substance which attracts iron, nickel and cobalt is called magnet. A freely suspended magnet always points to north-south direction. The substances that are attracted towards magnet are called magnetic substances. Iron, nickel and cobalt are some examples of magnetic substances. The special property of a magnet due to which it attracts iron, cobalt and nickel, etc. and points to north-south direction when suspended freely is called magnetism.

Learning Objectives

After completing the study of this unit, students will be able to:

- Introduce electricity and its sources.
- Introduce cell and describe the structure and working of a simple cell.
- Make simple cell using acid, copper, zinc and copper wire.
- Define electric circuit and describe its types with figures.
- Identify symbols used in electric circuit.
- Introduce and demonstrate heating effect of current electricity.
- Differentiate between fuse an MCB and describe the ways of their safety.
- Introduce magnet an describe magnetic field.
- Explain the methods to make magnet.
- Introduce electromagnet and state its uses.

Syllabus

- Introduction to electricity
- Sources of electricity
- Cell and structure of simple cell
- Electric circuit and its types
- Symbols used in electric circuit
- Heating effect and current electricity
- Fuse and MCB
- Introduction to magnet and magnetism
- Magnetic field and magnetic poles
- Methods to make magnet
- Electromagnet and its uses

Glossary

acid	:	a substance that gives hydrogen (H+) ions when dissolved in water
cell	:	a device which converts chemical energy into electrical energy
conductors	:	the substances through which electricity can flow
corrosive	:	tending to destroy something slowly
dynamo	:	a small device having magnet which is rotated to convert mechanical energy into electrical energy
electricity	:	a form of energy which is produced due to flow of electrons/ charges
electromagnet	:	the magnet made by using electric currents
fuse	:	a thin wire made of tin and lead which melts itself when current exceeds the safe value
generator	:	a very big dynamo which produces electricity in a large scale
insulators	:	the substances through which electricity cannot flow
induction	:	the process by which magnetism or electricity passes from one object to another without touching them
lightning	:	a bright flash of electricity produced by a thunderstorm
magnetism	:	the properties of a magnet to attract iron, cobalt, etc. and to point to north-south direction when suspended freely
navigator	:	a person who navigates, for example, on a ship or an aircraft
natural	:	existing in nature and not made or caused by people, coming from nature.
MCB	:	miniature circuit breaker, advanced form of fuse
thunderstorm	:	a storm with thunder and lightning

8.1 Electricity

8.1.1 Sources of Electricity

You might have seen various electrical appliances at your home and school. Bulb, tube light, TV, iron, mobile phone, heater, fridge, electric motor, etc. need electricity for their operation. We cannot operate these equipment without electricity.

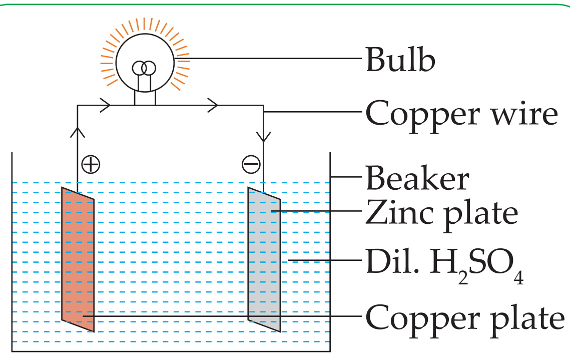
When a cell is connected to a bulb with copper wires, the bulb glows due to continuous flow of electrons through the wire. Such flow of electrons through a conductor is called current electricity. So, the form of energy which is produced due to continuous flow of electrons is called current electricity. Cell, battery, dynamo and generator are the sources of current electricity.

Current electricity is a very useful form of energy. It can be converted into heat energy, light energy, sound energy, magnetic energy. It is used to light bulb, to operate heater, television, computer, radio, fan, telephone, etc.

Those equipments from which electricity is obtained are called sources of electricity. Cell or battery, solar cell or photocell and dynamo or generator are the main sources of electricity. A brief description of sources of electricity is given below:

1. Cell

We use cell in torchlight, radio, watch, etc. Have you seen the cell of torchlight and watch? The device which converts chemical energy into electrical energy is called cell. It produces direct current. On the basis of structure, cells are of two types. They are:



Simple cell

Fig. 8.1

i. Simple cell ii. Dry cell

Activity 1

- Take a beaker and keep 100 ml of dilute sulphuric acid.
- Take a zinc plate and connect a piece of copper wire with the zinc plate.
- Take a copper plate and connect a piece of copper wire with the copper plate.
- Now, immerse copper plate and zinc plate into the acid.
- Connect a bulb with the wires. What do you observe? Does the bulb glow?

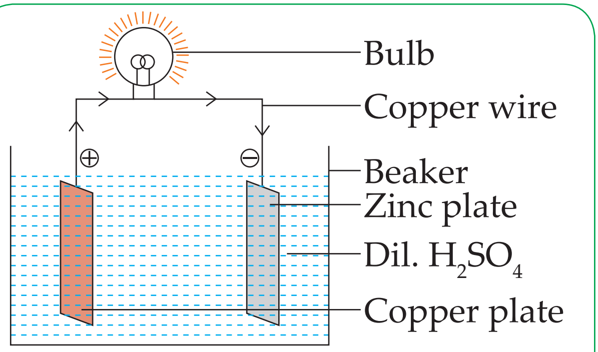
This type of cell is called simple cell.

Caution : Sulphuric acid is a very dangerous chemical. It is corrosive and burns our skin and clothes. So we should not touch it. Simple cell should be made only in the science lab under the supervision of science teacher.

i. Simple cell

The cell made by immersing two metal plates (copper and zinc) into acid solution (sulphuric acid) is called simple cell.

A simple cell has a container of dilute sulphuric acid (dil. H_2SO_4) in which two metal plates (one copper plate and another zinc plate) are dipped/immersed.



Simple cell

Fig. 8.2

In a simple cell, the copper plate acts as an anode and works as a positive terminal. Similarly, the zinc plate acts as a cathode and works as a negative terminal. Simple cell produces maximum potential difference of 1 volt.

In a simple cell, zinc reacts with dilute sulphuric acid and gets dissolved into acid. Zinc plate acts as a negative terminal. The hydrogen gas produced during chemical reaction gets deposited on copper plate. The copper plate loses electrons and acts as a positive terminal. When copper plate and zinc plate are connected to a bulb through copper wire, the bulb glows.

A simple cell cannot be transported easily as it contains acid, i.e. dangerous liquid. Similarly, it does nor produce more electricity and cannot be used for a long time. Due to these reasons, its use in not common in homes and offices.

ii. Dry cell

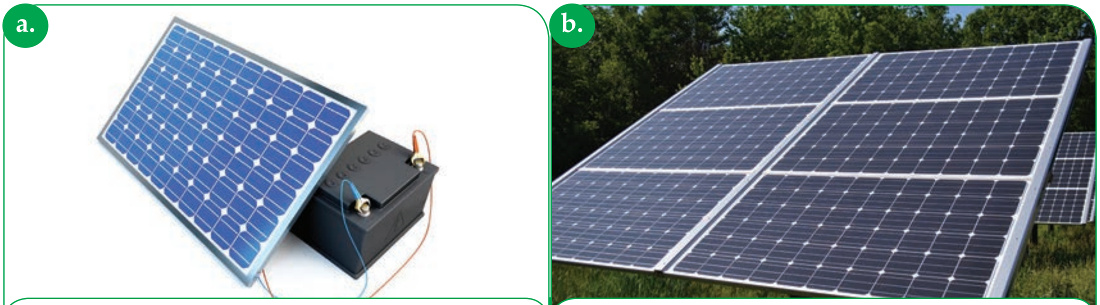
Dry cell is a very common source of electricity in rural areas. People use it in torchlight, clock and radio. The cell which does not contain acid is called dry cell. This cell can be carried easily from one place to another and produces more current. Therefore, dry cell is widely used in torchlight, camera, radio, tape-recorder, etc.

Fig. 8.3

2. Solar Cell

The special type of cell which converts solar energy into electrical energy is called solar cell or photo cell. The energy obtained by using solar cells or solar panel is called solar energy. A single photo cell produces a small amount of electricity. Therefore, thousands of photocells are combined in a solar panel to produce a large amount of electricity.

In Nepal, solar energy is the best alternative source of energy. Solar energy is used to heat water, light bulb and to operate radio, television, computer, etc. Solar energy can also be used to lift underground water.



a. *Solar cell* b. *Solar panel*

Fig. 8.4.

3. Dynamo and Generator

Dynamo is an equipment which converts mechanical(kinetic) energy into electrical energy. A strong magnet is used in dynamo. We use magnet in bicycle, motorcycle, car, truck, bus, etc. to generate electricity. However, dynamo cannot produce electricity in a large scale. So scientists have developed generator to generate electricity in a large scale. A very big dynamo which can produce electricity in a large scale is called a generator. It is used in hydropower stations. The turbines are rotated with the current of running water in hydropower stations to produce electricity in a large scale.

a.

Dynamo

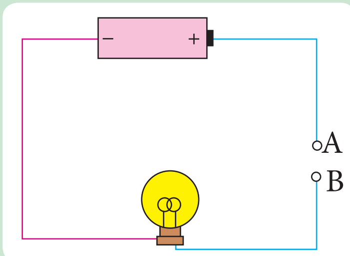
b.

Generator

Fig. 8.5

Activity 2

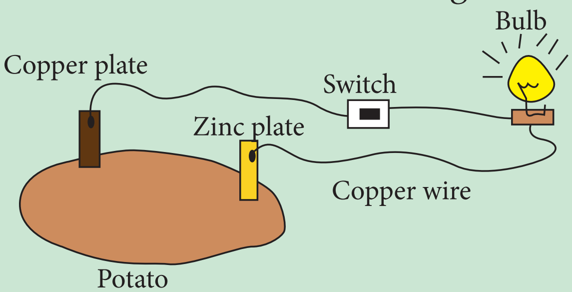
- Prepare an open electric circuit by connecting a dry cell, a bulb and connecting wire. Leave a gap AB in the circuit as shown in the figure.



- Bring small pieces of different metals and non-metals such as piece of iron, copper, aluminium, lead silicon, rubber, plastic, thread, dry wood, paper, glass, etc.
- Place each object turn by turn to fill the gap AB in the circuit. Observe carefully whether the bulb glows or not.
- Note: If the bulb glows while filling the gap, these objects are conductors. When the bulb glows brightly, they are good conductors, if the bulb glows dim, they are semi-conductors and if the bulb does not glow, they are insulators.

Activity 3

- Take a potato, zinc place, copper plate, lead bulb, switch and pieces of copper wire.
- Arrange these materials as shown in the figures.



- What do you observe? Does the bulb glow? What can you conclude from this activity?

8.1.2 Electric Circuit

Electric current requires a continuous path to flow. It can be made by connecting a conducting wire with the source of electricity and a load. So, the path made by connecting a source, conducting wire and load is called electric circuit.

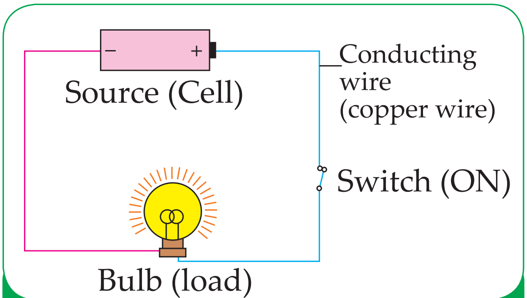


Fig. 8.6

The components of an electric circuit are i. cell or battery, ii. conducting wire, iii. load (bulb) and iv. switch.

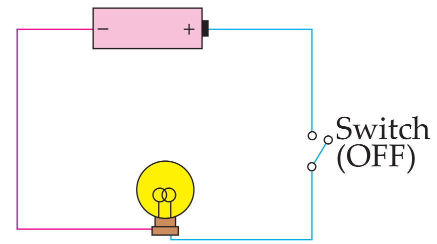
In an electric circuit, a cell or battery acts as a source of electricity. Conducting wire (copper wire) acts as the medium which offers flow of electric current through it. A bulb is the device which converts electrical energy into heat and light energy. Similarly, a switch is used to open and close the circuit when required.

Do you know ?

- Battery is the group of cells.
- In an electric circuit, cell or battery acts as a source of electricity.

a. Open Electric Circuit

The electric circuit in which a load does not work is called open circuit. In an open circuit, electric current does not flow continuously. So the load (bulb) does not work. A circuit may be open (i) if the switch is turned 'OFF', (ii) wire has broken or (iii)load (bulb) is damaged.

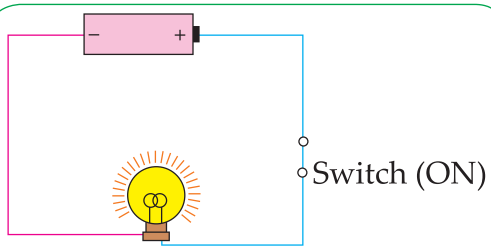


Open circuit

Fig. 8.7

b. Closed Electric Circuit

The electric circuit in which a load works continuously is called closed electric circuit. In this condition, current flows continuously through the circuit. The switch is turned 'ON' in a closed circuit.



Closed circuit

Fig. 8.8

Activity 4

- Take a dry cell, a bulb, a bulb-holder, a switch and piece of copper wire.
- Connect them and form an electric circuit.
- Does the bulb glow when the switch is turned 'ON' ? Why?
- Now, turn the switch 'OFF' and observe. Does the bulb glow? Why?
- Now break the connecting wire and turn the switch 'ON'. Does the bulb glow? Why?

What can you conclude from this activity?

8.1.3 Conductors, Semiconductors and Insulators

Conductors are those substances through which electricity can flow easily. Silver, copper, gold,

Do you know ?

Graphite is a non-metal which can conduct electricity.

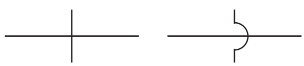
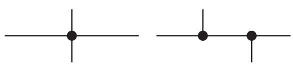
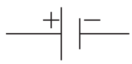
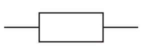
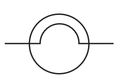
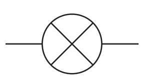
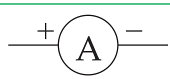
aluminium, iron, nickel, etc. are examples of conductors. Most metals are good conductors of electricity.

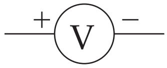
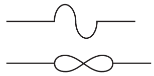
Semi-conductors are those substances which allow only a part of electricity to pass through them. Lead, silicon, etc. are semi-conductors of electricity.

Insulators are those substances through which electricity cannot flow. Rubber, glass, paper, dry wood, plastic, stone, brick, etc. are examples of insulators.

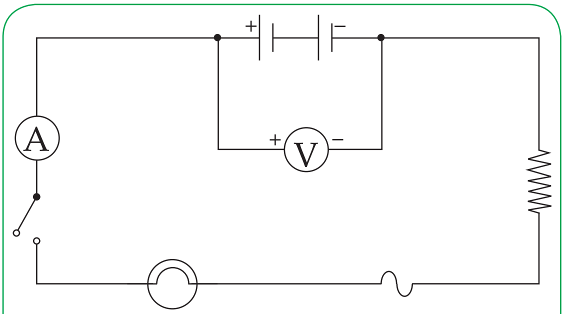
8.1.4 Symbols Used in Circuit Diagrams

While drawing circuit diagrams, electrical equipment and components of electric circuit are represented by their symbols. The main components and electrical equipments with their symbols and functions are as follows:

S.N.	Components/ Devices	Symbols	Function
1.	Wire		To make circuit
2.	Wires (not connected)		To make electric path
3.	Wires (connected)		To make electric path
4.	Switch		To open and close circuit
5.	Electric cell		Source of electricity
6.	Battery		Source of electricity
7.	Resistor/Load	 or 	To convert electrical energy into another form
8.	Bulb	 or 	To convert electricity into light
9.	Ammeter		To measure the current

10.	Voltmeter		To measure the voltage
11.	Fuse	 or	To break the circuit in case of overloading
12.	Galvanometer		To detect electric current

An electric circuit showing various components in proper order of combination is given below:



Electric circuit

Fig. 8.9

Activity 5

- Study the symbols of various components and electrical devices in the above table.
- Draw or circuit diagram showing at least five of above given components or electrical devices.

8.1.5 Effects of Current Electricity

Current electricity has so many effects. We can convert electrical energy into light energy by using bulb or tube light. We can convert electrical energy into heat energy by using an electric heater. We can make a magnet by using electricity. Similarly, electroplating and electrotyping can be done with the help of electricity. It shows that current electricity can have different effects. Some of them are mentioned below:

1. Heating effect
2. Lighting effect
3. Magnetic effect
4. Chemical effect

In this unit, we will study only heating effect of current electricity.

Heating Effect of Current Electricity

When we pass electric current though a conductor having a high resistance, it becomes hot and radiates heat energy. Such type of effect of current electricity is called heating effect. Heating effect of current electricity is widely used in our daily life. We use electric heater to make our home warm. Heating devices are also used to boil water, to cook food, to press clothes and so on. Similarly, we use immersion rod to heat water for bathing in winter. Some common devices that convert electrical energy into heat energy are given below:

Electric iron | Electric heater | Electric kettle | Immersion rod

Fig. 8.10

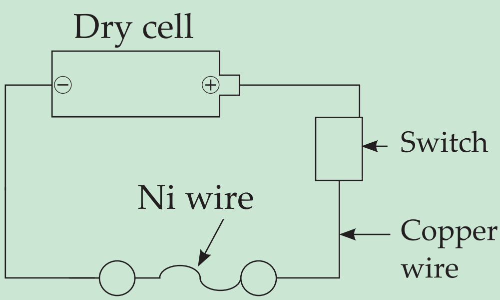
In heating devices like iron, heater, immersion rod, etc. nichrome wire is used as a heating element. Nichrome wire is an alloy of nickel and chromium. It has a very high resistance. So it becomes very hot while passing electricity and radiates heat energy. Nichrome wire does not react with oxygen when heated upto 900°C. Therefore, the heating element made of nichrome wire is more durable than any other heating element.

Do you know ?

Heating element is a wire having high resistance which converts electrical energy into heat energy. It is used in heating devices, e.g. nichrome wire.

Activity 6

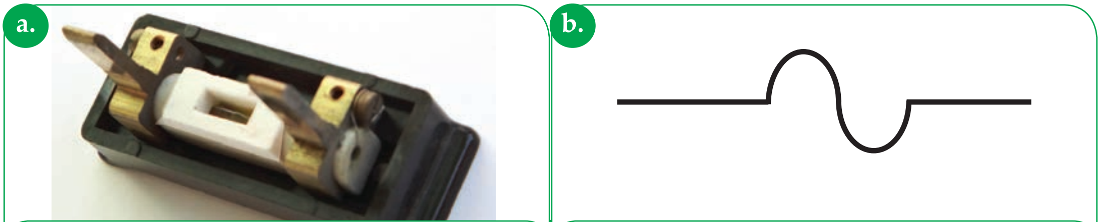
- Take a dry cell, pieces of copper wire, switch and a piece of nichrome or constantan wire.
- Prepare an open electric circuit on a wooden table connecting above materials.
- Now, turn the switch 'ON' and observe carefully.



- Does the nichrome or constantan wire become hot?
- What can you conclude from this activity?

8.1.6 Fuse

A fuse is a short piece of wire having low melting point. It breaks the electric circuit by melting itself when current exceeds the safe value. A fuse is made of tin and lead. A fuse protects electrical devices from damage due to overloading or short circuiting.



a. *Fuse* b. *Symbol of fuse*

Fig. 8.11

When a short-circuit or overloading occurs, the fuse gets heated and melts itself breaking the circuit. When a fuse melts, new fuse should be kept. In household circuit, we should use the fuse of appropriate rating. To select the fuse of appropriate rating, we should know the amount of current that flows through the circuit. The rating of the fuse should be slightly more than the current flowing through the circuit. For example, if a current of 4A flows through a circuit, a fuse of rating 5A should be used.

8.1.7 MCB

Fig. 8.12 MCB

MCB stands for miniature circuit breaker. It is an advanced form of a fuse which protects the household devices during overloading or short-circuiting.

MCB switches off the circuit within a fraction of a second during overloading or short-circuiting. It can be reset immediately after correcting the fault in the circuit.

> **Do you know?**
>
> MCB is the advanced form of fuse which protects the household wiring from overloading or short circuit whereas fuse protects the electric appliances in the circuit from getting damaged. Fuse should be replaced in case of its melting but MCB can be reset after correcting the fault. So, MCB is called the developed form of fuse.

Activity 7

- Take a fuse and MCB.
- Observe the structure of each and discuss the working mechanism of fuse and MCB in the classroom.

Differences between Fuse and MCB.

Fuse	MCB
1. A fuse is a thin wire made of lead (37%) and tin (63%) which is used in electric circuit.	1. MCB is advanced form of fuse which switches off the circuit within the fraction of second in case of overloading.
2. It needs wire to be exchanged.	2. It does not need wire to be exchanged.

Key Concepts

1. Those equipments from which electricity is obtained are called sources of electricity.
2. The device which converts chemical energy into electrical energy is called cell.
3. The cell made by immersing two metal plates (copper and zinc) into acid solution (sulphuric acid) is called simple cell.
4. The cell which does not contain acid is called dry cell.
5. The special type of cell which converts solar energy into electrical energy is called solar cell or photo cell.
6. Dynamo is an equipment which converts mechanical(kinetic) energy into electrical energy.
7. the path made by connecting a source, conducting wire and load is called electric circuit.
8. Conductors are those substances through which electricity can flow easily.
9. When we pass electric current though a conductor having a high resistance, it becomes hot and radiates heat energy. Such type of effect of current electricity is called heating effect.

10. A fuse is a short piece of wire having low melting point. It breaks the electric circuit by melting itself when current exceeds the safe value.

Exercise

1. Fill in the blanks using appropriate words.

a. The form of energy which is produced due to flow of electrons is called ....

b. .... is the device which converts mechanical energy into electrical energy.

c. A load works continuously in .... circuit.

d. .... produces electricity in a large scale.

e. Metals are .... of electricity.

f. In a simple cell, ... acts as a negative electrode.

2. Tick (√) the correct statement and cross (×) the incorrect one.

a. Solar cell converts light energy into electrical energy. ☐

b. Sulphuric acid is used in a simple cell. ☐

c. Current cannot pass through copper wire. ☐

d. Wood and paper are insulators. ☐

e. A simple cell is very easy to transport. ☐

f. A fuse is made of copper and lead. ☐

g. An electric heater converts electrical energy into heat energy. ☐

3. Tick (√) the best answer from the given alternatives.

a. .... produces a large amount of electricity.

☐ cell ☐ battery ☐ dynamo ☐ generator

b. .... converts electrical energy into heat energy.

☐ heater ☐ bulb ☐ dynamo ☐ battery

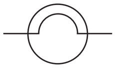
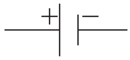
c. .... is a good conductor of electricity.

☐ copper ☐ wood ☐ plastic ☐ paper

d. A ………………………. works continuously in a closed circuit.

☐ load ☐ cell ☐ switch ☐ battery

e. Which of the following is the symbol of a batter?

☐  ☐ 

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4. Answer the following questions.

a. What is electricity? How is it produced?

b. Define sources of electricity with any three examples.

c. What is cell? Name two types of cell.

d. What is dry cell? Why is it used?

e. Define dynamo and generator.

f. Define electric circuit. Name the components of an electric circuit.

g. Define open circuit and closed circuit.

h. Define, semi-conductors and insulators with any two examples of each.

i. What is a simple cell? Draw a neat and labelled figure of a simple cell.

j. What is a fuse? What is it made of?

k. Why is a fuse used in household wiring system?

l. What is MCB? Write down its use.

5. Draw a neat and labeled figure of

a. Open electric circuit b. Closed electric circuit

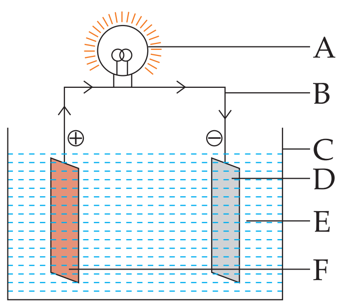
6. Describe an activity to demonstrate that metals are good conductors of electricity.

7. Draw the symbol of the each of the following :

a. Bulb b. Switch c. Cell

d. Battery e. Fuse

8. Study the given figure and name the parts A, B, C, D, E and F.



9. **Differentiate between:**
   a. Simple cell and dry cell
   b. Open circuit and closed circuit
   c. Fuse and MCB
10. **Draw a neat and labelled figure showing the structure of a simple cell.**
11. **Dry cell is widely used as compared to the simple cell. Give any two reasons to support this statement.**
12. **Describe an activity to demonstrate the heating effect of current electricity.**
13. **Electricians prefer the use of MCB rather than a simple fuse, why?**
14. **Can we use wire of any thickness to make a fuse? Why?**
15. **In the context of modern technology, electricity has become an important source of energy. Justify this statement**

8.2 Magnetism

8.2.1 Magnet and Magnetism

Have you seen a magnet? What type of substance is called a magnet? If you are given two substances, iron nail and gold ring. Which one will you use to find whether a substance is magnet or not? Discuss. A magnet which is found in nature is called a natural magnet. Lodestone is an example of a natural magnet. It was discovered by a shepherd boy Mangers while roaming on Mt. Ida of Asia Minor. He noticed that his iron straped sandals got stuck to the black stone. The black stone had a special property to attract iron. The black stone was the ore of iron called magnetite or lodestone. It is found in irregular shapes and the attractive property is very less in natural magnets. Therefore, natural magnets are not much useful.

Lodestone (Natural magnet) | *Bar Magnet* | *U-shaped magnet*

Fig. 8.13

When a bar magnet is brought near the iron nails, it attracts them. Similarly, iron attracts cobalt, nickel and steel. When a bar magnet is suspended freely, it always rests in the north-south direction. So, the substance which attracts iron, cobalt, nickel, etc. and rests in the north-south direction when suspended freely is called magnet.

Magnet exerts a force due to which it attracts iron, nickel, cobalt, etc. towards it. This special force is called magnetic force. Similarly, the special property of a magnet by virtue of which it attracts iron, nickel, etc. is called magnetism.

8.2.2 Properties of Magnet

The main properties of magnet are given below:

1. Magnet attracts iron, nickel, cobalt, etc.

When a magnet is kept near the iron nails or iron fillings, it attracts them.

Activity 8

- Take some iron dust and spread them on a sheet of paper.
- Now, bring a bar magnet near the iron dust. Does the magnet attract the iron dust?

When a magnet is brought near the iron dust, it attracts the dust. This property is called attractive property of a magnet.

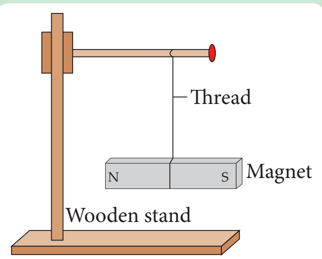
2. Magnetic poles are inseparable.

Every magnet has two poles. They are the north pole and the south pole. In a bar magnet, one end of the magnet behaves as the north pole and another as the south pole. When a magnet is broken into two or more pieces, every piece develops two poles and behaves as a complete magnet. It shows that magnetic poles cannot be separated. There is no magnet having only one pole, i.e. either the North Pole or the South Pole. Therefore, we can say that magnetic poles are inseparable and they exist in pairs.

Fig. 8.14

3. A freely suspended magnet always rests in the north - south direction.

Activity 9



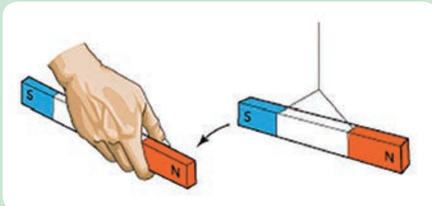
- Take a thread, a bar magnet and a wooden stand. Tie the magnet with the thread and suspend the magnet in the stand so that the magnet rotates freely.
- Leave the magnet undisturbed and wait until the magnet rests. The magnet rests by pointing to north-south direction.
- Now, take another bar magnet and repeat the above activity. This magnet also rests by pointing to north-south direction. This activity proves that a freely suspended magnet rests in the north - south direction.

4. Unlike poles of magnets attract and like poles repel.

If the north pole of one bar magnet is brought near the south pole of another magnet, they attract each other. But if the north pole of one bar magnet is brought near the north pole of another magnet, they repel. Similarly, if the south pole of a bar magnet is brought near the south pole of another magnet, they also repel. It shows that unlike poles of magnets attract and like poles repel.

Activity 10

- Take two bar magnets. Keep one of them on a wooden table.
- Now, bring the north pole of another magnet near the south pole of the magnet kept on the table. Do they attract each other?



- Now, bring the south pole of a the magnet near the north pole of the magnet kept on the table. What do you observe? Do they attract each other?
- Now, repeat the above activity with bringing like poles of both magnets in close contact. What do you observe? Write down the conclusion of this activity.

8.2.3 Magnetic Substances and Non-magnetic Substances

Those substances which are attracted towards magnet are called magnetic substances. Iron, cobalt, nickel and steel are the examples of magnetic substances.

a. *Iron nails* b. *Cobalt* c. *Nickel* d. *Steel*

Fig. 8.15 *Magnetic substances*

Those substances that are not attracted towards magnet are called non-magnetic substances. Plastic, stone, wood, brick, rubber, paper, glass, copper, aluminum, etc. are examples of non-magnetic substances.

Fig. 8.16 *Magnetic substances*

8.2.4 Magnetic Poles

Each magnet has two poles. They are the north pole and the south pole. The poles of a magnet are inseparable. The regions in a magnet having maximum attractive power are called poles of the magnet.

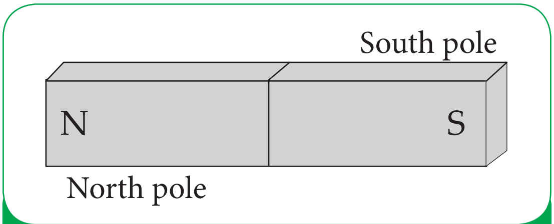


Fig. 8.17

Magnetic poles are located slightly near the ends of a magnet. But not at the terminal end. The effective length of a magnet is always shorter than the actual length.

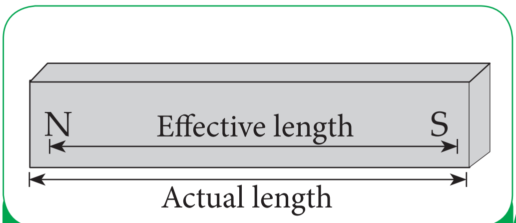


Fig. 8.18

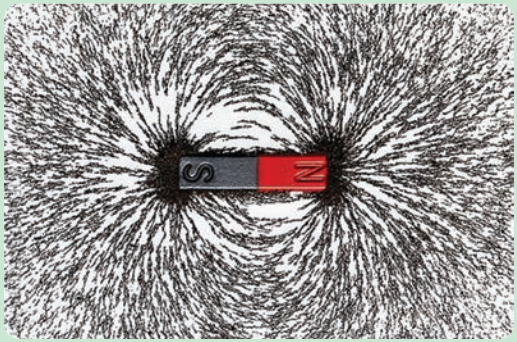
Do you know ?

The distance between the north pole and the south pole of a magnet is called effective length.

The north pole is a point near the end of a magnet which points towards the geographical north when suspended freely. Similarly, the south pole is a point near the end of a magnet which points towards the geographical south when suspended freely. The magnetic force is maximum at the poles and minimum at the middle portion.

Activity 11

- Take a spoonful of iron dust and spread it over a chart paper uniformly.
- Take a bar magnet and roll the magnet over iron dust several times.
- Now, pick up the magnet and observe which portions of the magnet attract maximum iron dust.



Magnetic force is maximum at poles

We can observe that maximum iron dust is attracted at the poles.

This activity proves that magnetic force is maximum at the poles.

8.2.5 Magnetic Field

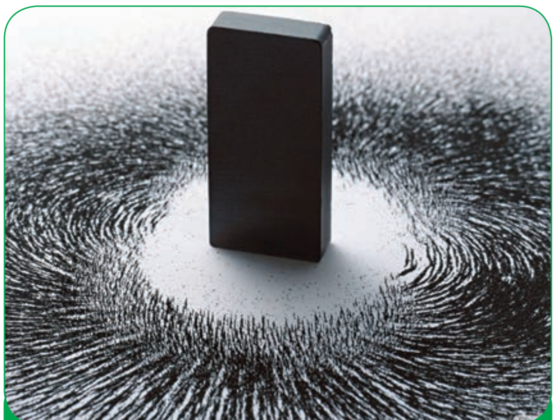


Fig. 8.19

When a magnet is brought near the iron nails, it attracts the nails. But if the magnet is moved away, it cannot attract them. Similarly, when a bar magnet is brought near another magnet, attraction or repulsion can be observed. But the influence of the magnet cannot be observed when they are kept away. It shows that a magnet can influence another magnet or magnetic substances in a certain region. The region is called magnetic field. So, magnetic field can be defined as a certain region around a magnet where the influence of the magnet can be observed. The magnetic field of a large magnet is more and vice-versa.

8.2.6 Methods of Making Magnet

Magnets can be made by various methods. Generally, we use iron and steel to make artificial magnets. But we cannot make magnet by using non-magnetic substances. Some common methods of making magnets are given below:

Do you know ?

Rubbing method of making magnet is also called stroking method.

1. Rubbing method

Rubbing method is the method of developing magnetism in a magnetic substance by rubbing a bar magnet over the magnetic substance for many times. It can be done by two methods.

i. Single touch method
ii. Double touch method

i. Single-touch method

The rubbing method in which single magnet is rubbed with a magnetic substance for many times in only one direction is called single touch method. By this method, we can develop magnetism in iron bar, blade, iron clips, iron rod, etc.

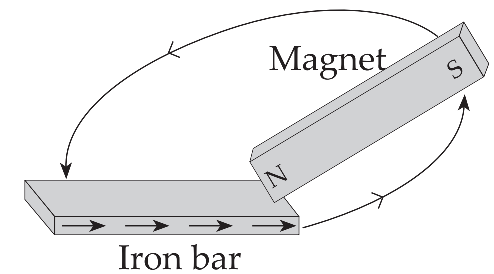


Fig. 8.20

Activity 12

- Take a steel bar and a bar magnet.
- Prepare a magnet by single touch method.
- Observe whether the newly formed magnet attracts iron nails or not.

ii. Double-touch method

The rubbing method in which a pair of magnet is rubbed for several times over a magnetic substance is called double touch method. In this method, two bar magnets are rubbed at the center of the magnetic substance with the unlike poles of two magnets simultaneously.

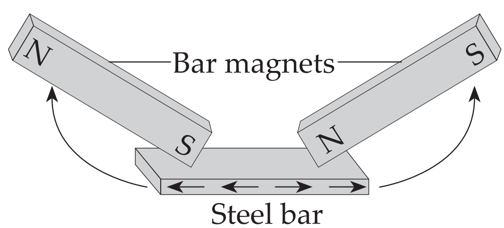


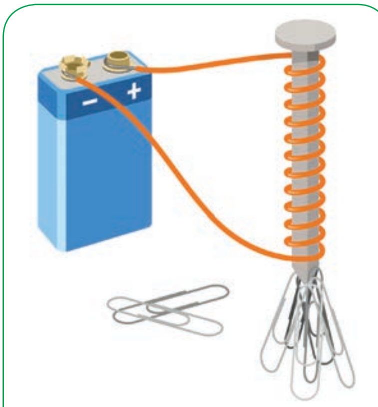
Fig. 8.21

Activity 13

- Take a steel bar and two bar magnets.
- Develop magnetic property on the steel bar by double-touch method.

2. Electrical method

Electrical method is the method of making electromagnet by passing electric current through an insulated copper wire wound around a soft iron core. Electromagnet is a temporary magnet as it retains magnetism until electric current flows through the wire.



Electromagnet

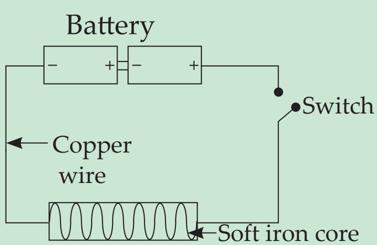
Fig. 8.22

Do you know?

- While making an electromagnet, winding should be done from only one side.
- An insulated copper wire is used for winding around soft iron core, short circuiting takes place if we use naked wire.

Activity 14

- Take two dry cells, a soft iron core, a switch, iron nails and a 5 metre long insulated copper wire.
- Prepare an electromagnet by using these materials.
- Test the magnetism of the newly formed electromagnet by using iron nails.



8.2.7 Uses of Magnets

1. Magnets are used in various equipment like electric bell, electric fan, speaker, microwave woven, etc.

2. They are used in radio, television, computer, dynamo, generator, electric motor, etc.
3. They are used in toys, doors of refrigerator, tape recorders, video recorders, etc.

Fig. 8.23

4. They are used to lift heavy loads of iron and to remove eye splinters.
5. They are used to find directions. Magnetic compass is used by navigators to find directions.
6. They are also used in magnetic therapy.

Fig. 8.24

8.2.8 Change in Magnetic Power in an Electromagnet

The power of an electromagnet can be increased or decreased according to our need and desire. The magnetic power can be increased by increasing the number of turns in the coil and the power can be decreased by decreasing the number of turns in the coil. Similarly, the power of an electromagnet can be increased by increasing the voltage and decreased by decreasing the voltage.

Key Concepts

1. The substance which attracts iron, cobalt, nickel, etc. and rests in the north-south direction when suspended freely is called magnet.
2. The special property of a magnet by virtue of which it attracts iron, nickel, etc. is called magnetism.
3. Magnet is a very useful substance. It is used in loudspeakers, mobile phones, radio, television, electric bell, dynamo, generator, etc.
4. Every magnet has two poles. They are the north pole and the south pole.
5. Those substances which are attracted towards magnet are called magnetic substances.

6. Those substances that are not attracted towards magnet are called non-magnetic substances.
7. The regions in a magnet having maximum attractive power are called poles of the magnet.
8. The magnetic force is maximum at the poles and minimum at the middle portion.
9. Magnetic field can be defined as a certain region around a magnet where the influence of the magnet can be observed.
10. The magnets which are made by human beings by various methods are called artificial magnets.
11. Rubbing method is the method of developing magnetism in a magnetic substance by rubbing a bar magnet over the magnetic substance for many times.
12. The rubbing method or stroking method in which single magnet is rubbed with a magnetic substance for many times in only one direction is called single touch method.
13. The rubbing method in which a pair of magnet is rubbed for several times over a magnetic substance is called double touch method.
14. Electrical method is the method of making electromagnet by passing electric current through an insulated copper wire wound around a soft iron core.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. A freely suspended magnet always rests in the north-south direction. ☐

b. A magnet does not attract cobalt. ☐

c. We can separate the north pole and the south pole of a magnet. ☐

d. Magnetic force is maximum at the poles. ☐

e. Magnet is used to find directions. ☐

2. Fill in the blanks using appropriate words.

a. …………… poles of magnet repel each other.

b. Wood, paper and glass are …………… substances.

c. A freely suspended magnet always rests in …………… direction.

d. The …………… length of a magnet is longer than …………… length.

e. The space around a magnet where the magnetic instance can be felt is called …………… .

f. Magnet can be made only from ……………… substance.

3. Tick (√) the best answer from the given alternatives.

a. Which of the following is a non-magnetic substance?

☐ Iron ☐ steel ☐ cobalt ☐ copper

b. A magnet has …………… poles.

☐ one ☐ two ☐ three ☐ four

c. The magnetic force is maximum at …………… of the magnet.

☐ north pole ☐ south pole ☐ poles ☐ middle

d. Which of the following is a natural magnet ?

☐ lodestone ☐ U-shaped magnet

☐ horse -shoe shaped magnet ☐ bar magnet

e. Which of the given substances has magnet?

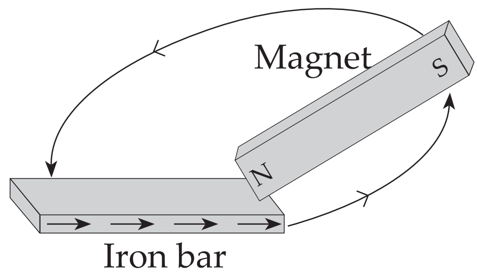
☐ load speaker ☐ radio ☐ compass ☐ all of them

4. Answer the following questions.

a. Define magnet and magnetism.
b. Write any two uses of magnet.
c. Mention any four properties of magnet.
d. Define magnetic and non-magnetic substances with any two examples of each.
e. What is meant by the north pole and the south pole of a magnet.
f. Where are magnetic poles located?

g. What are the two poles of a magnet?
h. Define magnetic field of a magnet.
i. Who discovered the magnet?
j. What is lodestone?
k. Write any two methods of making magnets. Describe any one of them.
l. Write any three uses of magnets.
m. Name any three equipment in which magnets are used.

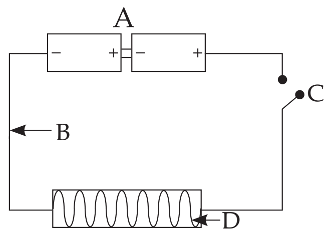
5. What is shown in the given figure? Explain it in brief.



6. Explain an activity to show that magnetic poles are inseparable.

7. Describe the method of making magnet by single touch method with a neat figure.

8. Label the parts A, B, C and D shown in the given figure.



9. Describe the method of making magnet by electrical method with a neat figure.

10 Write down the method of increasing power of electromagnet.

UNIT

9

Matter

Estimated teaching periods : 15

Before You Begin

Matter can be defined as anything having mass and volume. All matter have mass and they occupy space. For example, air, soil, water, milk, stone, brick, wood, smoke, cloud, petrol, kerosene, iron, gold, plastic, etc. Sound, light, shadow, heat, etc. do not have mass and volume. So they are not matter. Matter can be soluble or insoluble, transparent or opaque and good conductor or bad conductor of heat and electricity. Matter exist in three different states, viz. solid, liquid and gas. Same matter can exist in three different states. For example, water can exist in all three states, viz. solid (ice), liquid (water) and gas (vapour).

Among various substances found around us, some are pure and others are impure. Substances like gold, iron, copper, water, sodium chloride, carbon dioxide, etc. are pure substances. Similarly, air, soil, blood, milk, juice, tea, coffee, etc. are impure substances. The impure substances are found in the form of mixture. Similarly, some substances also found in the form of solution.

Learning Objectives

After completing the study of this unit, students will be able to:

- introduce matter with examples.
- describe mixture and its types.
- explain methods of separating the components of mixtures (distillation, chromatography and centrifuging).
- introduce solution with examples.
- state the uses of solution in daily life.
- describe the methods of separating solute from solution (churning method and evaporation)

Syllabus

- Matter
- Mixture and its types
- Method of separating mixtures
  - Distillation
  - Use of distillation as a local and industrial technology
  - Chromatography and its application
  - Centrifuging
- Solution
- Uses of solution in our daily life
- Separation of solute from solution
  - Churning method
  - Evaporation

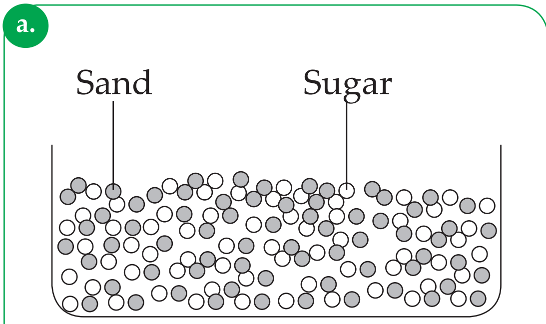
Glossary

centrifugation	:	the method of separating the mixture of heavy and light particles by rotating the mixture at very high speed
chromatography	:	method of separating different colour from their mixture
colloid	:	a homogeneous non-crystalline substance consisting of large molecules or ultra-microscopic particles of one substance dispersed through a second substance
condensation	:	the conversion of vapour into its liquid state
condenser	:	a device that cools gas in order to change it into a liquid
crystallization	:	the process of getting crystals by cooling a hot concentrated solution of a substance
distillation	:	a method which is used to separate liquids from solids or other liquids through evaporation and condensation
evaporation	:	the changing of a liquid into vapour or gas
heterogeneous	:	consisting of dissimilar or diverse ingredients or constituents
mixture	:	the resulting mass formed when two or more substances are brought together in any proportion by weight
homogeneous	:	of the same or a similar kind or nature, of uniform structure of composition
matter	:	anything having mass and volume
solution	:	the mixture of solute and solvent
sublimation	:	the changing of a solid directly into gas on heating and the gas into solid on cooling
sublime	:	a solid substance that directly changes into vapour on heating, e.g. camphor, iodine
suspension	:	a mixture in which particles are dispersed throughout the bulk of a fluid

9.1 Mixture

9.1.1 Introduction to Mixture

We all drink tea. Can you say what is tea made of ? What are the ingredients present in tea ? It consists of water, milk, sugar and tea leaves. So it is a kind of mixture. When we mix sand and sugar, it forms mixture. When we add sugar in milk, it also forms mixture. A mixture is the resulting mass formed when two or more substances are brought together in any proportion by weight. Tea, coffee, juice, sand and salt, sugar and water, sand and sugar etc. are some examples of mixture. Mixture may be homogeneous or heterogeneous. Similarly, mixtures may exist in solid, liquid or gaseous state. A mixture may contain solid, liquid or gas.



Mixture and sand and sugar

Mixture and tea, sugar and water

Fig. 9.1

The substances which are mixed in a mixture are called the components of mixture. In a heterogeneous mixture, almost all components can be seen through our naked eyes but all the components of mixture cannot be seen through our naked eyes in homogeneous mixtures. For example, we can see all the components in the mixture of salt and soil. So it is called a heterogeneous mixture. But we cannot see all the components in the mixture of sugar and water. So, it is called a homogeneous mixture.

Activity 1

- Go to chemistry (Science) laboratory and prepare different mixtures by mixing at least two of the given components.
  – Salt - Soil - Sugar - Sand - Water - Milk - Kerosene - Camphor - Flour
- Can you see all the components in these mixtures or not?
- Now, complete the given table after your observation.

Mixture	Components of the mixture	All the components	
		Can be seen	Cannot be seen
1. Salt and water	Salt, water		
2.			
3.			
4.			
5.			
6.			
7.			

9.1.2 Types of mixture

On the basis of the nature of two components, mixtures are of two types. They are (i) Homogeneous mixture and (ii) Heterogeneous mixture.

a. *Salt solution* b. *Sugar solution*

Fig. 9.2

i. Homogeneous mixture

Homogeneous mixture is that mixture in which mixing components are distributed uniformly and they cannot be seen with naked eyes. Sugar solution, salt solution and solution of milk and water are examples of homogeneous mixture.

ii. Heterogeneous mixture

Heterogeneous mixture is that mixture in which mixing components are not distributed uniformly and can be seen with our naked eyes. Sand and sugar, rice coats in rice, muddy water, soil and sand, etc. are examples of heterogeneous mixture.

a. *Sugar and sand* b. *Sand and rice*

Fig. 9.3

Differences between Homogeneous and Heterogeneous mixture

Homogeneous mixture	Heterogeneous mixture
i. In this mixture, the components of the mixture connot be seen with our naked eyes.	i. In this mixture, the components of the mixture can be seen with our naked eyes.
ii. In this mixture, the components of the mixture are distributed uniformly.	ii. In this mixture, the components of the mixture are not distributed uniformly.

Experiment 1

To prepare the mixture of various substances with water

Materials required

Sugar, salt, washing soda, soil, sand, cooking oil, chalk, stone, wood, beaker, water, glass rod

Procedure

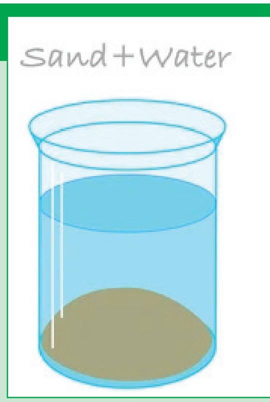
- Take a beaker. Add some water into it.
- Now, add one teaspoonful of sugar into water and stir it with a glass rod. Observe whether sugar dissolves in water or not. Fill in the given table after your observation.
- By the same way prepare a mixture of above given substances one by one.
- Observe whether these substances dissolve in water or not.
- Fill in the given table after your observation.

S.N.	Mixtures	Homogeneous mixture	Heterogeneous mixture
1	water + sugar	√	√
2	water + sand		
3			
4			
5			
6			

Activity 2

- Take a beaker and pour 200 ml water into it.
- Add two spoons of sugar into water and stir it with a spoon.
- Does all sugar disappear after stirring?
- What is this type of mixture called, why?

Activity 3



- Take a beaker and pour 200 ml of water into it.
- Add 2 spoons of sand or soil into it and stir it with a spoon for a while. What happens?
- Does the sand or soil disappear in water? What do you observe?
- What is this type of mixture called, why?

9.1.3. Forms of mixture

The different forms of mixture are given below:

1. Mixture of solid and solid, e.g. sugar and sand, rice and coats, wheat and stones, salt and sugar, etc.
2. Mixture of solid and liquid, e.g. salt and water, sugar and water, salt and milk, sugar and milk, etc.
3. Mixture of liquid and liquid, e.g. milk and water, juice and water, alcohol and petrol, petrol and kerosene, kerosene and water, etc.
4. Mixture of liquid and gas e.g. water and oxygen, water and air, beer, coca cola, etc.
5. Mixture of gas and gas, e.g air, smoke and air, vapour and air, etc.

9.1.4. Separation of the components of a mixture

We use many things in the form of mixture. But the components of a mixture are separated by various methods. Different components of a mixture have different physical properties like shape, size, solubility, density, etc. These properties are utilized to separate the components of the mixture. We should know the physical properties of the components of a mixture to select the suitable method for separating its components. The components of a mixture are separated to remove undesirable components, to remove harmful and useless components, to obtain pure substances and to obtain useful substances.

9.1.5 Methods of Separating the Components of Mixtures

The different components of a mixture have different physical state, shape, size, colour, solubility, density, etc. So, different methods are used to separate the components of a mixture on the basis of their properties. In this unit, we will study two methods for separating the components of a mixture. They are distillation and chromatography.

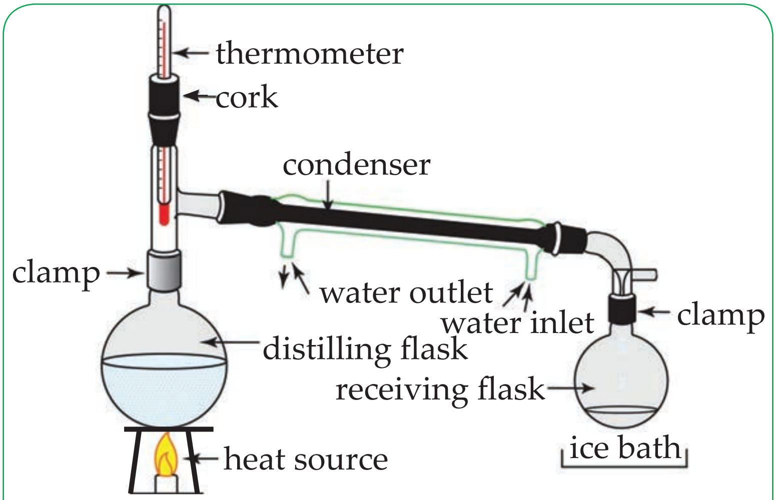
They are as follows:

1. Distillation 2. Chromatography 3. Centrifuging

A brief description of each of the given methods is given below:

1. Distillation

The method which is used to separate liquids from solids or from other liquids through evaporation and condensation is called distillation. This method is used to separate volatile liquids from a non-volatile solid or the mixture of two or more liquids having different boiling points. In distillation, a liquid is heated to convert it into vapour and then the vapour is cooled to convert into liquid again. Distillation can be used to separate the components from



Simple Distillation

Fig. 8.4

the mixture of salt and water, alcohol and water, etc. Different liquids can also be purified by distillation.

Distillation involves two processes viz. evaporation and condensation. When a liquid is boiled, it changes into vapour. The vapour is passed through a condenser to form a pure liquid. The liquid is collected into a container called receiver. The apparatus which is used in distillation is called still. The still consists of a boiler, a condenser and a receiver. A boiler is used to boil the liquid, a condenser is used to convert vapour into liquid and a receiver is used to collect pure liquid.

Types of Distillation

There are two types of distillation. They are:

a. Simple distillation b. Fractional distillation

In this lesson, we will study simple distillation only.

a. Simple distillation

A simple distillation is a method which is used to separate the components of the mixture of solid and liquid or the mixture of two liquids having different boiling points of a wide range. A simple distillation is method used to obtain a pure liquid from the impurities dissolved in it. Generally, a simple distillation is used to purify sea water and to separate the mixture of salt and water.

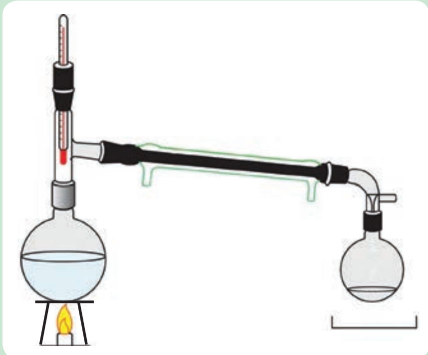
Two liquids of different boiling points of a wide range are also separated by simple distillation. When the boiling point of the liquid having the low boiling point is reached, the liquid changes into vapour. The vapour is passed through Liebig's condenser to convert the vapour into liquid again.

Substances	Boiling points
Alcohol	78 °C
Water	100 °C
Mercury	357 °C
Sea water	103 °C

The liquid formed after condensation is collected in a receiver. The temperature of the mixture does not increase till all liquid changes into vapour. When the boiling point of second liquid is reached, it gets evaporated. The vapour passes through condenser and changes into liquid which is collected into second receiver. The liquids having different boiling points are thus separated by simple distillation. The mixture of alcohol and water can be separated by this method. Similarly, distilled water can be obtained by simple distillation.

Activity 4

To separate the mixture of salt and water.



- Take a round bottom flask and keep the solution of salt and water.
- Set the apparatus as shown in the figure.
- Arrange the flow of cold water in the condenser.
- Now, heat the solution using Bunsen burner till all water gets evaporated.

Observe what happens after sometime. When water boils, it gets evaporated. When the vapour passes through the condenser, it gets condensed into liquid and falls down in the receiver.

In this way, the mixture of salt and water is separated by simple distillation.

2. Chromatography

A Chromatography is a method of separating different colours from their mixture. The principle of chromatography is that different colours move with different speed when they pass through the same medium. The fixed medium may be a filter paper, alumina, silica gel, cellulose powder, chalk powder, etc.

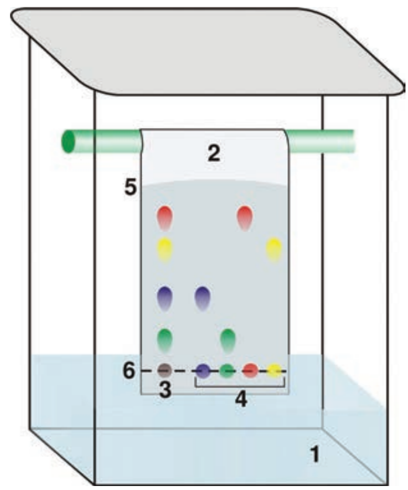
Chromatography was invented by a Russian scientist Tswett in 1906 AD. The word chromatography has been derived from two Greek words *kroma* and *graphy*. Here,"*Kroma*" means colour and *graphy* means to "write". Chromatography is widely used to separate different mixtures of solids, liquids and gases. Generally, pigments of different colours are separated from their mixture by chromatography. However, colourless pigments can also be separated by this method.

Types of chromatography

On the basis of nature of moving and fixed phases, chromatography is of three types, viz. (i) paper chromatography, (ii) column chromatography and (iii) gas chromatography. In class 8, we will study paper chromatography and column chromatography.

1. Paper chromatography

Paper chromatography is a method of separating various colours from the mixture by using filter paper. It is based on the principle that porous paper adsorbs different substances at different extremes.



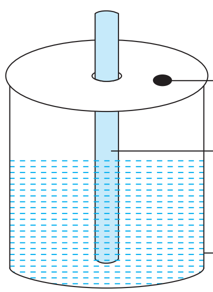
Paper chromatography

Fig. 8.5

For paper chromatography, the mixture of various colours is dissolved in a liquid. A filter paper is taken and a drop of the solution is kept about 1 cm away from the edge of the filter paper. When the solution dries, the strip of filter paper is hung vertically in a beaker. The lower edge of the paper touches the solvent in the beaker. The solvent rises in the paper and carries various components of the mixture to different distances from their original position. In this way, the mixture of different colours can be separated by paper chromatography.

Activity 5

- Take a petri dish and prepare a mixture of red and green ink.
- Take a beaker and pour some water into it.
- Take a filter paper and make a small hole at the centre and insert a roll of a filter paper through its hole.



- Put a drop of mixture of ink about 1 cm away from the centre of the filter paper and wait till the drop dries.
- Now, keep the roll of the filter paper on the beaker in such a way that the lower end of the roll of the filter paper touches the water in the beaker.
- Observe the filter paper after 2-3 hours.

After 2-3 hours, a pattern of different colours can be seen on the filter paper.

In this way, different colours can be separated by paper chromatography.

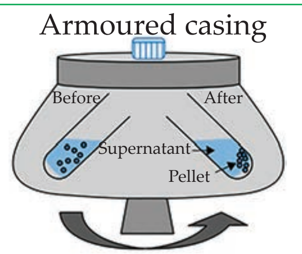
Differences between Distillation and Chromatography

	Distillation		Chromatography
1.	Distillation is the method that is used to separate liquids from solids or from other liquids through vaporization and condensation.	1.	Chromatography is the method used to separate various colours from their mixture.
2.	This method is used to separate a volatile liquid from a non-volatile one or the mixture of two or more liquids having different boiling points.	2.	This method is used to separate the chemicals present in colour, urine, blood, etc.

3. Centrifuging

When the mixture of heavy particles and light particles is rotated at a high speed, heavy and light particles get separated. This process is called centrifugation. It is done with the help of a machine called centrifuge.

a.



Centrifugation process

b.

Mechanical centrifuge

Fig. 9.6

The method of separating heavy and light particles from their mixture by rotating the mixture at a very high speed is called centrifugation.

The mixtures of clay particles and water, sand and water, cream from milk, blood cells and plasma, chalk powder from water, etc. can be separated by centrifugation.

To separate the components of a mixture by centrifugation, the mixture is kept into test tubes of the centrifuge. Then the test tubes are rotated at a very high speed for some time. When the mixture rotates in a high speed, the heavy particles settle at the bottom leaving the light particles at the top. Then the components of the mixture can be separated by decantation.

Experiment 2

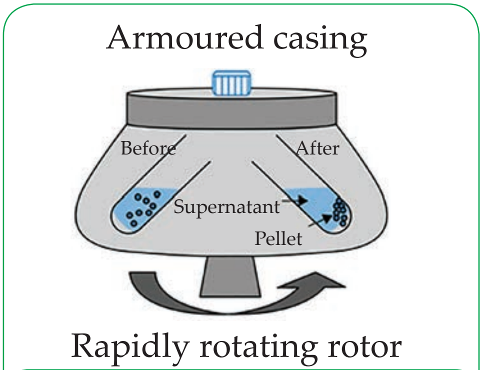
To demonstrate centrifugation by separating the mixture of clay, sand and water.

Requirements

Centrifuge (electric or mechanical) beaker, mixture of clay, sand and water.

Procedure

- Take a beaker and make the mixture of sand and water
- Take out the test tube from the centrifuge and keep the mixture of sand and water in these test tubes.
- Place the test tubes in the holders inside the centrifuge. Close the mouth of the test tube.
- Now, switch on the centrifuge machine to rotate the mixture for 2-3 minutes.
- Switch off the centrifuge and observe the mixture in the test tubes.



Paper chromatography

Fig. 8.7

Observation

The heavy sand particles settle at the bottom and light clay particles remain above the sand. Similarly, clear water remains over the clay and sand.

Conclusion

In this way, the mixture of clay, sand and water can be separated by centrifugation.

9.1.6 Classification of Mixture

On the basis of size of the component particles, there are three types of mixture. They are :

i. Solution   ii. Colloid   iii. Suspension

i. Solution

A solution is the homogeneous mixture of two or more substances. In a solution, the size of component particles is 10^{-7} cm or less. All the components of a solution cannot be seen through our naked eyes. Solution of sugar and water, salt and water, alcohol and water, coke and water, milk and water, etc. are some examples of solution.

A solution consists of two components. They are solute and solvent.

Solute + solvent = Solution

A solute is a substance which gets dissolved in a solvent. For example, sugar, salt, copper sulphate, magnesium chloride, etc.

A solvent is a substance which dissolves a solute into it. For example, water, alcohol, ether, etc. In the solution of salt and water, salt is a solute and water is a solvent.

Green plants absorb minerals from soil in the form of solution. Similarly, animals get nutrients in the form of solution. Therefore, solution plays a great role in the growth and development of living beings.

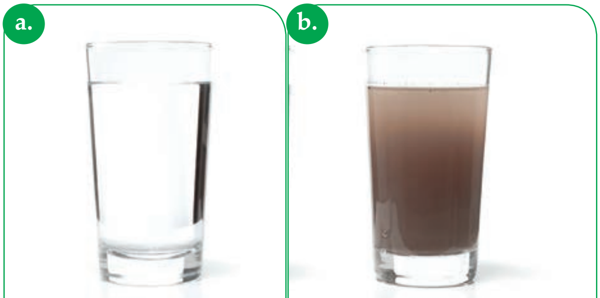
There are different types of solution on the basis of states of the components of the solution. Some common types of solutions are tabulated below:

Types of solution	Examples	Solution	Solvent
1. Solid + liquid	Salt water	salt	water
2. Liquid+ liquid	Ink and water	ink	water
3. Liquid + gas	Oxygen dissolved in water	oxygen	water
1. Gas + gas	Atmosphere	other gases	nitrogen

From above table, it becomes clear that the solution of solid and gas is not found in nature.

Dilute solution and Concentrated solution

Dilute solution is the solution which contains relatively less amount of solute. Similarly, concentrated solution is the solution which contains relatively more amount of solute. Dilute solution is lighter than the concentrated solution. It means that the density of concentrated solution is more than that of dilute solution.



Dilute solution *Concentrated solution*

Fig. 9.8

Differences between Dilute solution and Concentrated solution

Dilute solution	Concentrated solution
1. It has relatively less amount of a solute in a certain amount of solvent.	1. It has relatively more amount of solute in a certain amount of solvent.
2. It has less density.	2. It has more density.

Activity 6

- Take two beakers and keep 100 ml of water in each. Mark the beakers A and B.
- Add 5 gram of copper sulphate in the beaker A and stir it with a glass rod.
- Add 50 gram of copper sulphate in the beaker B and stir it with a glass rod.

The concentration of copper sulphate is more in the beaker B than in beaker A. The solution in beaker A is dilute and that in beaker B is concentrated.

Activity 7

- Take two glasses and put about 100 ml pure drinking water in each. Mark one glass A and another glass B.
- Dissolve 10 gram of table salt in the glass A and 50 gram of salt in glass B.
- Taste the salt solution from the beaker A. Rinse your mouth. Then taste the same amount of salt solution from the glass B. Which solution is more salty A or B? Which solution is dilute and which one is concentrated? Why?

ii. Colloid

You have seen some mixtures like milk, blood and gum. These mixtures are the examples of colloids. The mixture in which the size of component particles ranges between 10^{-7}cm to 10^{-5}cm in diameter is called a colloid. The particles of a colloid can pass through the filter paper and cannot be seen under the simple microscope. Butter, gelatin, paint, ice-cream soda are some more examples of colloid.

iii. Suspension

You have seen some mixtures like sand particles in water, muddy water, dust particles in air, etc. These mixtures are called suspensions. The mixture in which the size of component particles is 10^{-5}cm or large is called a suspension. The components of a suspension contain large particles and hence can be seen with our naked eyes.

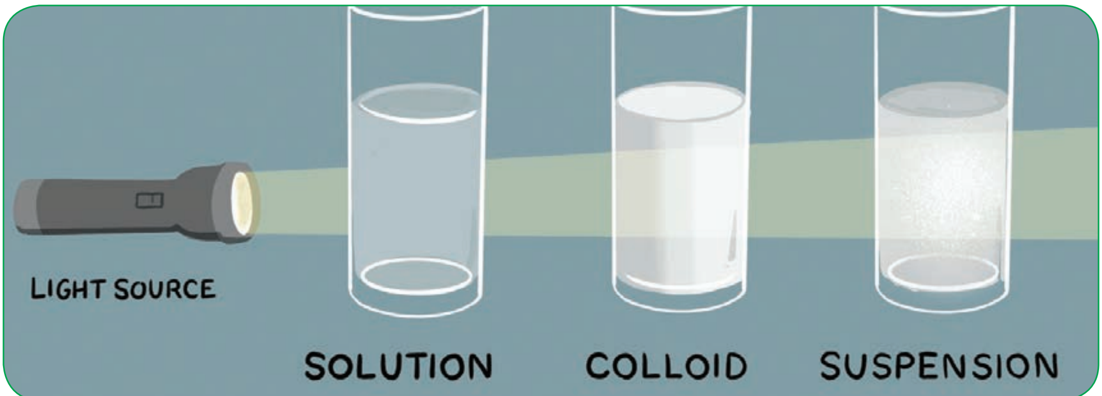


Fig. 9.9

10^{-5} cm or large	10^{-5} cm to 10^{-7} cm	10^{-7} cm or small
Suspension	Colloid	Solution

9.1.7 Utilities of Solution in Our Daily Life

Solution is very important in our daily life. The major utilities of solution are given below:

i. We use many medicines in the form of solution.

ii. We consume many drinks in the form of solution.

iii. The food that we eat is digested and absorbed in the form of solution.

iv. Green plants absorb water and minerals in the form of solution.

v. Aquatic plants and animals take oxygen in the form of solution.

vi. We use ink, paint, etc. in the form of solution.

9.1.8 Methods of Separating Solute from the Solution

In our daily life, we separate the components of different solutions for various purposes. Some solutions have heavier solutes than solvents and in some solutions, solvents are heavier than solutes. On the basis of this fact, various methods are adopted to separate the components of a solution. In this unit, we will study two methods of separation of solute from a solution. They are:

1. Churning method
2. Evaporation

1. Churning method

Churning is the process of shaking up cream or whole milk to make butter, usually using a butter churn. It is a traditional method in which butter is separated from milk by turning a wooden device very quickly and vigrously in opposite directions.

Fig. 9.10

In churning, lighter particles of a suspended solid are separated from the liquid. In rural areas, butter is obtained from curd or milk by using a wooden churn.

Activity 8

- Visit a nearby village along with your science teacher.
- Ask one of the villagers to demonstrate the process of separating butter from curd.
- Observe the process carefully. Prepare a short report and submit to your teacher.

Activity 9

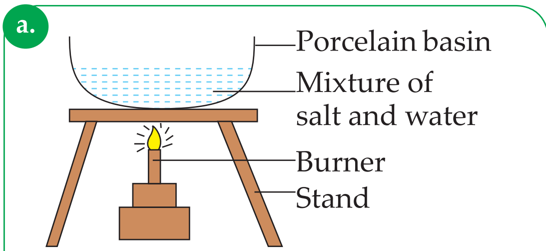
- Draw a neat figure of a wooden churn and demonstrate it in the classroom.

2. Evaporation

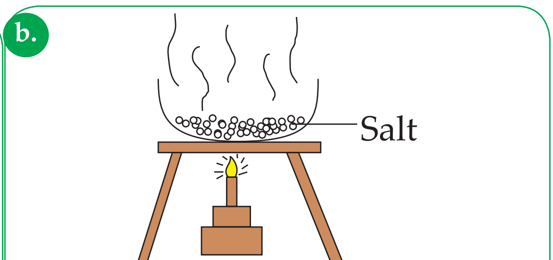
Evaporation is the changing of a liquid into vapour or gas. This method is used to separate the components from homogeneous mixture of solid and liquid such as water and sugar, water and salt, water and copper sulphate, etc.

Do you know?

The principle of evaporation is based on the fact that liquids change easily into vapour on heating but all solids do not change into vapour on heating except iodine, camphor, ammonium chloride, etc.



Evaporation process



Evaporation process

Fig. 9.11

When the mixture of salt and water is heated, the water evaporates. When this process continues, all the water gets evaporated and only salt is left behind. In this way, the mixture of salt and water can be separated by evaporation.

Activity 10

- Take a beaker and keep about 50 ml of water into it.
- Keep about 100 gram of sugar and stir it with a glass rod till all sugar gets dissolved in water.
- Now, heat the beaker and observe evaporation of water.
- Heat the beaker continuously till all water gets evaporated.

When the beaker is heated continuously, all water gets evaporated and only sugar is left behind. This method of separation of mixture is called evaporation.

Evaporation is utilized to separate salt from sea water. We can separate salt, sugar, alum, copper sulphate, etc from their solution by evaporation. Similarly, evaporation is utilized to separate salt from sea water in a large scale. The sea water is trapped in shallow lakes and allowed to remain there. The water present there get evaporated gradually due to the heat of the Sun leaving the common salt as a residue.

Key Concepts

1. A mixture is the resulting mass formed when two or more substances are brought together in any proportion by weight.
2. Homogeneous mixture is that mixture in which mixing components are distributed uniformly and they cannot be seen with naked eyes.
3. Heterogeneous mixture is that mixture in which mixing components are not distributed uniformly and can be seen with our naked eyes.
4. The components of a mixture are separated to remove undesirable components, to remove harmful and useless components, to obtain pure substances and to obtain useful substances.
5. The method which is used to separate liquids from solids or from other liquids through evaporation and condensation is called distillation.
6. A simple distillation is a method which is used to separate the components of the mixture of solid and liquid or the mixture of two liquids having different boiling points of a wide range.
7. The method of separating heavy and light particles from their mixture by rotating the mixture at a very high speed is called centrifugation.

8. A solution consists of two components. They are solute and solvent.
9. Dilute solution is the solution which contains relatively less amount of solute.
10. Concentrated solution is the solution which contains relatively more amount of solute.
11. Churning is the process of shaking up cream or whole milk to make butter, usually using a butter churn.
12. Evaporation is the changing of a liquid into vapour or gas.

Exercise

1. Tick (✓) the best answer from the given alternatives.

a. Which of the following is a homogeneous mixture?

- [ ] sugar and salt
- [ ] sugar and water
- [ ] sand and water
- [ ] soil and water

b. Which of the following is a heterogeneous mixture?

- [ ] salt and water
- [ ] milk and water
- [ ] alcohol and water
- [ ] sand and milk

c. What is the boiling point of alcohol?

- [ ] 100°C
- [ ] 0°C
- [ ] 78°C
- [ ] 32°C

d. Which of the given methods is used to separate the mixture of red ink and green ink?

- [ ] distillation
- [ ] evaporation
- [ ] chromatography
- [ ] churning

e. Which of the given mixture can be separated by distillation?

- [ ] sand and water
- [ ] alcohol and water
- [ ] salt and water
- [ ] blue ink and red ink

2. **Tick (√) the correct statement and cross (×) the incorrect one.**

a. Mixture does not exist in gaseous state. ☐

b. In a heterogeneous mixture, we can see all the components of a mixture. ☐

c. The mixture of sand and camphor can be separated by centrifugation. ☐

d. Chalk powder is used in column chromatography. ☐

e. The mixture of different colour can be separated by chromatography. ☐

3. **Fill in the blanks using appropriate words.**

a. The mixture of salt and water can be separated by ....

b. The mixture of red ink and green ink can be separated by ....

c. Distillation involves two processes, viz. .... and ....

d. ....is used to separate different colours from their mixture.

e. In rural areas, ... method is used to separate cream from milk.

4. **Answer the following questions:**

a. What is a mixture? Give any two examples.

b. Why do we separate the components of a mixture? Give any three reasons.

c. Name any three methods of separating the components of a mixture.

d. What is distillation? Name any two mixtures that can be separated by this method.

e. What is simple distillation? What types of mixtures can be separated by this method?

f. What is chromatography? What types of mixtures can be separated by this method?

g. Write down the principle of chromatography.

h. Name the chemist who introduced chromatography.

i. Define solution, solute and solvent.

j. What type of solution is called a dilute solution?

k. Define concentrated solution.

l. Define suspension and colloid with any two example of each.

m. What is evaporation? What type of mixture can be separated by this method?

n. What is churning?

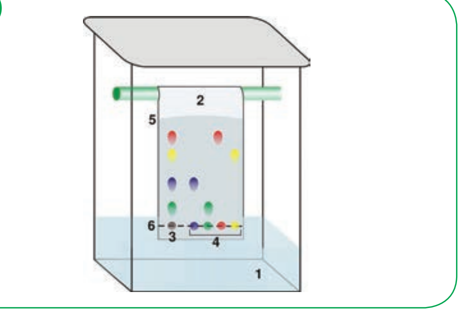
5. Write down the importance of mixtures in our daily life.

6. Write down the importance of solution in our daily life in any four points.

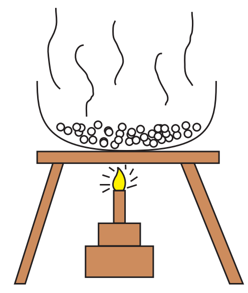
7. How are mixtures classified into three types ? Write.

8. Identify the method of separation of mixture given below :

a.



b.



9. Differentiate between:

a. Dilute solution and Concentrated solution

b. Solute and Solvent

c. Suspension and colloid

10. How is pure salt obtained from the sea water? Describe in brief.

11. How is butter separated from milk or curd in rural areas? Explain with a figure.

12. Can we separate salt and water by churning? Why?

UNIT

10

Materials Used in Daily Life

Estimated teaching periods : 10

Before You Begin

Different chemical substances like common salt, washing soda, soap, phenol, insecticides, plastics, sodium carbonate, sodium bicarbonate, glycerol, sugar, etc. are widely used in our day to day life. Water is also a chemical substance found on the earth's surface. Living organisms need water to survive. We use water for drinking, washing, bathing, cooking food, irrigation and so on. Water may be hard or soft. Glycerol is a sweet thick liquid which is used for making medicine, printing ink, ink for stamp pads, etc. Sodium carbonate is used for making soap, paper, glass, etc. Sodium bicarbonate is used for baking powder, cold drinks, fire extinguisher, etc. In this unit, we will study about various materials that are used in our daily life, metals and non-metals and chemical pollution in brief.

Learning Objectives

After completing the study of this unit, students will be able to:

- Introduce some chemicals that are used in our daily life. (baking soda, sodium carbonate, sodium chloride sucrose)
- Describe the chemicals used for cleansing purpose soap, detergent, phenol and stain remover)
- Introduce metals and non-metals and differentiate between them.
- Describe the properties of metals and state the properties of non-metals.
- Introduce chemical pollution and explain the effect in environment due to poor management of cleaning chemicals poor management of metals and minerals.

Syllabus

- Some useful chemicals as food materials (baking soda, sodium bicarbonate, sodium chloride, sucrose.)
- Chemicals used as cleaners soap detergent, phenol, stain remover, antiseptic.
- Introduction to metals and non-metals.
- Physical properties of metals
- Non-metals and their physical properties
- Chemical pollution environmental effect due to poor management of cleansing chemicals metals and minerals

Glossary

alloy	:	a homogeneous mixture of two or more metals or metals and non-metals
antiseptic	:	preventing or arresting the growth of micro-organisms
baking	:	a process of cooking using dry heat in an oven
corrosive	:	tending to destroy something by chemical action
detergent	:	a petrochemical which is used to wash clothes
diabetes	:	a disease which occurs due to lack of insulin
ductile	:	that can be made into a thin wire
ductility	:	the property of a substance due to which it can be drawn into a wire
fatigue	:	a feeling of being extremely tired
fragrance	:	a sweet or delicate odour as of fresh flowers, pine trees or perfumes
fertilizers	:	the substances that increase the fertility of soil
glycerol	:	a thick sweet liquid of alcohol group
goitre	:	a swelling of the throat caused by a disease of thyroid gland that occurs due to lack of iodine in diet.
insecticide	:	a chemical substance which is used to kill insects
lubricant	:	a substance, i.e. oil that you put on surfaces or parts of machine so that they move easily and smoothly
lustrous	:	having shiny nature.
malleable	:	that can be beaten into different shapes easily without breaking or cracking
metal	:	solid substances which are malleable, ductile and good conductor of heat and electricity
metalloid	:	the substance which shows properties of both metals and non-metals
non-metal	:	soft, non-malleable and non-ductile substances
phenol	:	a chemical which is used for killing germs
salt	:	a substance formed by complete or partial replacement of hydrogen ions by a metal or ammonium radical

10.1 Some Useful Chemicals

10.1.1 Introduction

We use different types of chemical substances in our day to day life. These chemical substances include common salt, sugar, vinegar, phenyl, washing soda, baking soda, oil, ghee, etc. These chemicals are used for various purposes. We use sugar in tea, coffee, sweets, etc. We use washing soda to wash clothes. We use vinegar in pickles. We use common salt to add flavour in food. We use phenyl to kill germs and so on. Among many chemicals, we study about common salt, sugar, ghee, chuk and baking soda, phenol, soap, detergent, antiseptic and stain remover.

a.


Soap

b.


Detergent

c.


Vinegar

d.


Sugar

e.


Ghee

f.


Phenol

Fig. 10.1

Chemical used as food materials

1. Common salt

The chemical name of common salt is sodium chloride (NaCl). It is used daily in our foods to add flavour. Common salt is a white crystalline solid. It is salty in taste.


Salt

Fig. 10.2

We add common salt in pulse, vegetables, pickle and other food items. Common salt is manufactured from sea water by evaporation. Common salt is also found in mines. Some amount of iodine is mixed in common salt which is commonly known as iodized salt.

Iodine is very essential for our body. It helps in healthy growth of children. It also protects us from goitre. Iodine evaporates on heating as it has low boiling point. Therefore, we should add iodized salt in food items just before serving. Similarly, we should keep iodized salt in a closed container to preserve iodine.

Common salt is widely used in vegetables, pulses, pickle, meat and many other food items. It is also used to preserve meat, fish, pickle, etc. It is used to protect food items from being spoiled.

Activity 1

- Discuss among friends and make a list of the various chemicals that are used at home.
- Also write down the main use of each chemical.

2. Sugar

Sugar is a very common sweetening agent. It is used in tea, coffee, sweets, chocolates, cold drinks, etc. It is also used to preserve foods. Sugar is a white crystalline solid. It is prepared from the sugarcane juice. Sugar beets are also used to make sugar. To prepare sugarcane, the stems of sugarcane are collected and washed. Then these stems are crushed to extract juice. The sugarcane juice can be extracted by using traditional sugarcane Kol or modern machines (Crushers). The juice is passed through sugarcane processing machines. Finally, white solid crystals of sugar are obtained. Chemically, sugar is called sucrose. It is also found in apple, pineapple, banana, mango, grapes, etc.

a. *Sugarcane* b. *Sugar mill* c. *Sugar*

Fig. 10.3

Sugar is also found in our blood in the form of glucose. It provides energy to our body. We feel weak and fatigue due to deficiency of glucose in our body. Due to lack of insulin, our body cannot regulate the amount of sugar in blood. As a result, sugar passes out of the body through urine. This condition is known as diabetes or sugar disease.

3. Ghee

Ghee is a very common fatty substance which is used in our daily life. Its chemical name is triglyceride. It is yellowish-white and slippery solid or semi-solid substance. It can be obtained from the milk of cow, buffalo, etc. Vegetable ghee is obtained from the seeds of some plants like chiuri, mustard, sunflower, etc.

a. Animal Ghee b. Vanaspati Ghee

Fig. 10.4

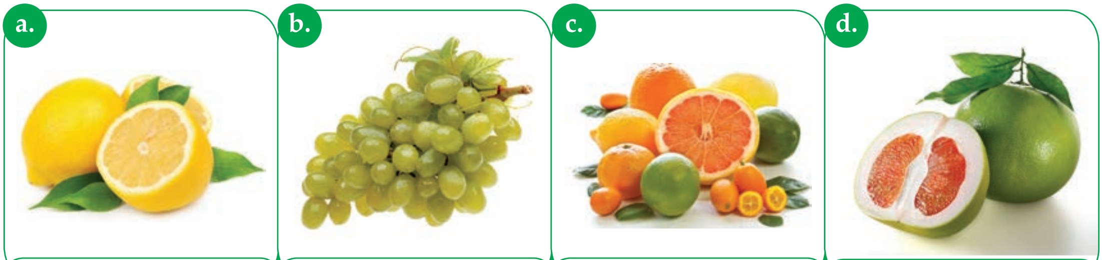
On the basis of source, ghee is of two types, viz. animal ghee and vegetable or vanaspati ghee.

The ghee which is obtained from the milk of animals is called animal ghee and the ghee obtained from the seeds of plants is called vanaspati ghee. First, the seeds of plants are crushed to extract oil. Then the oil is changed into vanaspati ghee by hydrogenation in industries.

During winter or cold days, ghee exists in solid state but in hot summer days, ghee is found in semi-solid state. Ghee is a good source of fat for our body. It provides energy to our body and makes our body smooth and fatty. Our body absorbs different vitamins like vitamin A, D, E and K with the help of ghee. We use ghee in foods and sweets.

4. Chuk

Chuk is a sour chemical substance which is obtained from sour fruits like citrus, lemon, pamilo, pomegranate, bhogate (grape fruit), lime, etc. It is a viscous (thick) fluid having black or brown colour.



a. Lemon | b. Grapes | c. Citrus fruit | d. Pamilo

Fig. 10.5

The chemical name of chuk is citric acid. To get chuk, first of all, the juice of sour fruits like citrus, lemon, etc. is extracted using a traditional Kol or modern machine. Then the juice is boiled continuously for a long time till we get a viscous fluid. Chuk is used in foods and pickles to add flavour. It is the main source of vitamin C. Chuk is also used to preserve foods.

5. Baking soda

The chemical name of baking soda is sodium bicarbonate ($NaHCO_3$). It is widely used in bakeries to make bread soft and spongy. It is also used for making cakes, biscuits and for making soft drinks like soda water.

a. Baking soda | b. Bread | c. Cake

Fig. 10.6

While making bread, wheat flour, water and some amount of baking soda are mixed to make semi-solid paste and the paste is left for a few hours. After a few hours, the paste is used to make bread. From this paste soft, light and spongy bread can be produced due to the presence of baking power.

Activity 2

- Take some baking soda, wheat flour, water and a plate.
- Add some water into the flower. Keep half spoon of baking soda and prepare dough.
- Cover the dough with a bowl and leave for 24 hours. What do you observe? What can you conclude from this activity.

10.1.2 Chemicals Used as Cleansers

1. Phenol

Phenol is a very useful chemicals used for cleansing purpose. It is used to kill germs and clean the surfaces. It helps to remove bad smell and repell houseflies. It is a toxic substance. We should avoid the contact of phenol to skin and eyes. It dissolves easily in water. We should wear gloves while using phenol.

Phenol

Fig. 10.7

2. Soap

Soap is a chemical used for bathing and washing clothes. Soap is generally found in solid form but liquid soap is also available in the market. We use different types of soaps for bathing and washing clothes. Soap dissolves in water and produces lather.

Bathing soap *Washing soap* *Liquid soap*

Fig. 10.8

3. Detergent

Detergent is another chemical used for washing clothes. It is a synthetic petrochemical obtained from hydrocarbon. It is more soluble in water than the soap. So, it has more cleansing property than the soap.

Detergent

Fig. 10.9

4. Antiseptic

Antiseptic is a chemical used as germicide. It dissolves in water. It makes skin germ free. It is commonly used in medical sector.

Antiseptic

Fig. 10.10

5. Stain remover

It is a chemical substance used to remove stains from clothes, carpets or any other surfaces. Stain remover is also used to remove nail polish. It is found in powdered state and liquid state.

Stain remover

Fig. 10.11

Activity 3

- Prepare a list of chemicals that are used at your home for cleaning purposes.
- Take a stain remover and try to remove the stains of clothes using it.
- Also, write how these chemicals are used in our homes.

Key Concepts

1. The chemical name of common salt is sodium chloride (NaCl). It is used daily in our foods to add the flavour. Common salt is a white crystalline solid.
2. Iodine is very essential for our body. It helps in healthy growth of children. It also protects us from goitre.
3. Sugar is a very common sweetening agent. It is used in tea, coffee, sweets, chocolates, cold drinks, etc.
4. Ghee is a very common fatty substance which is used in our daily life. Its chemical name is triglyceride.
5. Chuk is a sour chemical substance which is obtained from sour fruits like citrus, lemon, pamilo, pomegranate, bhogate (grape fruit), lime, etc.
6. Chuk is used in foods and pickles to add flavour. It is the main source of vitamin C. Chuk is also used to preserve foods.
7. The chemical name of baking soda is sodium bicarbonate ($NaHCO_3$). It is widely used in bakeries to make bread soft and spongy.
8. We should avoid the contact of phenol to skin and eyes.
9. Soap is a chemical used for bathing and washing clothes.

Exercise

1. Tick (✓) the correct statement and cross (X) the incorrect one.

a. The chemical name of common salt is sodium chloride. ☐

b. Iodine is not essential for our body. ☐

c. Sugar provides energy to our body. ☐

d. Vegetable oil is changed into vanaspati ghee by hydrogenation. ☐

e. The taste of chuk is sour. ☐

f. We should touch the phenol while using it. ☐

2. Fill in the blanks using appropriate words.

a. Common salt is manufactured from ....

b. Chemical name of sugar is ....

c. In our body, ... helps to absorbs vitamins.

d. .... is obtained from sour fruits.

e. .... is used in cakes, biscuits and breads.

f. Detergent is used for ....

3. Identify the chemicals shown below. Also, write the major use of each.

a.

....

b.

....

c.

....

4. Answer the following questions.

a. What is common salt? Write its chemical name.
b. Write any two uses of common salt.
c. What is sugar? How is it obtained?
d. What is ghee? Write its chemical name.
e. Write down the major use of ghee.
f. What is chuk? Name any two sources of chuk.
g. What is baking soda? Write its chemical name.
h. Write down the major uses of baking soda.
i. Why is baking soda added in flour while making breads?
j. What is soap? Write down the use of detergent.
k. Why is antiseptic used?
l. What is stain remover?

5. Differentiate between:

a. Chuk and Sugar

b. Common salt and Sugar

6. How is sugar prepared? Write in brief.

7. How is chuk prepared? Write in brief.

8. Write down the main use of:

a. Soap b. Detergent c. Phenol d. Stain remover

10.2 Metals and Non-metals

10.2.1 Metal

You have seen cooking utensils, electric wires, jeweleries, weapons, etc. These substances are made of metals. We use a number of metals, non-metals and metalloids in our daily life. Scientists have discovered 118 elements so far. These elements have been classified into metals, non-metals and metalloids on the basis of their physical and chemical properties. Among 118 elements, most elements are metals and only a few are metalloids.

a. *Cooking utensils made of iron*

b. *Cooking utensils made of copper*

c. *Cooking utensils made of aluminium*

Fig. 10.12

Metals are hard, malleable and ductile elements which are good conductor of heat and electricity. We use iron, copper, aluminiun, gold, silver, zinc, etc. These are examples of metals. We use metals for making cooking utensils, vehicles, construction materials, ornaments, furniture, electric wires, weapons and so on.

a. *Truck engine*

b. *Jeweleries*

c. *House pillars*

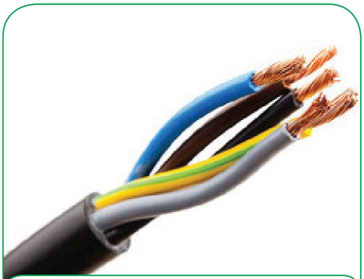
Fig. 10.13

Activity 4

- Observe the materials made of metals that are kept in your home.
- Write down the names and major use of these materials.

Properties of Metals

1. Most metals are found in solid state except mercury.
2. Most metals are malleable, i.e. they can be beaten into thin sheets.
3. Most metals are ductile, i.e. a thin and long wire can be made from metals.
4. Metals are lustrous, i.e. having shiny nature.
5. Metals are good conductor of heat and electricity.
6. They produce tinkling sound on hitting.
7. Most metals are hard except lithium, sodium and potassium.


Copper wire
Fig. 10.14

Activity 5

- Take a piece of wood, a piece of copper, a piece of coal, sulphur, an iron nail, etc.
- Press each of them one by one hard or soft. Try to break them and write down the result in the table.

Substances	Hard	Soft	Can be broken	Cannot be broken
1. Iron nail	√	×	×	√
2. Coal				
3. A piece of copper				
4. Sulphur				
5. Wood				

Activity 6

- Take a sheet of copper, gold ornament, coal, sulphur, paper, a sheet of zinc, etc.
- Observe whether they are shiny or not.
- Fill in the table after your observation.

Substances		Shines	Does not shine
1.	A sheet of copper	√	√
2.	Coal		
3.			
4.			
5.			

Activity 7

Make a list of substances that can be used to make a long wire.

The property of a metal be virtue of which it can be drawn into a long wire is called ductility. Most metals are ductile because they can be drawn into long wires.

Metals can be stretched slowly to make wire. When metals are stretched the positively charged ions and electrons in required amount are stretched slowly. As a result, the metal changes into a wire. This property of metals in called ductility.

The interatomic force of attraction is more in metals. So, they are hard and strong. As metals are hard and strong, they have high melting point and boiling point.

10.2.2 Non-metals

Non-metals are those substances which are generally soft, non-malleable, non-ductile and bad conductors of heat and electricity. They exist in all three states, viz. solid, liquid and gas. Carbon, iodine, sulphur, phosphorus, chlorine, etc. are examples of non-metals.

We use many non-metals in our daily life. Non-metals are used in construction works, to make containers, utensils, medicines, etc.

a. Carbon

b. Phosphorus

c. Sulphur

Fig. 10.15

Properties of Non-metals

1. Non-metals are found in all three states, i.e. solid, liquid and gas.
2. They are non-malleable.
3. They are non-ductile.
4. They are non-lustrous except iodine.
5. They are non-conductors of heat and electricity except graphite.
6. They do not produce tinkling sound on hitting.
7. Non-metals are generally soft.

Do you know?

- All non-metals are bad conductor of heat and electricity except graphite.
- Metals are sonorous and non-metals are non-sonorous.

Activity 8

- Collect various materials found at your home like metal wires, coins, spoon, brick, pencil, lead of pencil, plastics, iron nail, etc.
- Study the characteristics of these substances like malleability, ductility, conductivity, etc.
- Classify them in terms of metal and non-metals.

Differences between Metals and Non-metals

Metals	Non-metals
1. Metals are good conductors of heat and electricity.	1. Non-metals are bad conductors of heat and electricity.
2. They are malleable.	2. They are non-malleable.

3. They are ductile.	3. They are non-ductile.
4. They are lustrous.	4. They are non-lustrous.
5. Most metals are hard.	5. Most metals are soft.
6. They are sonorous.	6. They are non-sonorous.

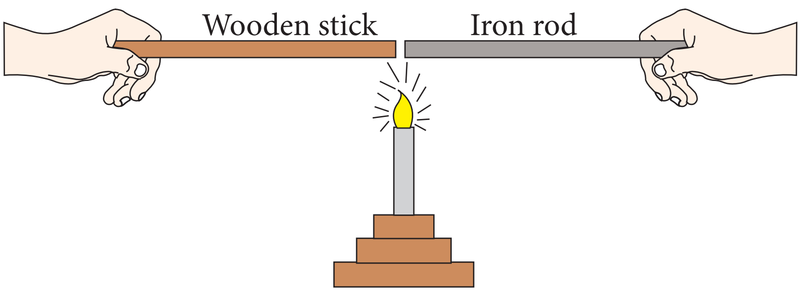
Experiment 1

To demonstrate that metals are good conductor and non-metals are bad conductor of heat.

Requirements : Bunsen burner, spirit lamp or a candle, match box, an iron rod, a wooden stick

Procedure

- Take an iron rod and a wooden stick of the same shape and size.
- Heat the one end of iron rod with a burner/ spirit lamp/ candle for a few minutes and catch the other end of the rod. Repeat the same process for wooden stick.



Copper wire

Fig. 10.16

Observation : The outer end of the iron rod is felt hot when heated for a few minutes but the outer end of wooden stick is not felt hot. Iron is good conductor of heat. So when one end of iron rod is heated for a while its another end is felt hot due to conduction of heat. But wood is bad conductor of heat, it does not conduct heat from one end to another. So another end of wooden stick is not felt hot.

Conclusion : From this experiment, it can be concluded that metals are good conductor and non-metals are bad conductor of heat.

Experiment 2

To demonstrate that metals are good conductor and non-metals are bad conductor of electricity.

Requirements : Battery, electric bulb, copper wire, coin, a piece of wood, rubber, a piece of plastic, a piece of blade

Procedure

- Take a battery, an electric bulb and pieces of copper wire
- Assemble an open circuit as shown in the figure.
- Leave the gap PQ in the circuit.
- Place a coin, to connect the ends of wire PQ. What do you observe? Does the bulb glow? Why?
- Remove the coin and repeat this activity by using a piece of wood, rubber, a piece of plastic, a piece of blade, etc. one by one.

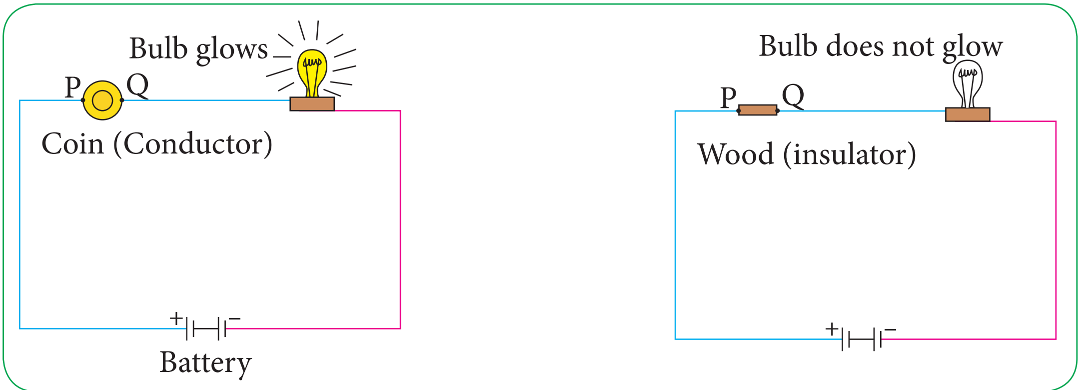


Fig. 10.17

Observation : When the circuit is completed by using metal objects (coin, piece of copper wire, coin, iron, etc.), the bulb glows but the bulb does not glow when circuit is completed with non-metals (wood, rubber, plastic, etc.). It shows that metals are good conductors and non-metals are bad conductors of electricity.

Conclusion : From this experiment, it can be concluded that metals are good conductor and non-metals are bad conductor of electricity.

Experiment 3

To demonstrate that metals are malleable and non-metals are non-malleable.

Requirements : Hammer, a thick copper wire, a thick iron wire, a piece of brick, a piece of stone

Procedure

- Take a thick wire of iron and hit it several times with a hammer. Now, take a piece of brick and hammer it. What do you observe?
- Repeat this activity with a thick wire of copper and a piece of stone. What do you observe?

Observation : Copper wire and iron wire become flat on hammering but they do not break down into pieces. It shows that metals are malleable. On other hand, brick and stone break down into many small pieces on hammering. It shows that non-metals are non-malleable.

Conclusion : From this experiment, it can be concluded that metals are malleable and non-metals are non-malleable.

Experiment 4

To demonstrate that metals are lustrous and non-metals are non-lustrous.

Requirements : steel plate, wooden board, cardboard paper,

Procedure

- Take a steel plate and reflect the sunlight using the plate.
- Repeat this activity with wooden board and cardboard paper one by one. What do you observe? Which object appears shiny? Why?

Observation : Steel plate appears shiny and reflects light. But the wooden board and cardboard paper do not reflect light. It shows that steel plate is lustrous but wooden board and cardboard are non-lustrous.

Conclusion : From this experiment, it can be concluded that metals are lustrous and non-metals are non-lustrous.

Experiment 5

To demonstrate that metals are sonorous and non-metals are non-sonorous.

Requirements : A hammer, a bell, steel plate, wooden block, brick

Procedure

- Take a hammer and hit a bell, steel plate, wooden block, brick one by one.
- Observe which object produces tinkling sound while hammering. Is there any difference between the sound produced by metals and non-metals when they are hammered? What do you observe?

Observation : The metal articles (bell, steel plate) produce tinkling sound and non-metals (wooden block, brick) do not produce tinkling sound on hammering. It shows that metals are sonorous and non-metals are non-sonorous.

Conclusion From this experiment, it can be concluded that metals are sonorous and non-metals are non-sonorous.

10.3 Chemical Pollution

10.3.1 Introduction to Chemical Pollution

We use a variety of chemical substances in our daily life. These chemical substances pollute the environment. The environment pollution caused by various chemical substances is called chemical pollution.

Chemical pollution

Fig. 10.18

Besides chemical substances, natural phenomena are also responsible for chemical pollution. Chemical substances like plastics, chemical fertilizers, insecticides, detergents, colours, synthetic cleansers, etc. cause chemical pollution.

Activity 9

- Observe various substances in your surroundings that cause environmental pollution.
- Note down these substances and identify the sources from where they come.
- Classify these substances in terms of metals, non-metals, minerals or any other chemicals.
- Discuss the adverse effect of these substances in the environment.
- Prepare a short report and submit to your science teacher.

10.3.2 Environmental Effect due to Poor Management of Cleansing Chemicals

We use a variety of substances for cleaning purpose. Soap, detergent, shampoo, dettol, phenol, acid, etc. are the most common cleansers prepared artificially. These substances contain harmful chemicals that pollute the environment. Use of these chemicals pollute air, water and soil. These substances also affect human health adversely. Therefore, we should know the adverse effects of these substances before using them.

Pollution due to detergents

Fig. 10.19

The harmful chemicals present in the synthetic cleansers like detergent, phenol, etc. degrade the composition and quality of soil. They affect the fertility of soil. Similarly mixing of solution of detergents in soil affects the growth and development of plants adversely. Therefore, we should reduce the use of synthetic cleansers to reduce environmental pollution. Aquatic animals may die due to mixing of these chemicals in water.

10.3.3 Environmental Effect due to Poor Management of Metals

Metals are useful for human beings. We use a variety of substances made of metals in our daily life. Now-a-days, we see so many substance like used blades, tin cans, iron nails, etc. thrown in our surroundings. These things do not decay for a long time and cause environmental pollution. We should dispose these substances properly. Similarly these substances should be recycled and reused as far as possible.

Thrown metals cause environmental pollution

Fig. 10.20

Some metals like mercury, lead, cobalt, etc. are harmful for human health. These metals affect aquatic animals when get mixed in water. Therefore, we should dispose such type of metals carefully to reduce environmental pollution.

10.3.4 Environmental Effect due to Poor Management of Minerals

We use a variety of minerals like petrol, coal, diesel, sulphur, etc. Unmanaged use of fossil fuels is the main cause of environmental pollution. When fossil fuels burn in air, they produce harmful gases and pollute the air. The amount of carbon, smoke and carbon dioxide increases in the atmosphere. Polluted air affects the health of living beings adversely. Therefore, we should find the alternative of fossil fuels to conserve environment

Air pollution due to burning of fossil fuels

Fig. 10.21

The processing of minerals also causes environment pollution. Mixing of harmful minerals in soil affects the quality of soil. Mixing of dust from cement factories causes air pollution. Similarly, the smoke produced from brick factories also pollutes the air.

Smoke produced from cement factory

Fig. 10.22

Activity 10

- Observe the status of chemical pollution in your locality.
- Identify the chemical substances causing pollution.
- Suggest the measures to reduce chemical pollution in your locality.

Key Concepts

1. Metals are the elements having conductivity, malleability and ductility.
2. We use metals like copper, aluminium, etc. for making electric wires as they conduct electricity.
3. Metals are malleable in nature. It means that metals can be converted into thin sheets by hammering.
4. Metals are shiny. They reflect light and shine brightly.
5. Non-metals are the elements which do not have malleability and ductility.
6. Metalloids are those elements that show the properties of both metals and non-metals.
7. Soap, detergent, shampoo, dettol, phenol, acid, etc. are the most common cleansers prepared artificially. These substances contain harmful chemicals that pollute the environment.
8. We should reduce the use of synthetic cleansers to reduce environmental pollution.
9. When fossil fuels burn in air, they produce harmful gases and pollute the air.

10. The processing of minerals also causes environment pollution. Mixing of harmful minerals in soil affects the quality of soil.

Exercise

1. Tick (✓) the correct statement and cross (×) the incorrect one.

a. Metals conduct heat and electricity. ☐

b. Non-metals are lustrous. ☐

c. Copper and iron are examples of metalloids. ☐

d. Silver does not conduct electricity. ☐

e. Harmful gases in the air cause pollution. ☐

2. Fill in the blanks using appropriate words.

a. .... are malleable and ductile.

b. Non-metals do not conduct heat and ....

c. .... produce tinkling sound on heating.

d. Silicon and arsenic are ....

e. Metals like ...., cobalt and lead are harmful for human health.

3. Tick (✓) the best answer from the given alternatives.

a. .... are malleable and ductile.

☐ metals ☐ non-metals

☐ metalloids ☐ elements

b. Which of the following elements is a non-metal

☐ silver ☐ chlorine ☐ gold ☐ iron

c. Which of the given elements shows the properties of both metals and non-metals?

☐ oxygen ☐ carbon ☐ silicon ☐ copper

d. Which of the given element is the best conductor of electricity?

☐ gold ☐ silver ☐ copper ☐ iron

e. Which of the given element undergoes rusting?

☐ silver ☐ iron ☐ copper ☐ gold

4. **Answer the following questions.**
   a. What are metals? Give any five examples.
   b. Write any five properties of metals.
   c. Write any five uses of metals.
   d. What are non-metals? Give any three examples.
   e. Write any five properties of non-metals.
   f. Write any five uses of non-metals.
   g. Name any three factors that cause chemical pollution.
5. **Differentiate between:**
   a. Metals and Non-metals b. Non-metals and Metalloids
6. **Write any four uses of each of the given metals.**
   a. Iron c. Copper
7. **Give reason.**
   a. Gold and silver are called metals.
   b. Iron and copper are used for making cooking utensils.
   c. Silicon is called a metalloid.
   d. Chlorine and iodine are called non-metals.
   e. Gold is used for making jeweleries.
8. **Describe an activity to show that metals are good conductor and non-metals are bad conductor of electricity.**
9. **Describe an activity to show that metals are malleable and non-metals are non-malleable.**
10. **Describe an activity to demonstrate that metals are sonorous in nature.**
11. **What is chemical pollution? Write the main causes of chemical pollution.**
12. **Write any five measures to reduce chemical pollution.**
13. **What is shown in the given figure? Write a short note on it.**

14. **Observe the condition of pollution in your locality and prepare a short report on it.**
15. **Describe the environmental effect due to poor management of cleansing chemicals.**
16. **Describe the effect of environment due to poor management of metals and minerals.**

UNIT

11

The Earth and Space

Estimated teaching periods : 10

Before You Begin

The earth is our home planet. Different types of plants and animals live on the earth. The earth revolves around the sun in an elliptical orbit. The shape of the earth is spherical. Its diameter is about 12756km. However, the earth is not a perfect sphere. It is flat at poles and bulging out at equator. The external surface of the earth is made of rocks, soil and water. The outer surface of the earth is hard and strong. It consists of plains, valleys, hills, mountains, plateaus, rivers, lakes, ponds, oceans, etc. Similarly, the internal part of the earth consists of crust (outer layer, mantle (middle layer) and cone (inner layer). In this unit we will study about external and structure of the earth in brief.

The earth is our home planet. All planets and animals live on the earth. The earth revolves around the sun in an elliptical orbit. The earth is a member of solar system. The family of the sun that includes the sun, eight planets, natural satellites, comets, asteroids, meteors, meteorites, etc. is called the solar system. Similarly, planets are heavenly bodies that revolve around the sun.

Most part of the earth is covered with soil. It provides habitat for plants and animals. Green plants get water and minerals from the soil for making food. Crawling insects, bacteria, fungi, etc. complete their life cycle in soil. Human beings depend on soil for various purposes. Soil provides favourable environment for survival of living beings on the earth. Soil is the mixture of weathered rock particles, sand, minerals and dead remains of plants and animals.

Learning Objectives

After completing the study of this unit, students will be able to:

- describe internal structure of the earth.
- state the position of the earth in solar system.
- explain four seasons that occur on the earth.
- introduce soil and describe the formation of soil.
- state composition of soil and explain soil profile with figure.
- introduce soil erosion, deposition and soil conservation.

Syllabus

- Internal structure of the earth
- The earth in the solar system
- Season change
- Solar system, Planets, Satellite, Comets, Meteors and Meteorites
- Soil- formation and composition
- Soil profile
- Soil erosion and deposition
- Soil conservation
- Soil pollution

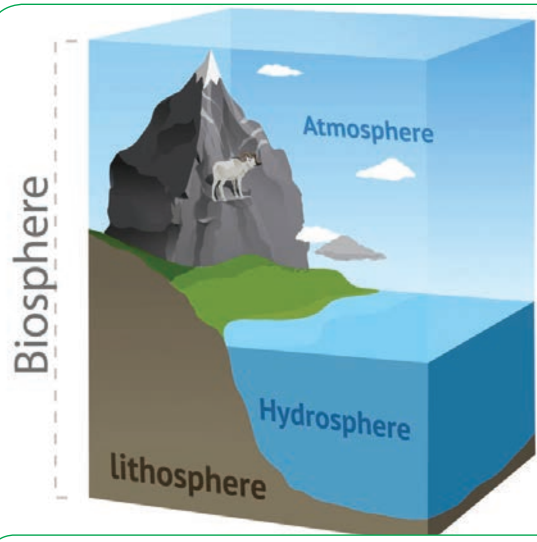
Glossary

afforestation	:	a process of planting trees in large numbers on bare land
asteroid	:	any one of the many small planets which go around
comet	:	a mass of ice and dust which looks like a bright star with a tail
comet	:	a mass of ice and dust that moves around the sun and looks like a bright star with a tail
conservation	:	a careful preservation and protection of something, planned management of natural resources to prevent exploitation, destruction, etc.
crust	:	the outermost solid and hard layer of the earth.
degradation	:	the damage or disturbance to any aspect of something
deposition	:	a process of depositing materials taken away during erosion
embankment	:	a raised structure used specially to hold back water or to carry a roadway
elliptical	:	oval shaped
erosion	:	a process of carrying away the weathered particles by wind, water, etc.
humus	:	a substance made from dead leaves and plants
hydrosphere	:	the part of water present on the earth
lithosphere	:	the part of land present on the earth
luminous	:	having own source of light for shining in the dark
mantle	:	the layer of the earth between the crust and the core
minerals	:	the natural materials which contain metals, non-metals and their compounds
opaque	:	object which does not allow light to pass through
orbit	:	a curved path followed by a planet
penumbra	:	the lighter patch of the shadow that surrounds the umbra
planet	:	the heavenly body that revolves around the sun
satellite	:	the heavenly body that revolves around the planet
solar	:	related to or of the sun
stars	:	the bright twinkling objects having their own source of light
umbra	:	the completely dark central patch of a shadow
weathering	:	the action of the sun, rain or wind on rocks, making them change their shape or colour

11.1 The Earth

11.1.1 External Structure of the Earth

The earth is the planet where we live in. Different types of plants and animals live on the earth. We construct houses, buildings, roads, bridges, school, industries, etc. on the earth. We cultivate crops, fruits and vegetables on the earth. All living begins get food living beings get food and shelter from the earth.



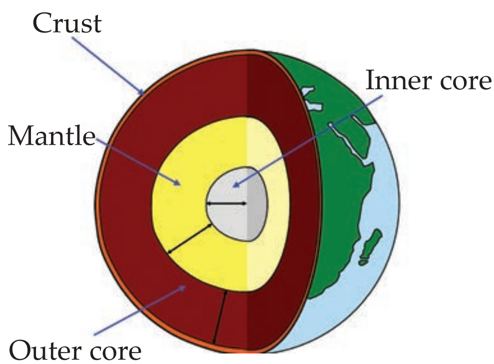
External structure of the Earth

Fig. 11.1

The shape of the earth is spherical like an orange. Its poles are flat but the earth is bulged out at equatorial region. The earth revolves around the sun in its elliptical orbit. The earth can be divided into three spheres. They are hydrosphere (the part of water), lithosphere (the part of land) and atmosphere (the part of air). All three spheres of the earth form biosphere.

11.1.2 Internal Structures of the Earth

The earth is the home of different plant and animals. It is very difficult to study the internal structure of the earth. It is studied with the help of earthquake and volcano. Scientists were able to study the inner parts of the earth having the radius of about 6400 km. The internal part of the earth is divided into crust, mantle, outer core and inner core. The brief description of these four layers of the internal part of the earth is presented below.



Internal structure of earth

Fig. 11.2

Crust

The outermost and thinest layer of the earth is crust. The average thickness of crust ranges from 5 to 50 km with the variation of temperature from 25°C to 75°C. The temperature of the crust increases with the increase in its depth. The pressure on the surface of the crust is one atmosphere and its density is about 3gm/cm^3. Generally, the crust is found in solid state. The elements found in crust are gases, liquids and solids. The elements that cover about 90% part of the crust are oxygen, aluminium, silicon, iron and calcium. The crust consists of various land structures like mountains, hills, plains, valleys, etc. including water bodies, deserts, farm lands, forests, etc.

Do you know ?

The earth is divided into three spheres. They are hydrosphere, lithosphere and atmosphere.

Mantle

The thickest layer of the earth found just beneath the crust is called mantle. It is 2 – 3 times heavier than the crust with thickness of about 2900 km. Similarly, the average pressure of mantle is 2 – 3 times more than that of crust. The temperature in mantle ranges from 750°C to 2500°C. The important elements found in mantle in molten state are iron, magnesium, silicon and oxygen. The molten state of these elements is called magma. During volcanic eruption, this molten magma escapes out of the earth's surface.

Outer Core

The third layer of the earth which is found between mantle and inner core is called outer core. It is the second thickest layer of the earth with thickness about 2100 km. Its temperature ranges from 2500°C to 3000°C. The density of the outer core ranges from 8gm/cm^3 to 10gm/cm^3 with pressure about 1.5 million atmospheric pressure. The important elements found in outer core liquid state are iron, cobalt and nickel.

Inner Core

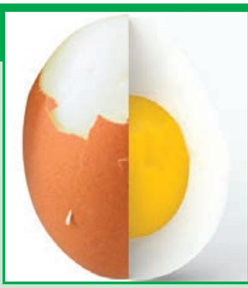
The central layer of the earth with thickness is about 1300 km is called inner core. It is the innermost layer of the earth with temperature ranging from 3000°C to 5000°C. The pressure in the inner core is about

3.5 million atmospheric pressure and its density is about 18 gm/cm^3. The substances in inner core are found in solid state due to its high pressure. The important elements found in inner core are iron, cobalt and nickel.

Activity 1

Draw a neat figure showing the internal structure of the earth and label the various parts.

Activity 2



- Take an egg and boil it.
- Take a knife and cut the boiled egg.
- Compare the structure of the egg with the internal structure of the earth. What can you conclude from this activity?

Activity 3

- Take clay of different color.
- Prepare the model of the earth using the clay. Use the clay of different color to make different layer of the earth.
- Demonstrate the model in your classroom.

11.1.3 The Earth in the Solar System

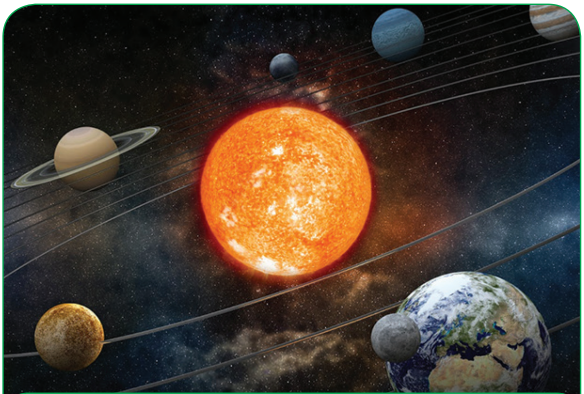
The earth is the third nearest planet from the sun. The earth has plenty of water, suitable temperature and life supporting gases. Therefore, life can exist on the earth. The earth is the only planet having all the requirements for the existence of life. The earth takes 24 hours to complete one rotation in its own axis. Similarly, the earth takes 365.25 days to complete one revolution around the earth. The revolution of the earth around the sun causes the change in seasons

The earth

Fig. 11.3

and the rotation of the earth causes day and night. The earth has only one satellite, i.e. the moon.

Solar system is the family of the sun which consists of eight planets and their satellites, comets, asteroids, meteors, meteorites, etc. The sun occupies the central position of the solar system. All the planets and other members of the solar system revolve around the sun in fixed paths called orbits.



Solar System

Fig. 11.4

11.1.4 Change in the Position of the Earth and the Sun

The shape of the earth is like an orange. It is spherical but not a perfect sphere. The earth is bulging at the equator and flat at the poles. The earth revolves around the sun in an elliptical orbit. This motion of the earth is called revolution. The earth takes 365 days to complete one revolution around the sun from west to east.

The earth spins in its own axis. This motion of the earth is called rotation.

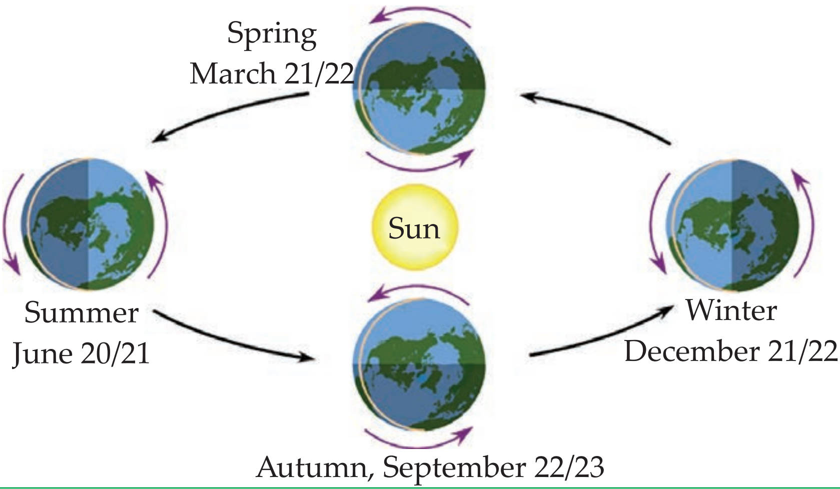
The earth takes 24 hours to complete one rotation in its own axis. The imaginary line passing through the north and south pole of the earth is called axis. The axis of rotation of the earth is tilted at an angle of 66.5° with its orbital plane. It has following effects on the earth.

1. Days and nights are not equal except in the equatorial region. Some days are longer than nights and some nights are longer than days.
2. The sunrise and sunset do not always take place from the same place.
3. The change of seasons take place on the earth.
4. The height of the sun from the earth in the afternoon changes every day.
5. The rays of the sun do not fall perpendicularly in a place all the time. It affects the climate of that place.

11.1.5 Change of Seasons

The earth completes one revolution around the sun in 365 days. The earth revolves around the sun in an elliptical orbit and the axis of rotation of the earth is tilted at an angle of 66.5°. Due to these reasons, the earth is not always at the same distance from the sun which results in the change in seasons on the earth. The duration of one year, i.e. 365 days is divided into four seasons. They are:

i. Summer season
ii. Autumn season
iii. Winter season
iv. Spring season



Formation of seasons on the earth

Fig. 11.5

The tilted axis of rotation of the earth always lies in the same direction. Due to this, the position of the northern and southern hemispheres of the earth towards the sun keeps on changing throughout the year. When the northern hemisphere is tilted towards the sun, we experience summer and the people in the southern hemisphere experience winter. Spring and autumn seasons occur when the earth lies in between these two extreme positions in its orbit.

On June 21, i.e. 8th of Asar, the earth lies the farthest from the sun in the southern hemisphere, but the nearest from it in the northern hemisphere. So, the northern hemisphere experiences the longest day and the southern hemisphere experiences the shortest day on June 21. At this time, the summer season occurs in the northern hemisphere and the winter season occurs in the southern hemisphere.

On December 22, i.e. Poush 7, the northern hemisphere has the shortest day and the southern hemisphere has the longest day. At this time, the winter season occurs in the northern hemisphere and the summer season occurs in the southern hemisphere.

On March 21, i.e. Chaitra 8, the sun lies above the equator and the days and nights are equal in all parts of the earth. At this time, the spring season occurs in the northern hemisphere and the autumn season occurs in the southern hemisphere.

On September 23, i.e. Asoj 7, the rays of the sun fall perpendicularly on the equator. So, day and night are equal in both hemispheres. At this time, the autumn season occurs in the northern hemisphere and the summer season occurs in the southern hemisphere.

Differences between Summer season and Winter season

Summer season		Winter season	
1.	It is the hottest season of the year.	1.	It is the coldest season of the year.
2.	It has longer days and shorter nights.	2.	It has longer nights and shorter days.

11.1.6 Types of Seasons

The duration of one year is divided into four seasons which are as follows:

1. Spring season
2. Summer Season
3. Autumn season
4. Winter season

1. Spring season

In Nepal, spring season occurs in Fagun, Chaitra and Baisakh, i.e. from February to April. In the northern hemisphere, spring season comes after winter season. Days become longer gradually and nights become shorter during spring season. On 21st March, i.e. 7th of Chaitra, day and night are almost equal.

In spring season, weather is neither too hot nor too cold. Trees sprout and produce flowers. Plants are full of fresh leaves, buds and flowers. Animals and birds enjoy in the forest and butterflies can be seen on flowers.

2. Summer season

In Nepal, summer season occurs in Jestha, Asar and Shrawan, i.e. from May to July. In the northern hemisphere, summer season occurs after spring. During this season, days are long and nights are short. On 21st June, i.e. 7th of Asar the day is the longest and the night is the shortest. It is the warmest season of the year.

a.

Landslide

b.

Eating ice-cream

c.

Planting paddy

Fig. 11.6

Heavy rainfall, floods and landslides occur in summer season. Plants appear green. We wear light clothes and use fans, coolers, etc. during this season. Farmers cultivate crops and most insects reproduce during summer season. It is very hot in the midday. We prefer cold drinks and ice creams during summer season.

3. Autumn Season

In Nepal, autumn season occurs in Bhadra, Ashwin and Kartik, i.e. from August to October. In the northern hemisphere, autumn season occurs after summer season. Days and nights are almost equal in this season. Both days and night are equal on 23rd September, i.e. 7th of Ashwin.


Autumn season

Fig. 11.7

In autumn season, we cultivate winter crops like wheat, barley, lentil, mustard, potatoes, etc. Some flowers like marigold, makhamali, etc. bloom in this season. Rainfall decreases and fruits and crops ripen in this season. We harvest crops like maize, rice, soyabean, etc. during autumn. In cold countries, leaves of plants dry and become yellow. In this season, weather is neither too hot nor too cold.

4. Winter season

In Nepal, winter season occurs in Mangsir, Poush and Magh, i.e. from November to January. It is the coldest season of the year. In the northern hemisphere, winter season comes after autumn. During winter season, the sun rays falling on the earth are slanted causing very less heating. Therefore, we feel very cold during winter. The days are short and nights are very long during winter. On 22nd December, i.e. 7th Poush, the day is the shortest and the night is the longest.

a.

Snowfall

b.

Warming body in winter

Fig. 11.8

During winter, snowfall occurs in high hills and mountains. We like to eat hot foods and drinks. We wear warm clothes and use a heater in the room to keep our body warm. Leaves of trees become dry and fall down, grasses get dry and die. Some animals go for hibernation during winter season.

Activity 4

What changes can you observe in spring, summer, autumn and rainy seasons? Ask to your seniors and prepare a short report on it.

11.1.7. Season in the Context of Nepal

In Nepal the duration of one year has been divided into six seasons. Each season has two months which are as follows:

	Name of the season	Months included
1.	Spring season	Chaitra and Baisakh
2.	Summer season	Jestha and Asar

3.	Rainy season	Shrawan and Bhadra
4.	Autumn season	Ashoj and Kartik
5.	Pre-winter season	Mangsir and Poush
6.	Winter season	Magh and Falgun

Activity 5

Take a chart paper. Draw figures showing the features of six seasons. Also, mention the agricultural activities that are done in different seasons in Nepal.

Key Concept

1. The internal part of the earth is divided into crust, mantle, outer core and inner core.
2. The outermost and thinest layer of the earth is crust.
3. The thickest layer of the earth found just beneath the crust is called mantle.
4. The third layer of the earth which is found between mantle and inner core is called outer core.
5. The central layer of the earth with thickness is about 1300 km is called inner core.
6. The earth is the only planet having all the requirements for the existence of life.
7. All the planets and other members of the solar system revolve around the sun in fixed paths called orbits.
8. The earth takes 365 days to complete one revolution around the sun from west to east.
9. The duration of one year, i.e. 365 days is divided into four seasons. They are:

   i. Summer season
   ii. Autumn season
   iii. Winter season
   iv. Spring season

Exercise

1. Tick (✓) the best answer from the given alternatives.

a. The outermost layer of the earth is ....

☐ crust ☐ mantle ☐ outer-core ☐ inner-core

b. The thickness of the mantle is ....

☐ 50 km ☐ 2900 km ☐ 500 km ☐ 290 km

c. In Nepal, ... season occurs in Jestha, Asar and Shrawan.

☐ Spring ☐ Winter ☐ Autumn ☐ Summer

d. The earth takes .... to complete one rotation around its own axis.

☐ 365 days ☐ 7 days ☐ 24 hours ☐ 365 hours

e. In Nepal, the duration of one year has been divided into ....

☐ three ☐ four ☐ five ☐ six

2. Fill in the blanks using appropriate words.

a. The thickness of the outer core is ....

b. The temperature of inner core ranges from ....

c. The earth is the .... nearest planet from the sun.

d. The earth completes one revolution around the sun in ....

e. During ...., snowfall occurs in maintains and high hills.

3. Tick (✓) the correct statement and cross (×) the incorrect one.

a. Outer core is the second inner layer of the earth. ☐

b. The temperature in mantle ranges from 750°C to 2500°C. ☐

c. On March 21, day and night are equal in all parts of the earth. ☐

d. In Nepal, heavy rainfall and flood occurs in spring season. ☐

e. Summer season has shorter nights and longer days. ☐

4. Answer the following questions.

a. What is crust? Write its two features.

b. What is outer core?

c. Which elements are found in the inner core?

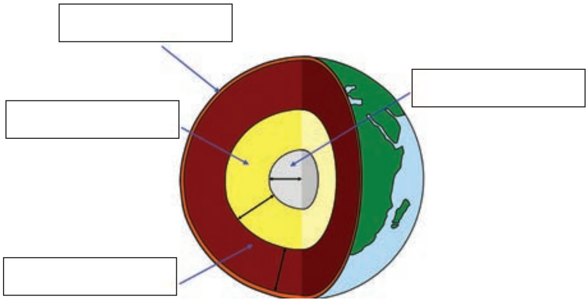
d. What is solar system?

e. When do spring season and summer season occur.

f. What is axis?

g. What is the natural satellite of the earth?

5. **Label the parts A, B, C and D shown in the given figure. Also, write any two features of each.**



6. **Differentiate between:**

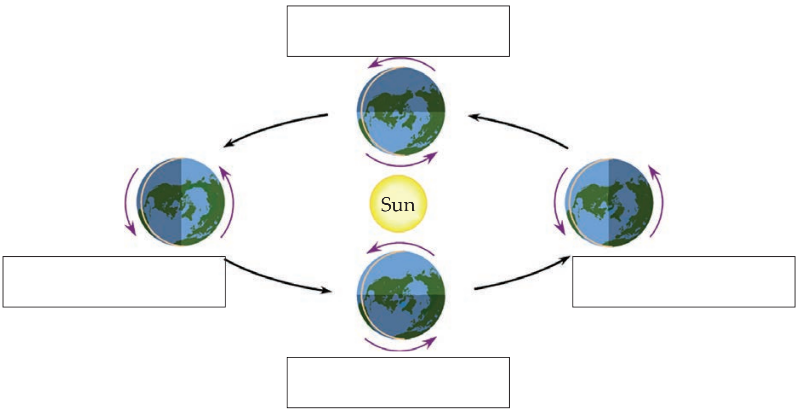
a. Crust and mantle

b. Mantle and core

c. Spring season and winter season

7. **Draw a neat and labelled figure showing the internal structure of the earth.**

8. **Complete the data in the given figure.**

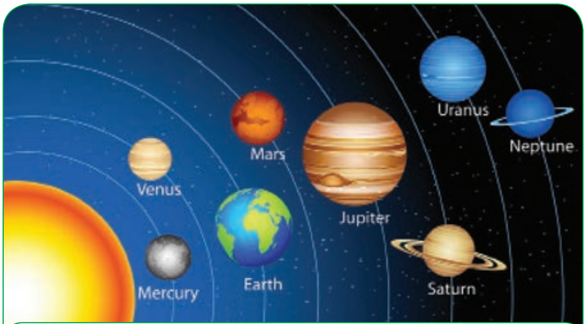


7. **Make a list of seasons that occur in Nepal.**

11.2 Solar System

11.2.1 The Sun

The Sun is the brightest heavenly object. It is a medium sized star close to the earth. The Sun is extremely hot. It is a huge ball of burning gas. So it is extremely hot. It releases a large amount of heat and light energy. All the plants, animals and human beings use the solar energy. Life would not exist on the earth in the absence of the Sun.



Solar System

Fig. 11.9

Solar system is the family of the Sun which consists of eight planets and their satellites, comets, asteroids, meteors, meteorites, etc. The Sun occupies the central position of the solar system. All the planets and other members of the solar system revolve around the Sun in fixed paths called orbits.

Project work

- Take a chart paper and draw a neat and labelled figure of the solar system.
- Put suitable colour on the picture and demonstrate in your classroom

Do you know ?

- The Sun is the brightest heavenly body that we see from the earth.
- Animals and plants cannot survive on the earth in the absence of the Sun.

11.2.2. Planets

We know that the earth revolves around the Sun in its own orbit. So, it is called a planet. Planets are heavenly bodies that revolve around the Sun in elliptical paths called orbits. Planets do not have their own source of light for shining. So they are called non-luminous bodies. However, planets appear bright in the sky as they reflect the light coming from the Sun. The Sun holds all planets together with its strong force of attraction which is called gravitation.

There are eight planets in the solar system. The eight planets of the solar system in the order of their increasing distance from the Sun are given below:

(i) Mercury	(ii) Venus	(iii) Earth	(iv) Mars
(v) Jupiter	(vi) Saturn	(vii) Uranus	(viii) Neptune

A brief description of all the planets of the solar system is given below:

1. Mercury

Out of the eight planets, mercury is the closest planet to the sun. It is the smallest planet of the solar system. Life cannot exist on the mercury as it has no atmosphere. The part of the mercury that faces the sun is extremely hot and the other part is extremely cold. Mercury has no satellites.

Mercury

Fig. 11.10

Activity 6

- Mercury can be seen just before the sunrise in September and October. It can also be seen just after the sunset in March and April.
- Observe the mercury in the sky and write its three features after your observation

Do you know?

- Mercury is the smallest planet of the solar system.
- Venus is the hottest and brightest planet of the solar system.

2. Venus

Venus is the nearest planet to the earth. It is the brightest and hottest planet of the solar system. Life cannot exist on the venus. The atmosphere of the venus consists of carbon dioxide. This planet also has no satellites.

Venus

Fig. 11.11

Activity 7

- Venus can be seen just before the sunrise and just after the sunset.
- Observe the venus and write its three salient features.

Do you know?

- Mars is called a red planet.
- Jupiter is the largest planet of the solar system.

3. Earth

The earth

Fig. 11.12

The earth is our home planet. It is the third nearest planet from the Sun. The earth has plenty of water, suitable temperature and life supporting gases. Therefore, life can exist on the earth. The earth is the only planet having all the requirements for the existence of life. The earth takes 24 hours to complete one rotation in its own axis. Similarly, the earth takes 365.25 days to complete one revolution around the earth. The revolution of the earth around the Sun causes the change in seasons and the rotation of the earth causes day and night. The earth has only one satellite, i.e. the moon.

4. Mars

Mars

Fig. 11.13

Mars is commonly known as a red planet. It is the fourth distant planet from the Sun. It is nearly half the size of the earth. The mars can be seen with our naked eyes and it looks like a bright orange red star. The atmosphere of the mars mainly consists of nitrogen gas. It has two natural satellites. They are phobos and deimos.

5. Jupiter

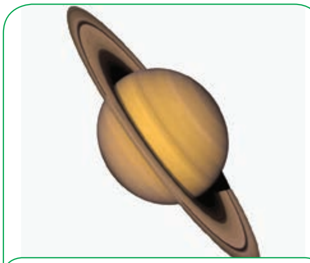
Jupitar

Fig. 11.14

Jupiter is the largest planet of the solar system. It looks like a bright star with our naked eyes. Jupiter is the third brightest object in the night sky after the moon and the venus. The jupiter consists of bands of clouds and a big red spot. This planet has 79 known satellites.

6. Saturn

Saturn is the second largest planet of the solar system. It is the third farthest planet from the sun. The Saturn is surrounded by rings of dust and rocks. This planet has 62 known satellites. Titan is the largest satellite of the Saturn.



Saturn

Fig. 11.15

7. Uranus

Uranus is the second farthest planet from the Sun. It is a very cold planet. It has rings around it like the Saturn. This planet has 27 known satellites.

Uranus

Fig. 11.16

8. Neptune

Neptune is the coldest planet of the solar system. It cannot be seen with our naked eyes. This is the farthest planet of the solar system. Neptune has 14 known satellites.

Neptune

Fig. 11.17

11.2.3 Satellites

We all know that planets revolve around the sun in elliptical orbit. In the same way, some heavenly bodies revolve around the planets, which are called satellites. The moon revolves around the in its own-elliptical orbit. So it is considered as the satellite of the earth. A satellite is a heavenly body which revolves round a planet on its own orbit. There are two types of satellites. They are:

1. Natural satellites
2. Artificial satellites

1. Natural satellites

The moon is the natural satellite of the earth. A satellite which is made by nature that revolves continuously around a planet is called a natural satellite. Examples: Moon,Phobos,Titan, Triton, Arial, Deimos,etc. In solar system, all the planets have satellites except mercury and venus. Jupiter has 79 known planets.

Moon

Moon is the natural satellite of the earth. The diameter of the moon is about 3456 km. The mean distance between the earth and the moon is about 382400 km. Gravitational force of the earth holds the moon in its orbit. The moon has no air and water. Days are extremely hot and nights are very cold on the moon.

Moon

Fig. 11.18

The size of the moon is very small though the size of both sun and moon appears similar. The size of the sun is extremely large as compared that of the earth and moon. If the size of the moon is considered as that of a mustard grain, the size of the earth and the sun will be that of pea and basketball respectively.

The diameter of the sun is about 1400000 km and that of the earth is 12735 km. It shows that the sun is 110 times larger than the earth. Similarly, the diameter of the moon is about 3475 km. It shows that the size of the sun is about 403 times larger than that of the moon. Similarly, the size of the earth is 3.66 times larger than that of the moon.

2. Artificial satellites

Now-a-days, scientists design satellites and launch them into the space. They revolve around the planet from a fixed distance.

Artificial satellite

Fig. 11.19

These man made satellites are called artificial satellites. Those satellites which are made by humans and launched in space are called artificial satellites. For example, INSAT, METSAT, Sputnik,etc.

11.2.4 Asteroids

The rock and metal objects which are present in between the orbits of Mars and Jupiter that revolve around the sun are called asteroids or minor planets. Some examples of other asteroids are Juno,Vesta, Pallus, Eros, etc. There may be as many as 100000 asteroids in the solar system. The biggest asteroid is Ceres which has a diameter of about 800 km whereas the smallest asteroid is as small as a pebble.

11.2.5 Comets

Comets

Fig. 11.20

When we observe the sky at night, Some broom-shaped tailed structures revolve around the sun in long elliptical orbits which are commonly known as comets. A broom -shaped shining object with a bright head is called a comet. Some examples of comets include Halley's comet, Enke, Bennett, etc. Comets are made of gases, dust and ice. The head is made up of ice. Comets have no light of their own. They reflect the light from the sun. Comets revolve around the sun in long elliptical orbits. As the comet approaches the sun, it develops a long glowing tail and becomes visible to us.

As the comet approaches the sun, it develops a long glowing tail and becomes visible to us. A comet becomes visible only when it approaches the sun as the ice and gaseous particles get evaporated due to heating of the sun. The thus formed gas and particles of ice flow to the opposite direction of the sun due to the solar wind and form a long tail. The rays of the sun make its gas glow, which spread, out to form a tail millions of kilometers long.

11.2.6 Meteors or Shooting Stars

Meteor shower

Fig. 11.21

When the heavenly body enters the earth's atmosphere with high speed, friction is developed between the body and air. Due to the friction, heat is produced in it, and a burning object is seen in the atmosphere in the form of a streak of light. This heavenly body is known as meteor. The pieces of stone or metal which enter the earth's atmosphere are called meteors. These are streaks of light in the sky at night, which disappear within a few seconds.

A meteor lasts for a very short time because the small rock pieces burn and vaporize completely due to the excessive heat produced by atmospheric friction.

Sometimes the big meteor does not burn completely and may reach the surface of the earth. This object is called a meteorite. A large number of meteors fall near the North Pole and South Pole of the earth. A meteor shower can be seen in the polar region. An extremely large and bright meteor shower is called fire ball.

Meteorite

Fig. 11.22

Key Concepts

1. The sun is the brightest heavenly object. It is a medium sized star closed to the earth.
2. All the plants, animals and human beings use the solar energy. Life would not exist on the earth in the absence of the Sun.
3. Solar system is the family of the Sun which consists of eight planets and their satellites, comets, asteroids, meteors, meteorites, etc.
4. Planets do not have their own source of light for shining. So they are called non-luminous bodies.
5. The earth is the only planet having all the requirements for the existence of life.
6. The revolution of the earth around the Sun causes the change in seasons and the rotation of the earth causes day and night.
7. Jupiter is the largest planet of the solar system. It looks like a bright star with our naked eyes.
8. A satellite is a heavenly body which revolves round a planet on its own orbit.

9. A satellite which is made by nature that revolves continuously around a planet is called a natural satellite.
10. The rock and metal objects which are present in between the orbits of Mars and Jupiter that revolve around the sun are called asteroids or minor planets.
11. A broom -shaped shining object with a bright head is called a comet.
12. The pieces of stone or metal which enter the earth's atmosphere are called meteors.
13. Sometimes the big meteor does not burn completely and may reach the surface of the earth. This object is called a meteorite.

Exercise

1. Tick (√) the correct statement and cross (×) the incorrect one.

a. There are eight planets in the solar system. ☐
b. The distance between the Sun and the earth is about 15 crore meters. ☐
c. Jupiter is the largest planet of the solar system. ☐
d. Earth is the natural satellite of the moon. ☐
e. Asteroids are found between the orbits of mars and jupiter. ☐

2. Fill in the blanks using appropriate words.

a. .... occupies the central portion of the solar system.
b. The nearest planet from the Sun is ....
c. .... is the coldest planet of the solar system.
d. .... are broom-shaped heavenly bodies having a long tail.
e. Meteors are made of .... and ....

3. Tick (√) the best answer from the given alternatives.

a. Solar system does not include the ....
☐ Sun ☐ stars ☐ planets ☐ comets
b. The smallest planet of the solar system is the ....
☐ earth ☐ mercury ☐ jupiter ☐ uranus
c. Which of the following is the nearest planet to the sun.
☐ earth ☐ mars ☐ venus ☐ mercury

d. Which of the following is a comet?

☐ Titan ☐ Phobos ☐ Bennett ☐ Triton

e. Which of the following has a long tail?

☐ Satellite ☐ Planet ☐ Comet ☐ Asteroid

4. Answer the following questions.

a. What is the solar system? Write any three features of the Sun.

b. What are planets? Name the eight planets of the solar system.

c. Write any two features of each mercury, earth, mars, jupiter and saturn.

d. Name the largest and smallest planet of the solar system.

e. Name the coldest and hottest planet of the solar system.

f. Name the nearest and farthest planet of the solar system.

g. What are satellites? Give any two examples.

h. Define artificial satellites.

i. What are comets?

j. Define asteroids, meteors and meteorites.

5. Write any three differences between planets and stars.

6. Write any two differences between planets and satellites.

7. Draw a neat figure showing solar system.

8. Identify the given heavenly bodies.

9. Differentiate between :

a. Planets and Satellites

b. Meteors and meteorites

c. Earth and Jupiter

d. Moon and Earth

10. Why do planets revolve around the sun?

11. Why does the earth not fall towards the sun?

11.3 Soil

11.3.1 Introduction to Soil

Soil

Fig. 11.23

Most part of the earth is covered with soil. It provides habitat for plants and animals. Green plants get water and minerals from the soil for making food. Crawling insects, bacteria, fungi, etc. complete their life cycle in soil. Human beings depend on soil for various purposes. Soil provides favourable environment for survival of living beings on the earth. Soil is the mixture of weathered rock particles, sand, minerals and dead remains of plants and animals.

11.3.2 Formation of Soil

Soil is formed by a very slow and gradual process. The process by which formation of soil takes place is called weathering. Soil is formed by various methods. Some of them are given below:

Do you know ?

- Weathering is a slow and gradual process in which large rocks break down into fine particles.
- Weathering of rocks is a very slow but continuous process.

1. During rainy season, big rocks from the hilly region are carried away by rivers, streams, etc. These rocks break into small pieces due to collision. When this process continues for a long time, large rocks change into fine particles. As a result, soil is formed.
2. The rocks expand due to heat of the sun and contract due to cold at night. As this process continues, cracks are formed on rocks and finally these rocks break into fine particles. As a result, soil is formed.
3. Strongly blowing wind carries minute rock particles away and these rock particles are deposited somewhere. As a result, soil is formed due to blowing wind.

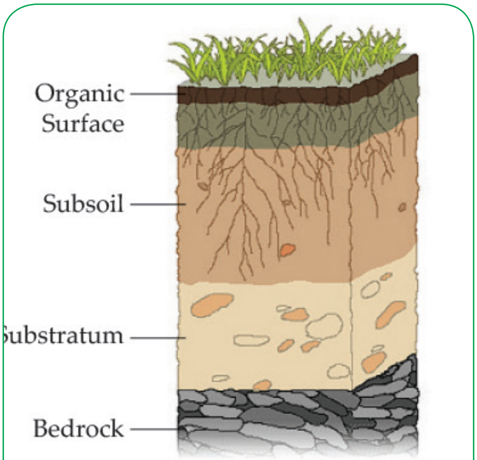
4. Frost also helps in weathering of rocks which finally results in the formation of soil.
5. Various activities of human beings and other animals also help in weathering of rocks. Similarly, some plants grow on the cracks of rocks and break the rocks into pieces. Likewise, some lichens (plants) produce acids which corrode the rocks and produce fine particles. As a result, soil is formed.

11.3.3 Composition of Soil

Soil is formed by fine rock particles, minerals and organic matter. Soil also consists of air, water and dead remains of plants and animals. The substances found in soil differ from place to place. The soil consists of various layers. The uppermost layer of soil contains more humus or organic matter than the second layer of soil. The third inner layer of soil contains minerals like iron, aluminium, etc. Similarly, the lowermost layer of soil contains pebbles and bed rock. Therefore, soil consists of humus, dead remains of plants and animals, minerals, pebbles and bed rock.

11.3.4 Soil Profile

The arrangement of various layers of soil vertically down from the surface of the soil is called soil profile. A soil profile can be seen by digging a trench vertically down at a place. A soil profile has various layers or horizons. Top soil, sub-soil and bed rock are the three main horizons or layers of soil profile.'



Soil profile
Fig. 11.24

The uppermost layer of soil profile is called the top soil. It is rich in humus and dark in colour. In this layer, living organisms like earthworm, insects, bacteria, fungi, etc. are found. It also consists of roots of small plants. The soil is soft, porous and holds enough water.

The sub-soil is the layer of soil found below the top soil. It is hard, compact and rich in minerals. Humus and dead remains of organisms are not found in this layer.

The bed rock is the lowermost layer of the soil profile. This layer cannot be easily dug up as it contains pieces of rocks.

11.3.5 Soil Erosion and Deposition

Various agents like water, wind, air, storm, hurricane, etc. and human activities carry away the land surface or weathered particles. This process is called erosion. It removes the top fertile soil and reduces the fertility of the soil. So, the removal of fertile soil by running water, wind and human activities is called soil erosion. Soil erosion is a very common process in the mountains and hilly regions of Nepal.

Soil erosion

Fig. 11.25

The materials taken away during erosion get deposited at other places. This process is called deposition. So, the process of depositing materials taken away during erosion is called deposition. Soil erosion is followed by deposition. Therefore, we can say that soil erosion and deposition occur side by side. Various agents like air, water, rain, river, ocean, etc. are responsible for soil erosion and deposition.

Deposition

Fig. 11.26

Causes of Soil Erosion

Fig. 11.27

1. In the deforested areas, the soil particles become loose and can be easily carried away by rain water and wind. So deforestation is one of the causes of soil erosion.
2. Floods and heavy rainfall cause a lot of damage to the top soil and cause soil erosion.
3. Overgrazing makes the top soil weak and helps in soil erosion.
4. Improper agricultural pratices in slopes also cause soil erosion.

Fig. 11.28

Effects of Soil Erosion and Deposition

1. Soil erosion causes landslides.
2. It reduces the fertility of soil.
3. Deposition covers fertile lands and vegetation.
4. Soil erosion and deposition form dunes, plateaus, etc.

Soil erosion and deposition occur side by side

Soil erosion is the process of carrying away of land surface or weathered particles by the agents like wind, air, storm, hurricane, etc. It is caused by wind, water, river, glaciers and even human activities like construction works. Deposition is the process that the materials taken away during erosion are deposited at any other places. This means erosion is followed by deposition. If soil erosion occurs in one place, the eroded material get deposited on another place. Deposition is not possible without erosion. So, erosion and deposition occur side by side.

11.3.6 Soil Conservation

Soil is one of the most important natural resources. Therefore, we should conserve soil. Some methods of soil conservation are given below:

Terrace farming

Fig. 11.29

1. Deforestation should be discouraged and afforestation should be encouraged.
2. Terrace farming should be done in slopes.
3. Shelter belts should be constructed in dry places and deserts.
4. Crops rotation should be done to protect the fertility of the land.
5. Embankment should be done on the sides of rivers, streams, etc.
6. Overgrazing should be controlled.
7. Explosions should be stopped while constructing roads in the hilly regions.
8. Plants having strong roots like bamboo should be planted on river sides.


Shelterbelts in soil
Fig. 11.30


Embankment
Fig. 11.31

11.3.7 Soil Pollution


Soil pollution
Fig. 11.32

We throw a variety of wastes in the soil. Mixing of plastics, detergents, chemical fertilizers, insecticides, glass pieces, etc. degrade the quality of soil. The chemical fertilizers make the soil dry which affect the plants and animals living there. Similarly, household wastes also degrade the quality of soil when they get mixed in soil. All plants and animals depend on soil for getting food and shelter. So soil is an important substance for plants and animals. But the soil is being polluted day by day due to human activities. The mixing of harmful and unwanted substances in the soil is soil pollution.

Causes of soil pollution

1. Throwing of household wastes on soil or land
2. Improper disposal of garbage and sewage on soil
3. Improper disposal of industrial wastes on soil
4. Excessive use of chemical fertilizers, insecticides and pesticides on soil

Effects of soil pollution

1. Polluted soil may spread various diseases in plants and animals
2. It causes contamination of crops, fruits and vegetables.
3. It affects the habitat of plants and animals.
4. Plastics and glasses in the soil affect its fertility.

Measures to reduce soil pollution

1. Throwing of household wastes on soil or land should be avoided.
2. Improper disposal of garbage and sewage on soil should be stopped.
3. Improper disposal of industrial wastes on soil should be avoided.
4. Excessive use of chemical fertilizers, insecticides and pesticides on soil should be avoided.

Activity 8

- Visit a nearby place having soil pollution.
- Observe the various pollutants ant list them. Identify whether these pollutants are biodegradable or not?
- Study the main causes and effects of soil pollution and find out the possible solutions to reduce soil pollution.
- Prepare a short report and present in the classroom.

Key Concepts

1. Soil provides favourable environment for survival of living beings on the earth. Soil is the mixture of weathered rock particles, sand, minerals and dead remains of plants and animals.
2. The process by which formation of soil takes place is called weathering.
3. Weathering is a slow and gradual process in which large rocks break down into fine particles.

4. The arrangement of various layers of soil vertically down from the surface of the soil is called soil profile.
5. The sub-soil is the layer of soil found below the top soil. It is hard, compact and rich in minerals.
6. the removal of fertile soil by running water, wind and human activities is called soil erosion.
7. the process of depositing materials taken away during erosion is called deposition.
8. Various agents like air, water, rain, river, ocean, etc. are responsible for soil erosion and deposition.
9. The mixing of harmful and unwanted substances in soil is called soil pollution.
10. It is our duty to conserve soil and control soil pollution in our locality.

Exercise

1. Fill in the blanks using appropriate words.

a. Most part of the ....is covered with soil.

b. Green plants get water and minerals from the ....

c. Frost and strongly blown wind helps in .... of rocks.

d. The arrangement of various layers of soil is called ....

e. Soil .... causes landslide.

f. Improper disposal of garbage in soil causes........................

2. Tick (✓) the correct statement and cross (×) the incorrect one.

a. Soil does not provide suitable environment for survival of living beings. ☐

b. Weathering of rocks is very slow but continuous process. ☐

c. The lowermost layer of soil contains humus. ☐

d. The layer of sub-soil is found below the top soil. ☐

e. Deforestation helps in soil conservation. ☐

f. Polluted soil spreads diseases in plants and animals. ☐

3. **Answer the following questions.**

   a. What is soil? Name any three things found in soil.

   b. How is soil formed? Write any three methods of soil formation.

   c. How does rain help in soil formation? Write in brief.

   d. Write down the composition of soil.

   e. What is soil profile?

   f. Define soil erosion and deposition.

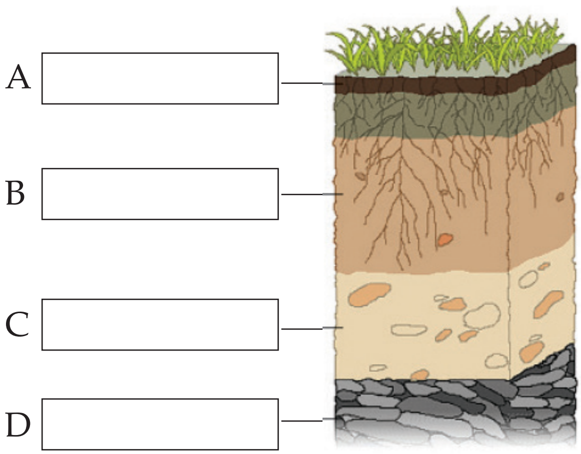
   g. What is soil conservation.

   h. What is soil pollution? Name any two things that cause soil pollution.

4. **Draw a neat and labelled figure showing soil profile.**

5. **State the causes and effects of soil erosion.**

6. **What is shown in the given figure? Label A, B, C and D.**



7. **Observe the given figure and write a paragraph on it.**

8. **Soil erosion and deposition go side by side. Justify this statement.**

9. **What is land or soil pollution. Write its causes and effects.**

10. **Observe the status of soil in your locality and suggest any five measures to control soil pollution.**