MY Science and Environment

Grade - 8

Government of Nepal
Ministry of Education
Curriculum Development Centre

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Preface

The curriculum and curricular materials have been developed and revised on a regular basis with the aim of making education purposeful, practical, relevant and job-oriented. It is necessary to instill the feeling of nationalism, national integrity and democratic spirit in students and equip them with morality, discipline and self-reliance so as to develop in them social and personal skills as well as the basic competencies of language, science, occupation, information and communication technology, environment and health, and life skills. It is also necessary to enable them to appreciate, preserve and promote arts and aesthetics, social norms and values and ideals. Moreover, in order to develop an equitable society, it is necessary to inculcate students with respect for ethnicity, gender, disabilities, languages, religions, cultures and regional diversity. Likewise, education should also help them to be well-informed of human rights and social norms and values so as to make them capable of playing the role of responsible citizens. This textbook has been developed in this form based on the Basic Education Curriculum 2069 (Grade 6 to 8), incorporating the feedback obtained from teachers, students, parents and other stakeholders during its piloting.

This textbook was translated and edited by Pushpa Raj Bhatta, Ramchandra Regmi, Ujjwol Bhomi, Pushparaj Dhakal. In bringing out this text book in this form, the contribution of the Executive Director of CDC Mr. Diwakar Dhungel, Deputy Director Dambardhoj Angdembe, Prof Dr. Hridayaratna Bajracharya, Prof Dr Chidananda Pandit, Umanath Lamsal“Umesh”, Parvati Bhattarai, Uttara Shreshtha, Bijay Kanta Mishra and Harish Panta is highly commendable.

Language of this book was edited by Parsuram Tiwari and Ramesh Dhakal. Typing was done by Abhaya Shrestha. The layout design of the book was done by Jayaram Kuikel and Bhawana Sharma. The illustration of the book was done by Sunil Ranjit and Gautam Manandhar. CDC extends sincere thanks to all those who have contributed in the development and revision of this text book.

Textbook is considered as an important tool of learning. Experienced teachers and curios students can use various learning resources and tools to achieve the competencies targeted by the curriculum. An attempt is made to make this textbook activity oriented and interested as far as possible. The teachers, students and other stakeholders are expected to make constructive comments and suggestions to make this book a more useful learning material.

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Unit 1 Measurement

We measure different quantities of different objects in our daily life. Measurement is the process of finding size, length or amount of any quantity. We express the measured quantities in mathematical form. Those quantities that can be measured and expressed in mathematical form are called physical quantities e.g. area, mass, time, length, etc. The quantity which we can not measure in mathematical form is not physical quantity for example, kindness, love, will desire, interest, feeling, etc.

There are two types of physical quantities:

i) Fundamental physical quantities

ii) Derived physical quantities

Fundamental physical quantities

Some physical quantities do not depend on other physical quantities. Those physical quantities that do not depend on other quantities are called fundamental quantities. Mass, length and time have no interrelation of each other. Mass of a body is not related to its length. So mass and length are independent of each other. Therefore, they are fundamental physical quantities.

Derived physical quantities

Those physical quantities which depend on other physical quantities are called derived quantities. Some examples of derived quantities are area, volume, density, etc. The area of a surface depends on its length and breadth. So the area is derived physical quantity.

Unit

We can find exact value of any physical quantity with measurement. A fixed quantity is used for measurement of any physical quantity. The fixed quantity of measurement is called unit. Unknown physical quantities are compared with the known standard quantity and expressed in terms of the unit.

Measurement is the process of comparing an unknown quantity with a known standard quantity. The measurement of a physical quantity is expressed in number and its unit. For example, the mass of a body is 5 kg. Here 5 is quantity and 'kg' is the unit of the mass. It means that given mass is 5 times greater than 1 kg mass. So, it is necessary to write unit in measurement.

The units of physical quantity are universally accepted. Different units are used in measurement. There are mainly two types of units:

i) Fundamental unit:

Those units which do not depend on other units are called fundamental units. Meter (m), kilogram (kg) and second(s) are fundamental units. The followings are the fundamental units used in physics.

S N	Physical quantity	Fundamental unit	Symbol
1	length	meter	m
2	mass	kilogram	kg
3	time	second	s
4	temperature	Kelvin	K
5	electricity	Ampere	A
6	Intensity of light	Candela	Cd
7	Amount of matter	Mole	mol

ii) Derived unit

The units which are formed by the combination of fundamental units are called derived units. We need to know the distance covered and time taken by a car to find the speed of the car. The unit of speed depends on the units of length and time. So, the unit of speed 'm/s' is derived unit since it has two fundamental units meter and second.

Some derived units are given below:

S N	Physical quantity	Derived unit	Symbol
1	Area	square meter	m^2
2	Volume	cubic meter	m^3
3	Density	kilogram per cubic meter	kg/m^3

S N	Physical quantity	Derived unit	Symbol
4	Speed/ velocity	meter per second	m/s
5	Acceleration	meter per second^2	m/s^2
6	force	Newton	N
7	work/energy	Joule	J
8	Power	watt	W
9	Pressure	Pascal	Pa

Measurement of mass

The quantity of matter contained in a body/object is called its mass. The mass of a body/object depends on the number of atoms and their atomic mass. The mass of a body is always constant. We use beam balance (or physical balance) to measure mass beam balance consists of two pans. An unknown mass is placed on one pan and a standard mass (***Dhak***) on the other pan. When two pans are balanced both pans have equal masses. In balanced condition, the pointer at the center of the beam remains vertical and coincides with the mark. Then, we can say that the mass of unknown body is equal to the standard mass. The standard unit of mass is kilogram. The smaller units of mass are gram (g), milligram (mg), etc. The mass of large bodies are measured in quintal and tonne.

1000 mg = 1 g

1000 g = 1 kg

100 kg = 1 quintal

1000 kg = 1 ton

Fig. 1.1

What is 1 kg mass?

One kg mass is same all over the world. The mass of standard weight (Dhak) made up of platinum and iridium, kept in International Bureau of Weights and Measures (IBWM) in France, is considered as 1 kilogram in SI system. The standard weight of 1 kg in other countries is made by comparing with this standard weight. In Nepal, the standard mass of 1 kg (1 kg Dhak) should be equal to that of 1 kg weight kept in the department of metrology.

Activity 1

Take a physical balance and different standard masses (Dhak). First find the mass of your science book and them the mass of the science book of one of your friends. Compare the mass of two books. Have you found any difference? What is the reason?

Measurement of weight

If we throw a body towards the sky, it will fall down to the earth after some time. Why?

The earth attracts any object towards its center. So any object thrown up always returns to earth's surface. Fruits fall off the tree. Rain water, snow, hails etc. also fall down due to the attraction of the earth. The force of attraction of the earth is called 'gravity'. The gravity acting upon a body is called its weight.

> The force by which an object is attracted towards the center of the earth is called its weight.

The SI unit of weight is Newton (N). Weight is a kind of force. So it is measured by spring balance. The acceleration produced on a body when it falls down from a certain height is called acceleration due to gravity. The weight is equal to the product of mass of a body and acceleration due to gravity on that place.

Weight (W) = mass (m) × acceleration due to gravity (g)

The earth is not a perfect sphere. The value of 'g' depends upon the distance of that place from center of the earth. So, the acceleration due to gravity is not uniform throughout the surface of earth. Since the different places have different values of acceleration due to gravity, the weight of a body is also different. Although we use weight and mass in a similar way, these two quantities are quite different. When we measure mass of a body with a physical balance, the effect of gravity on both the pan is equal in balanced condition.

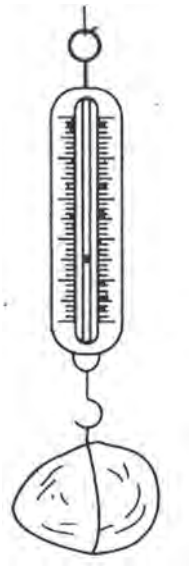


Fig. 1.2

Measurement of time

The interval between two events is called time. The unit of time is determined on the basis of the time taken by the earth to rotate about its axis. The time taken by the earth to complete one rotation about its axis is called one solar day. If a day is divided into 24 equal parts, each part will equal to one hour. If one hour is further divided into 60 equal parts, one part is called one minute. If one minute is further subdivided into 60 equal parts, each part is called one second.

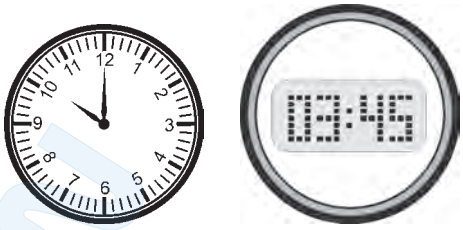


Fig. 1.3

Therefore, 1 day = 1 ×24 hours

= 24×60 minutes = 1440 minutes

= 24 × 60 × 60 second

= 86400 seconds

1 day has 86400 seconds.

1 second is defined as (1/86400) part of one solar day.
That is 1 second = (1/86400) day

Different types of watches are used to measure the time. For example: simple watch, digital watch, atomic watch, etc.

In our simple watch, few seconds may fluctuate from the exact time. So, scientists use atomic watch to measure the accurate time.

Activity 2

Set the time of your watch with the time announced by the radio before broadcasting the news. After one month, compare the time given by radio and your watch. Did you find any difference? Discuss with your friends and tell the result to your teacher.

Experimental activity

1) Measure the mass of your body.
2) Place a white cardboard paper on the ground on a sunny mid-day. Hammer a 3/4 inch long nail at the center of the cardboard paper to keep the nail in upright position. Mark the tip of its shodow at noon. Observe the shadow of the nail at the same time next day. At what time does the tip of the shadow coincide with the mark? Find out the difference of time.

Summary

1. Those quantities which can be measured and expressed in mathematical form are called physical quantities.
2) The standard quantity of measurement is called unit. Unknown quantities are measured by comparing with the standard quantity.
3) There are two types of units: fundamental unit and derived unit.
4) Fundamental units do not depend on other units e.g. meter, kilogram, second, etc.
5) Derived units consist of two or more fundamental units, e.g., joule, newton, watt, pascal, etc.
6) The quantity of matter contained in a body is called mass. It is measured by beam balance or physical balance.
7) 1 kg mass is the mass of standard weight which is made up of platinum and iridium metals kept in the International Bureau of Weights and Measures in France.
8) The attractive force applied by the earth to a body is called weight.
9) The interval between any two events is called time. A clock is used to measure time.
10) One part of 86400 parts of 1 solar day is called 1 second.

Exercise:

1) Fill in the gaps with appropriate words.

a) The unit which does not depend on other units is called ……unit.

b) The standard unit of mass is ……..

c) The force of gravity acting on a body is called …….

d) 1 second is 1 part of ……parts of a day.

e) Mass of a body is measured by ……..

2) Choose the correct answer.

a) Which is the standard unit of mass?

i) gram ii) kilogram iii) quintal iv) tonne

b) Which device is used to measure the weight of a body?

i) physical balance ii) spring balance

iii) beam balance iv) top- pan balance

c) Which watch is used by scientists for correct measurement of time?

i) simple watch ii) digital watch

iii) atomic watch iv) quartz watch

d) Which for the following is derived unit?

i) meter ii) kilogram

iii) second iv) joule

3. Differentiate between.

a) Fundamental unit and derived unit

b) Mass and weight

4. Answer in brief:

a) Define physical quantity. b) What is mass?

c) What is 1kg mass? d) What is unit of speed?

5) Convert the following units as:

a) 4.5 hours into second b) 2.5 kilograms into gram

c) 1 day into second [Ans: a) 16200 sec., b) 2500 gm, c) 86400 sec.]

6) Manita carries a box of 40 kg. What is the weight of the box? ($g = 9.8\ m/s^2$) [Ans: 392 N]

Unit 2

Velocity and Acceleration

Trees, stones, towers etc. always remain at the same place. They are called stationary objects. In other words, they are at rest. Some bodies keep on changing their position. They move from one place to another. They are known as the moving objects. For example, a walking man, a running bus and flying bird. There are two types of motion of a body. They are: i) uniform motion ii) non-uniform motion.

The bodies which move with uniform motion have constant velocity. But those bodies which do not have constant velocity are in non-uniform motion. We can obtain an average velocity when a body has non-uniform motion.

Average Velocity

The average distance travelled by a body in a particular direction in one second is called average velocity.

$$\text{Average velocity} = \frac{\text{total displacement}}{\text{total time taken}}$$

$$v_{av} = \frac{s}{t}$$

Where, v_{av} = average velocity

s = total distance covered in a particular direction (or total displacement)

t = total time taken.

If a body has displaced 10m in 2 sec and 32m in other 5 sec time, then,

$$\text{Average velocity} \quad V_{av} = \frac{\text{total displacement}}{\text{total time}}$$

$$= \frac{10m + 32m}{2\ sec + 5\ sec}$$

$$= \frac{42\text{m}}{7\text{ sec}}$$

$$= 6\text{m/sec}$$

Average velocity = 6 m/sec

If a body has initial velocity u and final velocity v then average velocity of the body is given by

Vav= (u+v)/2

Example 1

A man rides a motorbike for 4 minutes to reach his office 6km far. Find his average velocity.

Here, total time taken (t)= 4 min. = 4 × 60 sec = 240 sec.

Total distance travelled(s) = 6km = 6 × 1000m = 6000m

Now, average velocity (v) = ?

We have formula,

v= s/t

v= 6000m/ 240s

v= 25m/s

Average velocity of the motorbike is 25m/s.

Relative velocity

Is a person, inside a moving bus at rest or in motion? Why?

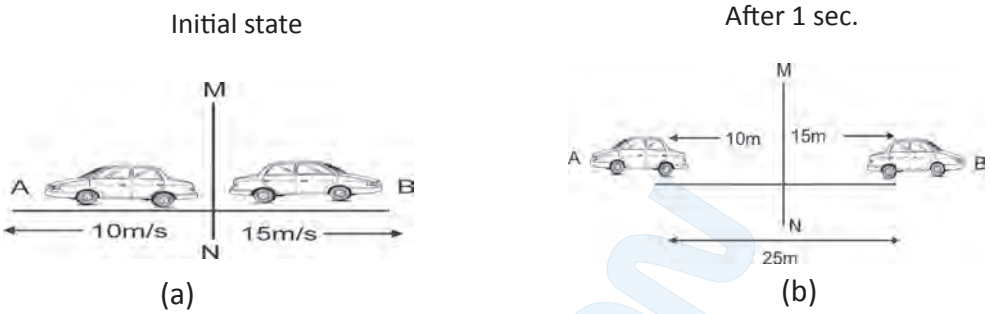
A person in a moving bus doesn't change his position with respect to the bus. So, he/she is at rest with respect to the bus. But the person is changing his/her position with respect to road. That's why; he/she is in motion with respect to the road. Therefore, rest or motion of a body is the relative term. It depends on the state of the body with the reference objects. The state of rest or motion of a body is defined with respect to a point, called the reference point.

The velocity of a body described with respect to a reference point is called relative velocity.

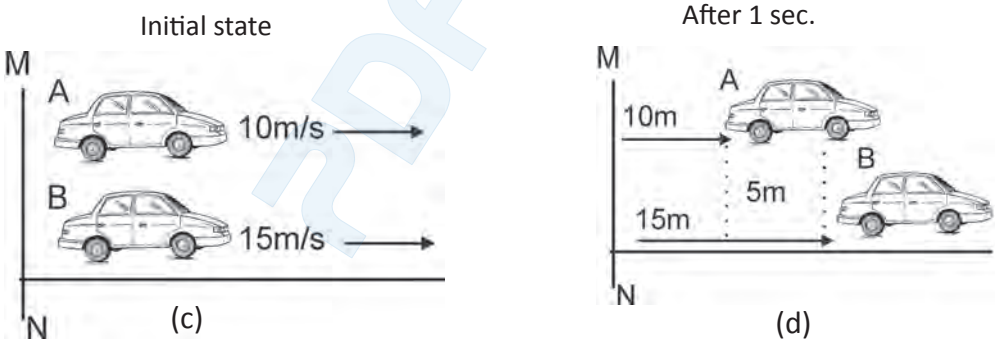
1) Observe the figure given below. Initially both the cars are at the same

straight line MN. Here MN is a reference point. Car A is moving due west with 10m/s and car B is moving due east with velocity 15m/s.

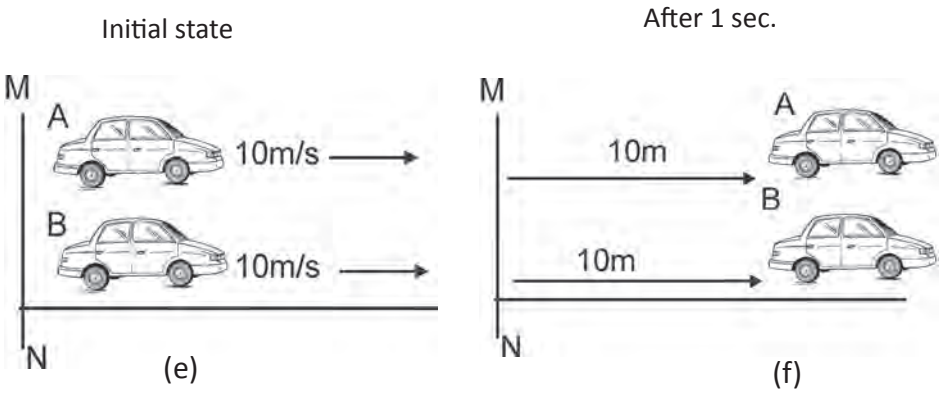
In figure b, the state of cars after 1 second is shown. In this position, A and B have travelled 10 m and 15m respectively. Now, car B is seen to have travelled 25m from car A in 1 sec. So, velocity of car B relative to car A is 25m/s.



2) The initial state of two cars is shown in figure c The car A is moving with velocity 10m/s and car B is moving with 15m/s in the same direction. The state of cars after 1 second is given in figure d.The car A has travelled a distance of 10m and car B has travelled 15m. Since both the cars are moving in the same direction, car B is seen to have travelled only 5m from car A. In this case, the relative velocity of car B with respect to car A is 5m/s.



3. In figure e initially two cars A and B are at a line MN. Both cars have the same velocity, i.e., 10m/s in the same direction. In figure f , the position of the cars after 1 sec. is given. In this case, both cars have travelled a distance of 10m. If car B is seen from car A, it is found as if car B has not moved through any distance or the relative velocity of car B with respect to car A is zero.



Similarly, the relative velocity of two cars moving in the same direction= velocity of one car - velocity of the other car.

$\therefore v_{AB} = v_A - v_B$

Where vA = velocity of A ,V_B = velocity of B

V_{AB} = relative velocity of A with respect to B

If two cars are moving opposite to each other then, the relative velocity = velocity of one car + velocity of the other car.

$\therefore V_{AB} = V_A + V_B$

Example 2

Two cars A and B are moving with velocity 12m/s and 8 m/s respectively in the same direction. Find the relative velocity of A with respect to B. If they move in opposite direction, what will the relative velocity be?

Here, velocity of car A, (V_A)= 12m/s

Velocity of car B, (V_B)= 8 m/s.

Relative velocity, (V_{AB})= ?

When two cars move in the same direction,

Relative velocity, $(V_{AB}) = V_A - V_B$

$= 12m/s - 8 m/s$

$\therefore V_{AB} = 4m/s$

When two cars move in opposite direction,

Relative velocity (V_{AB}) $= V_A + V_B$

$= 12m/s + 8m/s$

$= 20m/s$

Therefore, the relative velocity of the cars moving in the same direction is 4m/s and that in opposite direction is 20m/s.

Considerable question:

While travelling by a bus, if we overtake another bus, we feel the bus is moving slowly but a bus coming from opposite direction seems as moving fast, why?

Acceleration and retardation

The velocity of moving bicycles, motorbike and vehicles is not always the same. Their velocity varies according to time. If a bicycle is running downhill,its velocity increases. If an object falls down the earth from a height, its velocity increases. The rate of increase in velocity is acceleration.

The change in velocity per unit time is called acceleration. Its unit is m/s^2.

Suppose a bicycle has initial velocity u m/s and its velocity becomes v m/s after time (t);

then the change in velocity = (v - u)m/s and time taken = t

So, acceleration (a) = change in velocity/ time taken

$$= \frac{\text{final velocity - initial velocity}}{\text{time taken}}$$

$$\text{or, } a = \frac{v - u}{t}$$

There is no acceleration of a body in uniform velocity. Sometimes the velocity of a running bus decreases. When an object is thrown upwards its velocity goes on decreasing. Similarly, the velocity decreases if we apply brake on a moving bus. In the above cases, the velocity has been decreased. The rate of decrease of velocity of a body is called retardation or negative acceleration or deceleration.

Example 1:

A car starts to move from rest. In 5 seconds, its velocity becomes 10m/s. Calculate its acceleration.

Here, initial velocity (u) = 0

Final velocity (v) = 10m/s

Time taken (t) = 5 s

Acceleration (a) =?

We have formula,

$$a = \frac{v - u}{t}$$

or, $a = \frac{10\text{-}0}{5}$

$\therefore a = 2 m/s^2$

Example 2

A car running with 15m/s comes to rest in 5sec, what is its retardation?

Here,

Initial velocity (u) = 15m/s

Final velocity (v) = 0m/s

Time taken (t) = 5s

Retardation (a) =?

We have formula,

$$a = \frac{v - u}{t}$$

$$a = \frac{0 - 15}{5}$$

$a = -3 m/s^2$

Therefore, the retardation of the car is $3 m/s^2$.

Equations related to velocity and acceleration

The initial velocity, final velocity, acceleration, time and distance covered have relations which can be given by equations of motion.

Example 1

Let initial velocity = u Final velocity = v

Acceleration = a Time taken = t

Distance covered = s

According to the definition of acceleration,

a = final velocity – initial velocity / time taken

$a = \frac{v-u}{t}$ ..... (i)

v–u = at

v= u + at ..... (ii)

According to definition of average velocity;

Average velocity= total distance covered / time taken

= s/t

Again, average velocity = u+v/2

Or, s/t= u+v/2

Or, s = (u+v)/2 × t ..... (iii)

Now substituting value of t from equation (i) in equation iii),

s= (u+v)/2 × (v-u)/a

$S = \frac{v^2 - u2}{2a}$

$\therefore v^2 = u^2 + 2as$ .....(iv)

Now substituting v from eqn (ii) in eqn (iii)

We get, s = (u+u+at)/2 ×t

s = (2u+at)/2 ×t

$s = (2ut+at^2)/2$

$\therefore s= ut + ½ at^2$ .....(v)

Above formulae are useful to solve mathematical problems related to motion.

Example 2

A car starts to move from rest. If the acceleration is $0.3 m/s^2$, what will be its velocity after 1 minute? What will be the distance covered during the time?

Here,

Initial velocity (u) = 0m/s (because the car is at rest)

Acceleration (a) = $0.3 m/s^2$

Time (t) = 1 minute = 60

Final velocity (v)= ?

Distance covered (s)=?

We have formula,

$v = u + at$

$v = 0 + 0.3 \times 60$

or, $v = 18 m/s$

Again, we have,

$s = u + v/2 \times t$

$s = 0 + 18/2 \times 60$

$= 540 m$

Therefore, final velocity of the car is 18m/s and distance covered is 540m.

Experimental activity

1) Make a group of some of your friends. Mark at 50m or 100m in your school compound and run the distance turn by turn and note the time taken by each individual. Find the velocity of each.

2) Mark two points at 100m distance and put a mark at the middle. Start a race from the point at middle simultaneously. Note the time taken by them to run 50m and calculate their velocity and relative velocity.

Summary:

1. The average distance travelled by a body per unit time is called average velocity.

2. Reference point is a point with respect to which the relative velocity of an object is defined.
3. The velocity of a body described with respect to a reference point is called relative velocity.
4. The relative velocity of a body is different with respect to different objects.
5. The time rate of change of velocity is called acceleration.
6. The negative acceleration is called retardation.
7. The equations of motion are:

(i) $a = \frac{v-u}{t}$ (ii) $v = u + at$ (ii) $s = \frac{u+v}{2} \times t$

(iv) $v^2 = u^2 + 2as$ (v) $s = ut + \frac{1}{2}at^2$

Exercise:

1. Fill in the blanks with appropriate words.

a) The distance covered in a particular direction per unit time is called.....

b) The time rate of change of ..... is called acceleration.

c) The negative acceleration is called .....

2. Define.

a) Average velocity b) Relative velocity c) Velocity

3. Differentiate.

a) Average velocity and relative velocity

b) Acceleration and retardation

4. Give one word answer.

a) The change in displacement per unit time .....

b) The rate of change of velocity .....

c) The unit of acceleration .....

5. Give answer in brief.

a) What is acceleration? b) What is meant by retardation?

c) Explain relative velocity with examples.

d) Define reference point.

6. Solve the following numerical problems:

a) A bus has velocity of 20m/s towards east and another bus has velocity of 15m/s in west direction. If they start to move from a point simultaneously, what distance do they cover in 2 minutes? What will be their separation?

Ans (2400m east, 1800m west, 4200m)

b) If a motorbike travels 2.4 km in 5 minute, find its average velocity.

Ans (8m/s)

c) A car starts from rest and gains velocity of 20 m/s in 10 seconds. Find its acceleration. Ans ($2m/s^2$)

d) If a truck starts from rest and it has acceleration of 4 m/s^2 for 5 seconds, calculate its final velocity. What will be the distance travelled by the truck during the time interval? Ans (20m/s, 50m)

e) A car was moving with a uniform velocity. When its brake was applied, it stopped in 5 seconds with retardation of 1 m/s^2. Calculate its initial velocity. Ans (5m/s)

f) Two cars are moving with velocities of 70km/hr and 50 km/hr towards east and west direction respectively. Find their relative velocity. Ans (120km/hr)

g) If two cars A and B are moving with velocity of 60km/hr and 80km/hr respectively in the same direction.,what will be the relative velocity of B with respect to A? Ans (20km/hr)

Unit 3

Simple Machine

We use various types of devices or instruments to make our work easier, faster and simpler. These devices are called simple machine. For example: crowbar, scissors, fire tongue, knife, spoon, pulley, screw driver, etc.

Features of simple machines:

1) Heavy loads can be uplifted with smaller force (they multiply force).
2) They accelerate the rate of doing work.
3) They change the direction of applied force.

Lever

In the given figure, a small boy is able to lift a heavier man. How is this possible? We can see in the figure that there is a support in the middle of the wooden plank which is called fulcrum or pivot. It is possible because the heavier man is near the fulcrum and the small boy is at farther point. If so in which principle, does lever work?

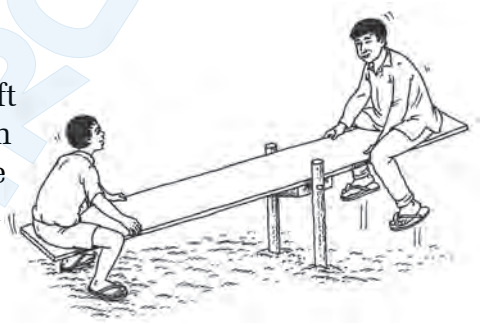


Fig. 3.1

Working principle of lever

Lever is the simplest machine which is a long bar or plank that can rotate about a fixed point i.e. fulcrum.

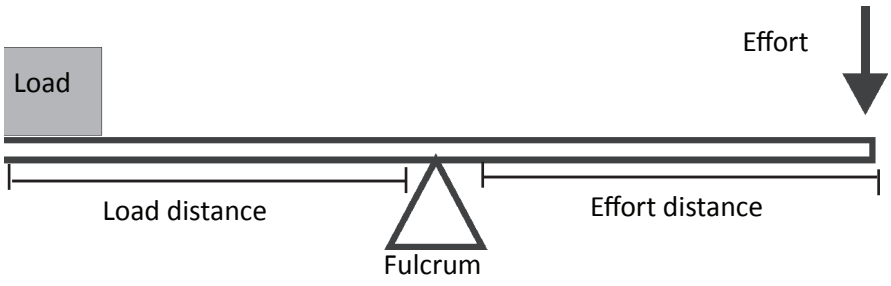


Fig. 3.2

An effort is applied at a point on a lever. The distance between fulcrum and effort is called effort distance. The effort works against a load. The distance between load and fulcrum is called load distance. So, a lever has load, load distance, effort and effort distance. The section of lever between load and fulcrum is load arm and that between effort and fulcrum is called effort arm.

Activity 1:

Take a scale of 30 cm. Make a small hole at its center with a nail and adjust it with a string as shown in the figure. Now, suspend two weights on each arm and balance it. Convert the mass into effort where 100g mass is equivalent to 1N force. Consider the mass on the right arm as load and the mass on the left arm as effort. Change the location of the masses keeping the scale horizontal. Now fill the given table observing your results.

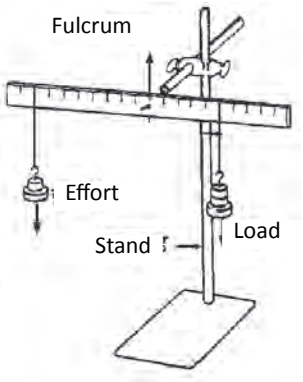


Fig. 3.3

Example

SN	To the left			To the right		
	E	E.D.(cm)	E×E.D.	L	L.D. (cm)	L × L.D.
1.	5N	4	20	2N	10	20
2.						
3.						
4.						

We can draw a conclusion from the experiment as

Effort × Effort distance = Load × Load distance

If the effort distance is shorter, more effort is necessary. If load is placed near to fulcrum, a heavy load can be lifted up even with a littlell effort. Therefore the lever function is based on this principle. We have used many levers e.g. scissors, lemon squeezer, nut cracker, crowbar, etc., which always make our work easier.

Mechanical advantage:

The ratio of load to effort on a balanced lever is called mechanical advantage.

$$\text{Mechanical advantage (MA)} = \frac{\text{Load (L)}}{\text{Effort (E)}} \qquad \text{or, MA} = \frac{L}{E}$$

Mechanical advantage of a simple machine shows the number of times that the force is multiplied by the machine.

In the given figure, a load of 500N is lifted by an effort of 200N. The load distance is 30cm and effort distance is 90cm. The lever has magnified the effort hence to lift the heavier load. We calculate mechanical advantage to find the number of times that the effort is multiplied.

$$\text{Mathematically, MA} = \frac{\text{Load}}{\text{Effort}} = \frac{500\text{N}}{200\text{N}} = 2.5$$

It means that the lever can lift up a load of 2.5 times heavier than the applied effort. Some energy is wasted due to friction. So, the mechanical advantage decreases with the increase of friction in simple machine.

Velocity ratio

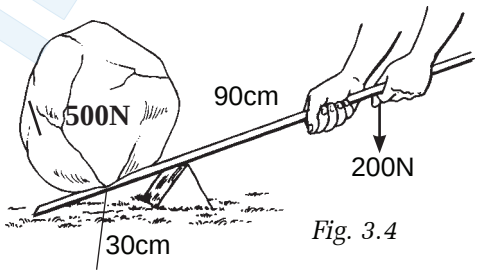


Fig. 3.4

Load and effort move a certain distance when simple machine is used to lift a load by an effort. The distance covered by the movement of load and effort is never equal to each other since the load to be lifted up is greater than the effort applied. The distance covered by effort must be greater than the distance moved by load. The ratio of distance covered by the effort to the distance moved by the load is called velocity ratio.

$$\text{Velocity ratio (VR)} = \frac{\text{distance moved by effort}}{\text{distance moved by load}}$$

In a lever, velocity ratio is equal to the ratio of effort distance and load distance.

$$\text{VR} = \frac{\text{effort distance}}{\text{load distance}}$$

In fig. 3.4, load distance is 30cm and effort distance is 90cm.

$$\text{Therefore, VR} = \frac{\text{effort distance}}{\text{load distance}}$$

$$= 90\text{cm}/30\text{cm}$$

$$= 3$$

$$\therefore \text{VR} = 3$$

The velocity ratio of the machine is 3, which means that the effort has to move 3 times more distance than the load. There is no effect of friction on velocity ratio of a simple machine. But the mechanical advantage is affected by friction. So, the value of MA is always less than the value of VR for a machine.

Efficiency

When an effort is applied in a machine, some work is done. That work is called input work.

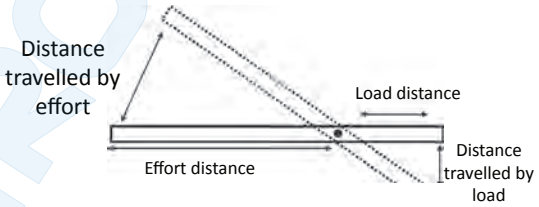


Fig .3.5

Input work = effort × effort distance

The work done by machine when effort is applied is called output work.

Output work = load × load distance

The ratio of output work to input work in a machine is called efficiency. It is expressed in percentage and denoted by η(eta).

$$\text{Efficiency} = \frac{\text{output work}}{\text{input work}} \times 100\%$$

$$= [(\text{L} \times \text{L.D.}) / (\text{E} \times \text{E.D.})] \times 100\%$$

$$= \frac{(\text{L/E})}{(\text{E.D.})/\text{L.D.}} \times 100\%$$

$$= \frac{\text{MA}}{\text{VR}} \times 100\%$$

Mechanical advantage is always less than velocity ratio due to friction. So the efficiency of a machine is never 100% or more.

Example: 1

An effort of 50N is applied to lift a load of 200N by using a lever. If effort is displaced through 5m to lift a load through 1m, calculate its MA, VR and efficiency.

Here,

Load = 200N

Effort = 50N

Effort distance = 5m

Load distance = 1m

Mechanical advantage (MA) = ?

Velocity ratio (VR) = ?

Efficiency = ?

We have formula,

MA = load /effort = 200N/ 50N = 4

VR= E.D./L.D. = 5m/1m= 5

Now efficiency (η)= MA/VR x 100%

= 4/5 x 100%

= 80%

Therefore, MA= 4, VR = 5, η = 80%.

Experimental activity:

Take a lever and prove the principle of lever L × L.D. = E × E. D.

Summary

1) Lever is a long bar or a plank which is capable of rotating about a fixed point, i.e., fulcrum.
2) E × E.D. = L × L.D. is the principle of lever.
3) Mechanical advantage is the ratio of load to effort.
4) The ratio of effort distance to load distance is called velocity ratio.
5) The ratio of mechanical advantage to velocity ratio expressed in percentage is called efficiency.

Exercise:

1) Fill in the blanks with the appropriate words

a) The point at which a lever is fixed is called .....

b) In a lever, E x E.D. = L x ……..

c) Mechanical advantage = load/…….

d) Velocity ratio = ……./load distance

2) Define

a) Mechanical advantage b) Velocity ratio c) Efficiency

3) Give reason.

a) Efficiency of a lever is always less than hundred percent.

b) The blades of a metal cutter are shorter than that of blades of paper cutter scissor.

c) It will be easier to lift a load in wheel barrow if the load is moved towards the wheel.

4) Give two differences between mechanical advantage and velocity ratio.

5) The mechanical advantage of a lever is 4. What does it mean?

6) Two men are trying to carry a wooden pole. If one of them is weaker than other, how can they carry the pole hence making small load for the weak man?

7) Solve the following numerical problems.

a) A load of 400N is lifted up by an effort of 100N. If load distance is 20cm, what will be the effort distance? *(Ans : 80cm)*

b) Two boys, Shrijan having weight 600N and Shrijesh having weight 300N are playing see-saw. If Shrijan is sitting at 2m from fulcrum, where should Shrijesh sit from fulcrum to balance Shrijan? *(Ans: 4m)*

c) A lever of length 1m has been used to lift a load of 600N by applying an effort of 200N. If load is at 20cm from fulcrum, calculate mechanical advantage, velocity ratio and efficiency. *(Ans: MA = 3, VR = 4, η=75%)*

d) Study the figure below and find the value of effort. *(Ans: 120N)*

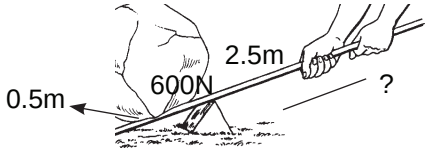


Fig. 3.6

Unit 4

Pressure

The earth is surrounded by air about 1000 km high from the earth surface. The layer of air which surrounds the earth is called atmosphere. The air has weight and hence it exerts pressure. The pressure exerted by air in the atmosphere is called atmospheric pressure.

Atmospheric pressure

The pressure exerted by the atmospheric air on the surface of the earth is called atmospheric pressure. The atmospheric pressure decreases as we go up from the earth's surface. The atmospheric pressure at the sea level is 101300N/m^2 or 760mmHg. Due to the changes in atmospheric pressure of earth surface, the air blows from one place to another place. Let's observe the following experiment.

Activity 1

Take a glass tumbler full of water. Cover it with a cardboard (or a post card) in such a way that no air would get inside. Now invert the glass tumbler supporting the post card with your palm. Hold the glass and remove the supporting palm slowly. What can you see?

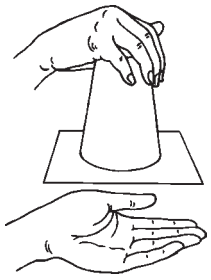


Fig. 4.1

The post card remains in its own place and water does not fall. It is due to the atmospheric pressure exerted by air to the post card.

Considerable question

An empty glass tumbler does not dip in water in its upside down position, why?

Activity 2

Take a metallic can having tight lid. Put some water in the can and heat the can opening its mouth. Close the lid tightly after the water boils. Let the can be cool and observe it.

The can starts to squeeze because of difference between the pressure of the air inside the can and atmospheric air pressure outside. The pressure inside and outside the can was equal before heating the water so it didn't affect the can. When the water was heated, the vapor pushed air out of the can and the volume of air inside decreased. The air could not enter into the vessel after closing its lid. When the can was cool, the volume of air inside decreased and pressure of the air lowered which was lesser than the pressure of the atmosphere. As the atmospheric pressure became greater than the pressure of air inside the can, it collapsed inwards.

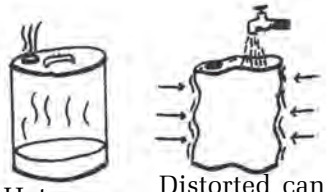


Fig. 4.2

Activity 3

Take some water in a glass and dip a straw pipe into it. Suck the water gently with your mouth. Do you get water in your mouth?

When you suck the air from the straw, the air comes out and pressure inside the pipe becomes less than the atmospheric pressure. Then water in the glass is pressed by the atmospheric air and the water rises up to our mouth.

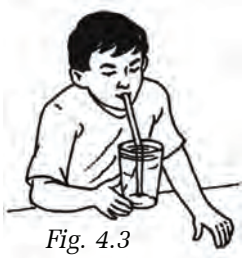


Fig. 4.3

Similarly, the rise of ink into a fountain pen and an injection of liquid into a syringe are also the result of same phenomenon i.e. difference in pressure of air inside and outside the chamber.

Importance of atmospheric pressure:

Some useful devices work due to the atmospheric pressure which are as follows:

a) To fill ink into a fountain pen

b) To fill a syringe

c) To inflate a bicycle tube with a pump

d) To lift water using a hand pump

These instruments work on the basis of the atmospheric pressure. If there were no atmospheric pressure, they would have no use at all. Therefore, the atmospheric pressure has great importance to our daily life.

Pressure of liquid

Pressure is defined as the force acting perpendicularly per unit area. A solid object exerts pressure on a surface where it is placed. Likewise, liquid also exerts pressure on the bottom of its container due to its own weight.

The force exerted by a liquid per unit area on the bottom of its container due to its weight is called liquid pressure.

Pressure exerted by a regular body (P) $= \frac{\text{force (F)}}{\text{area (A)}}$

Measurement of pressure of liquid

Take a vessel as shown in figure. Let A be the area of its base. Pour some liquid up to a height 'h'. Let 'd' be the density of the liquid and 'g' be acceleration due to gravity on that place.

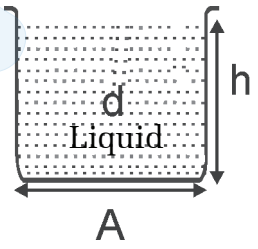


Fig. 4.4

Then, volume of the liquid(v)= A×h

Here, the net force given by the liquid on its bottom will be equal to the weight of the liquid.

We know that pressure of liquid on the base of the container is equal to perpendicular force acting per unit area.

So, Pressure(P)= $\frac{\text{weight of liquid (w)}}{\text{area of its base(A)}}$

Or, P= w/A

Or, P= mass × acceleration due to gravity / A (w= mg)

Or, P= (density x volume x g) /A

Or, P= (d x A x h × g)/A

∴ P= hdg

Therefore, the pressure of liquid on the base is equal to the product of density of liquid (d), height of the liquid column (h) and acceleration due to gravity (g). The pressure of liquid is directly proportional to height of liquid column and density of the liquid.

Example: 1

A tank of water has a height of 1.5m. If the tank is full of water, what will

be the pressure given by water at its bottom? (Density of water= 1000kg/m^3)

Here,

Height of liquid (h) = 1.5m

Density of the liquid (d)= 1000 kg/m^3

Acceleration due to gravity (g)= 9.8 m/s^2

Pressure (P)= ?

We have,

P =h x d × g

= 1.5 × 1000 x 9.8

= 14700N/m^2

∴ P = 14700 Pascal

Example: 2

The depth fo a liquid in a drum is 2m and the pressure exerted by the liquid at bottom of the drum is 500N/m^2. Calculate the density of the liquid.

Here,

Depth of the liquid (h)= 2m

Pressure of the liquid (P)= 500N/m^2

Acceleration due to gravity (g)= 9.8 m/s^2

Density of the liquid(d)= ?

we have,

P= h × d × g

Or, d= P/h × g

Or, d= 500/2.98

∴ d= 25.51 kg/m^3

Therefore, the density of the liquid is 25.51 kg/m^3.

Characters of liquid pressure:

1) The pressure of a liquid increases with the increase of depth.

   Or, the more the depth of a liquid increases, the more the pressure of the liquid increases.

Activity 4

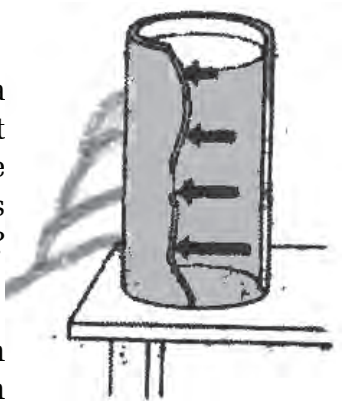


Fig. 4.5

Take a mineral water bottle or a plastic can or a tin can with three holes in vertical line at different height. Fill the bottle with water keeping all the holes closed with tape. Now, open all these holes simultaneously. What happened to the water? Observe it carefully.

You will find that the water coming out from the hole at maximum depth covers maximum horizontal distance as it has come out with the maximum force. The water comes out of the bottle from the other holes with lesser force as depth of water decreases. This experiment shows that the pressure of liquid increases with the increase of depth. That is why; the wall of a dam is made wider and stronger at the bottom so that it can withstand large pressure of the water.

2) Liquid transmits equal pressure normally in all directions

Activity 5

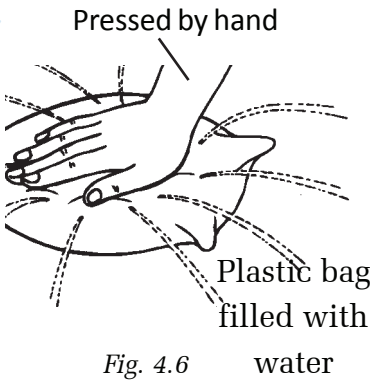


Fig. 4.6

Take a plastic bottle and make numerous pores on it with the help of a needle. Fill in the bottle with water and tight its lid. Then, press the bottle with your hand. What happened to the water? Observe it.

You will find the water coming out from each pore with equal pressure. This is because; the water gives an equal pressure in all directions. This experiment can also be carried out with a polythene bag that has numerous pores and filled with water.

Density

It is heavy to lift a pack of cement but we feel light to lift the same sized pack filled with rice or maize. How does it happen so? Discuss it.

How can you differentiate a heavier body from a lighter body e.g. a wood and wax? Can you find by weighing? The mass of a block of wood will be

larger if its size is large. Again, the wax may have larger mass if its size is large. Therefore, we need to weigh the blocks of wood and wax having equal volume. The block having greater mass will be heavier substance. No two substances can have equal mass in equal volume. So, mass of unit volume is calculated by measuring mass and volume of a substance. The mass of unit volume is found by taking ratio of mass to volume of a body.

The mass of unit volume of a body is called its density.

Therefore, density of a body (d) = $\frac{\text{mass (m)}}{\text{volume (v)}}$

Density of a body is not affected by its shape and size but it depends up on the nature of substance. Density of a body is its denseness or compactness. The greater the denseness, the density of a substance is higher. For example: iron is heavier than wood. It means, the iron has more density than the wood.

Example: 3

The mass of an iron ball is 16000kg whose volume is $2m^3$. Calculate the density of iron.

Here, volume of iron ball (v)= $2m^3$

Mass of the iron (m)= 16000kg

Density (d) =?

We have,

density (d) = $\frac{\text{mass}}{\text{volume}}$

$= \frac{16000}{2}$

$= 8000\ kg/m^3$

$\therefore$ Density of iron is $8000\ kg/m^3$.

Unit of density

If the mass and volume are measured in kg and m^3 respectively, then the unit of density is kilogram per cubic meter (kg/m^3). But if mass is measured in gram and volume is in cm^3, then the unit of density will be gm/cm^3.

Activity: 6

Take two containers of same size and regular shape. Fill one container with water and the other with sand. Weigh both containers separately to find their mass. Find volume of the container and calculate the density of water and sand separately.

Relative density

The relative density is defined as the ratio of density of a substance to the density of another substance. Considering density of water as standard value, the density of any substance is compared with it. Hence generally relative density of a substance is defined as the ratio of the density of a substance to the density of water.

$$\therefore \text{Relative density} = \frac{\text{density of a substance}}{\text{density of water}}$$

Activity 7

Repeat the activity 6. Calculate the relative density of sand.

Floating and sinking

Some objects sink in water but other objects float. Why does it happen? Discuss with your friends and consult your teacher with your conclusion. Generally, objects having density greater than the density of water sink in water. Let's carry out an activity to find which objects float on or sink in water.

Activity: 8

Collect some pieces of wood, plastic, eraser, pieces of iron, small gravels, etc. Take a beaker with some water. Put the stuffs onto the beaker one after other. Observe and find out whether the given objects float or sink. Fill in the following table on the basis of your result.

SN	Objects	Float/sink	More/less density than water
1	wooden pieces		
2	plastic		
3	eraser		
4	iron pieces		
5	gravel		

Those objects which sink in water have greater density than that of water. Similarly, the floating objects have less density than that of water.

Considerable question:

When we mix kerosene and water, which one will float? Why?

Activity 9

Take a beaker of clean water. Put an egg gently into the beaker. The egg descends to the bottom of beaker or sinks in water. Now, dissolve some salt in the water slowly. When the concentration of salt in water increases, the egg starts to float on. Here, the density of egg is greater than the density of pure water. So, the egg sinks in it. The egg floats when the density of egg is less than the density of salty water. Hence, floating or sinking of an object depends on the density of the object.

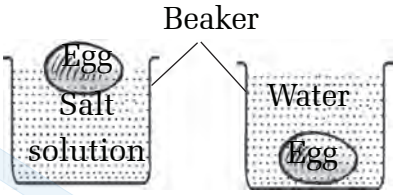


Fig. 4.7

Experimental activity:

1) Take a polythene bag. Fill the bag with water and close its mouth tightly. Pierce numerous holes on the bag with a needle. Press the bag and observe it. What is the conclusion? Explain.

2) Take a bucket of water. Dip an empty glass bottle from its mouth. What happens when water enters into the bottle? What is its conclusion?

3) Blow a balloon. The balloon blasts if it is inflated more and more, why? Why does it happen? Explain.

Summary

1) The region of air which surrounds the earth is called the atmosphere.
2) The pressure exerted by air per unit area on the surface of the earth is called atmospheric pressure.
3) The air is compressible.
4) It is possible to fill a fountain pen with ink as well as a syringe with an injection liquid and to lift water by hand-pump due to atmospheric pressure.
5) The pressure of a liquid (p)= hdg
6) Force is measured in Newton (N) and pressure is measured in Pascal or N/m^2.

7) The pressure of liquid increases with depth (h).

8) Liquid transmits in an equal normal pressure in all directions.

9) The mass contained in a unit volume of a substance is called its density.

10) The ratio of density of a substance to the density of water is called relative density.

11) Those substances which have density more than the density of water sink whereas those having density less than that of water float on water.

Exercise

1) Fill in the blanks with the appropriate words.

a) The pressure exerted by the air in atmosphere is called .....

b) Pressure is the .....applied per unit area.

c) The pressure .....as the depth of liquid increases.

d) The SI unit of density is .....

e) An object floats on water if the .....of the object is less than that of water.

2) Choose the correct answer.

a) Which is the SI unit of density?

i) kg/m^3 ii) kg/liter iii) kg/cm^3 iv) kg/m

b) What is the formula of density?

i) M = M × V ii) V= D × M

iii) $D = \frac{V}{M}$ iv) $D = \frac{M}{V}$

c) Which object floats on a liquid?

i) an object having less density than that of water

ii) an object having density

iii) an object having greater density than water, that of water

iv) an object having mass

d) On which direction does a liquid exert pressure?

i) only upwards ii) only downwards

iii) only on lateral sides iv) in all directions

e) A point is at a depth of 100m and acceleration due to gravity 9.8 m/s^2, how much pressure will the water exert?

i) 980 Pa ii) 9800 Pa iii) 98000 Pa iv) 980000 Pa

3) Give reason.

a) The pressure of liquid varies as per its depth.

b) The base of a dam is made thicker.

c) The strongly blown balloon gets blasted.

4) Answer in brief.

a) Explain atmospheric pressure with examples.

b) How do you know that a liquid exerts pressure?

c) How is the atmospheric pressure detected?

d) Define density.

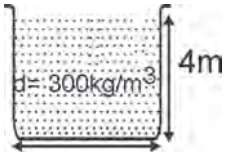
e) What type of objects float on water?

f) What is relative density?

5) Solve the numerical problems.

a) Calculate the pressure of water at the bottom of a well if the depth of water is 10m. (g= 9.8 m/s^2) *(Ans: 98000Pa)*

b) In the given figure, find the pressure exerted by the liquid at its base. *(Ans: 11,760 pa)*



c) Calculate the mass of a block of ice having volume of 5 m^3. *(density of ice= 920 kg/m^3)* *(Ans: 4600 kg)*

d) A tank with dimensions: 3m x 2m x 2m contains water upto its half portion. What is the pressure at the base of the tank? (density of water = 1000 kg/m^3, g= 9.8 m/s^2) *(Ans: 9800 Pa)*

Unit 5

Energy, Work and Power

Energy

All living beings require food. Foods give us energy which is used to do different kinds of work. Similarly, vehicles like motorbike, aero planes, cars, etc. get energy from fuel. Some instruments run using electric energy. Energy provides force for work. Energy is a capacity to do work. If there is no energy in a body, it cannot perform work.

The capacity of a body to do work is called energy. The unit of energy is Joule.

Kinds of energy

There are different forms of energy in nature. They are mechanical energy, heat energy, sound energy, magnetic energy, light energy, electric energy, chemical energy, nuclear energy, etc. In this chapter, we learn only the mechanical energy.

Mechanical energy

The energy possessed by a moving body or a body at rest is called mechanical energy. There are two types of mechanical energy, i.e., potential energy and kinetic energy.

a) Potential energy

Activity 1

Take a catapult with a small stone. Stretch its rubber and shoot the stone to an empty area. How could the stone go away from you? Where does its energy come from? Discuss with your friends. When you stretched the rubber of catapult, muscular energy transferred from your hand to the catapult and it was stored in the catapult. The energy thus stored in the stretched rubber is potential energy.

Potential energy is the energy possessed by a body by virtue of its position or configuration.

A lifted stone up to a certain height or water stored in a dam, etc. have potential energy due to position. Similarly, when a spring is twisted or stretched, its configuration changes and it has a tendency to return back to its initial state. Due to this process, the energy is stored in the spring. The raised foot before kicking a football also stores energy due to change in configuration of foots as well as its muscles.

Suppose a body has mass m when the body is lifted to a height h from the ground, total force applied on the body is equal to its weight. So, weight of the body is F= mg. Now, total work done on the body, w = force × distance = mg × h = mgh. The work done on the body is equal to the potential energy possessed by the body at height h. Therefore, potential energy = mgh.

Example: 1

What is the energy required to lift a stone of mass 5kg up to a height of 3m?

Here, Mass (m)= 5kg

Height (h)= 3m

Acceleration due to gravity (g)= 9.8 m/s^2

We have formula, PE = mgh

= 5 × 3 × 9.8

= 147 Joule

b) Kinetic energy

When we release a stone from a certain height, it makes a pit on the ground. A running vehicle gets its face broken when it collides with another vehicle. Why does this happen? Anybody in motion possesses an energy called kinetic energy. For example, flowing water, a fired bullet, rolling football. Hydroelectricity is generated from the kinetic energy of flowing water. Similarly, in windmill, electricity is generated from kinetic energy of wind.

The energy possessed by a body by virtue of its motion is called kinetic energy.

Activity: 2

Take a ball. Throw the ball and tell your friend to catch the ball. Again, throw the ball more

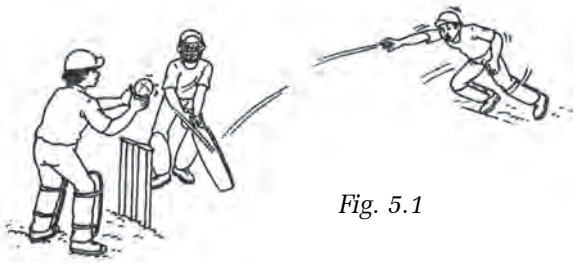


Fig. 5.1

strongly and tell your friend to catch. What difference have you found between the throws before and after while catching the ball? Similarly, repeat the same activity with a heavier ball (cricket ball) first and then with light ball (tennis ball). Have you found any difference between the throws of the balls? Discuss it.

Kinetic energy of a ball increases with its velocity so it is difficult to catch a fast ball. Similarly, heavy ball has kinetic energy greater than a light ball. So, kinetic energy depends up on mass and velocity of a moving body. The kinetic energy of a body is calculated by half of product of its mass and square of its velocity. If m be mass and v be the velocity of a body, then,

Kinetic energy (KE) = $1/2 \times$ mass $\times$ $(\text{velocity})^2$

or, KE= $1/2 m v^2$

Example: 2

A motorbike has mass of 200kg and velocity of 20m/s. Calculate its kinetic energy.

Here, mass (m)= 200kg

velocity (v)= 20m/s

KE = ?

We have, KE = $1/2\ mv^2$

$= 1/2 \times 200 \times (20)^2$

$= 40000J$

$= 40\ KJ$

Therefore, the kinetic energy of the motorbike is 40000J or 40KJ.

Work

What is work? Does a man have work when he stands still with a heavy bag? We have been doing several works in our daily life. But they may not be the work done at all scientifically. It is necessary to displace a body by the force to be work. A body at rest does not have any work done. Work is said to be done if a body has a displacement in the direction of force when it is acted upon the body. For example: when a body is lifted up or pulled on the ground, work is done.

For work, it is necessary to have the followings.

i) force applied on a body

ii) displacement (along the direction of force)

work (w)= force (f) × displacement (d)

$\therefore W = f \times d$

If force is in Newton and displacement is in meter then the work done is measured in Joule.

The work done on a body when it is acted by 1N force to displace through 1m is called 1J work.

Types of Work

a) work done against friction b) work done against gravity

a) Work done against friction.

When we pull or push a body, an opposing force comes into action which is called friction. If a body is moved by pulling or pushing, a work is done against the friction.

Activity 3

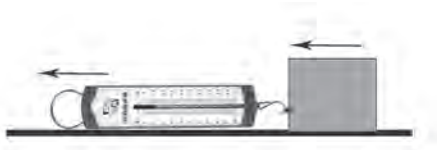


Fig 5.2

Take a spring balance and a cubical wooden block. Tie the block with a string strongly. Draw the block steadily with the spring balance on a horizontal surface. The block moves after a force has been applied against the friction. If the spring balance shows a force equal to the weight 3kg and it is moved through a distance of 5m then find the work done.

Here, friction of force (f) = mg = 3kg x 9.8m/s^2 = 29.4 N

Distance (d) = 5m

Work (w) =?

We have formula, w = f × d

= 29.4 × 5

= 147.0 J

So, the total work done in moving the block through 5m is 147J.

Example: 3

A porter carries a bag of weight 1000N to a distance of 50m, calculate work done by him.

Here, weight of bag (F)= 1000N

Distance covered (d) = 50m

Work done (w) = ?

we have formula

$w = f \times d$

$w = 1000N \times 50m$

$w = 50000J$

Therefore the porter has done 50000J work.

b) Work against gravity

Gravity pulls an object downwards while lifting the object. When a body is moved upwards, a work has to be done against the gravity of the earth called work done against gravity.

Activity: 4

Take a spring balance and hang a stone on its hook as shown in the figure. Lift the spring balance with the stone. Gravity pulls the stone downwards when we hold the spring balance. A force has to be applied against the gravity force to lift the body. This work is called the work done against gravity.

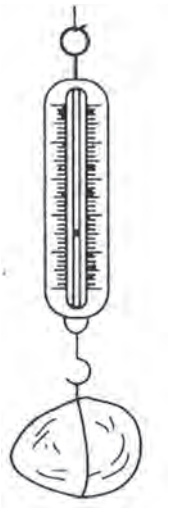


Fig 5.3

Consider the spring balance shows weight of the stone as 4kg. What will be the work done in lifting the stone at the height of 4m?

Here, mass of the stone (m)= 4kg

Acceleration due to gravity (g) = $9.8m/s^2$

Distance (d) = height (h)= 4m

Work done (w) = ?

Work done against gravity (w) = mgh

$= 4 \times 9.8 \times 4$

$= 156.8$ J

Therefore, the work done is 156.8 J.

Example : 4

The mass of Shrijan is 50kg. How much does he work when he climbs 20m high ladder? Calculate.

Here, Mass of Shrijan (m)= 50kg

Height (h)= 20m

Acceleration due to gravity (g) = $9.8 m/s^2$

Work done against gravity (w)= ?

We have formula,

$w = mgh$

$w = 50 \times 9.8 \times 20$

$w = 9800J$

$\therefore$ Total work done by him is 9800J.

Transformation of energy

Energy can neither be created nor be destroyed but it can be changed from one form to another. It is known as law of conservation of energy. Different kinds of energy are required in our daily life. Whatever energy available for us, we convert its one form into another form as per our need. We use certain devices to convert the energy from one form to another. The process of conversion of energy from one form to another is called transformation of energy. Solar panel transforms solar energy into electric energy. Electric energy is converted into heat and light by heater and bulb respectively. A battery in a torch converts chemical energy into light energy.

Power

We have already discussed that different devices convert energy from its one form to an other. The rate of conversion of energy is called power. All devices do not convert the energy in identical way. Conversion of energy refers to the work done by the device. Some devices can work faster while other does slow. The rate at which a device can work is called its power.

$$\text{Power (P)} = \frac{\text{work done (w)}}{\text{time taken (t)}}$$

If work done is in Joule and time in second, unit of power is Joule per second or watt.

If a machine can do 1 Joule work in 1 second then its power is called 1 watt. The larger units of power are kilowatt (Kw) and megawatt (Mw). The power of engines can also be measured in Horse Power (HP).

1000w = 1kw

1000 kw = 1Mw

746 watt = 1hp

Relation between energy, work and power

Energy, work and power are interrelated to each other. In fact, the capacity of doing work is energy. When work is done on a body, its energy is increased. By the principle of conservation of energy, the energy gained by the body is equal to the energy lost during the work on it. For example, if a book on a table is moved, a work has to be done on the book. So, some energy is spent to move the book. The kinetic energy gained by the book is equal to work done on it.

We eat food for energy. Every food has energy in chemical form. When we eat food, chemical energy of the food changes into muscular energy of our body. By this energy, we can do work. When we are hungry, we feel tired and cannot do any work.

Similarly, the rate at which we can do work is called power. Power is the rate of conversion of energy. As work done in a short time interval increases, power also increases accordingly. Power may also be defined as the ratio of energy spent to the time taken to do the work. When the energy consumed in a certain time increases, power also increases and hence work is done fast. So, work, energy and power are interrelated to each other.

Example: 5

The mass of Sparsha is 40kg. He takes 10 seconds to climb a ladder of 14 steps each having height of 15cm. Find his power.

Here, Mass of Sparsha(m)= 40kg

Weight of Sparsha (w)= mg= 40 × 9.8= 392N

Total height (h)= 15cm × 14=210cm= 2.1m

Total time taken(t)= 10sec

Now, work done (w)= f × d =392 × 2.1 = 832.2J

Again, P= w/t = 832.2/10 = 83.22watt

Experimental work

Weigh your mass. Measure the height of a step of the staircase of your school. Count the total number of steps in the staircase and find out the total height of first floor. Stand at the bottom and ask your friend to stand at the top of the stairs with a stop watch and whistle. Ask him to whistle and switch the watch on simultaneously. Start to climb the stairs as soon as you hear the whistle. Note the time taken to reach the second floor. Then, calculate your power from it and do the same for other friends as well.

Summary

1) The capacity of doing work is known as energy. Energy is measured in Joule.
2) The energy possessed by a body by virtue of its position or configuration is called potential energy. PE = mgh
3) The energy of a body by the virtue of its motion is called kinetic energy. KE= 1/2m v^2
4) The product of force and displacement of body in the direction of force is called work done. It is measured in Joule. The two types of work are : (i) the work done against friction (w)= f × d and (ii) work done against gravity (w)= mgh.
5) The work done in moving a body through 1m by a force of 1N is called 1J work.
6) Energy can neither be created nor be destroyed but can be changed from one form to another.
7) The rate of work done per second is called power. Power is also defined as the rate of conversion of energy. Power is measured in watt (w).
8) If 1 Joule of work is done in 1 sec, the power is said to be 1 watt.
9) The power of engines is also measured in Horse Power (HP). (1HP = 746 watt)

Exercise

1) Fill in the blanks with appropriate words.

a) Energy is the capacity of doing .....

b) Work is the transformation of .....

c) Work is measured in .....

d) When a stone is lifted up, ... is stored

e) Wind has..... energy.

2) Choose the correct answer.

a) Which of the followings have work done?

i) ploughing the field ii) standing guard

iii) standing with a load iv) trying to move the vehicle at rest

b) A raised foot to kick the football has

i) kinetic energy ii) potential energy

iii) chemical energy iv) mechanical energy

c) Which device converts mechanical energy into electric energy?

i) cell ii) electric motor

iii) generator iv) electric fan

d) What is the nature of a machine having more power?

i) can do a lot of work ii) can do a small work

iii) can work faster iv) works slowly

e) A man is standing with a load of 25kg at a height of 1m from ground. How much work has he done?

i) 24.5J ii) 25J iii) 50J iv) 0J

3) Answer in brief.

a) What is energy?

b) What is work? Write down the types of work.

c) Define power with an example.

d) Define 1J work.

e) What do you mean by 100W power?

f) What is transformation of energy? Explain with example.

4) Write down the transformation of energy in torch light.

5) Explain the relation between work and energy with examples.

6) Why are we unable to work long without food?

7) Write down the types of energy in the following bodies.

i) battery ii) sun

iii) water in a dam iv) a bullet fired from the gun

v) a stretched rubber vi) a stone at the top of slide

8) Write down the device which changes energy as mentioned below.

i) Light energy to electric energy

ii) Chemical energy to electric energy

iii) Mechanical energy to electric energy

iv) Electric energy to heat energy

v) Electric energy to light energy

vi) Chemical energy to light energy

9) Write down the points to differentiate work, energy and power in the following table.

Work	Energy	Power
1	1	1
2	2	2
3	3	3

10) Solve the following numerical problems.

a) What is the energy required to lift an object of mass 25kg to a height of 10m? *(Asn: 2450J)*

b) If a stone of 0.5kg is thrown with speed of 5m/s, find its kinetic energy. *(Ans: 6.25J)*

c) An inclined plane is 3m high. If a kid sits at its top, what will be his potential energy? *(Ans: 1176J)*

d) A man displaces a box through a distance 20m by applying 20N force. What is his work done? If he takes 2 sec time for this work, calculate power. *(Ans: 400J, 200W)*

e) A person can carry 20 bricks at a time. Each brick weighs 10N. If he takes 50s to carry 20 such bricks to a distance of 100m, what is his power? *(Ans: 400W)*

Unit

6 Heat

Heat and temperature

When we touch a piece of ice, we feel cold. Similarly, if we touch a heated body, we feel hot. What is the reason behind this?

The feeling of hot or cold is the transfer of heat energy from one body to another. When we touch a hot body we receive heat from the hot body and feel hot. Likewise, heat flows from our body to ice when we touch it. Then we feel cold. So, flow of heat from one body to other causes the sensation of hot or cold.

If we rub our hands, we feel hot. An iron nail also gets heated when it is rubbed against a stone. How does it happen so?

A matter is composed of molecules. The molecules have potential energy stored in them. When a body is heated, it produces vibration in the molecules. Kinetic energy is produced from the molecular vibration which gives heat energy. Heat energy of a body is the sum of kinetic energy of all molecules contained in the body. The more the molecules are vibrated, the more the body contains heat. The degree of hotness or coldness of a body is called temperature. The more a body has temperature, the intensity of vibration of its molecules is higher.

Activity 1

Take a glass tumbler of hot water. Measure its temperature and write in your exercise book. Again take another glass tumbler of cold water. Measure its temperature and note it. Now mix the water of both glass tumblers in a larger vessel and measure its temperature. What is the final temperature?

The temperature of the mixture is different from the temperature of hot and cold water. The mixture has temperature between hot and cold water. Thus, the hot water loses heat but cold gains heat when they are mixed. Heat always flows from a body at higher temperature to the body at lower temperature.

Relation between heat and temperature

The temperature of a body increases when it is heated. Similarly, its temperature decreases when it is cooled. It means, heat is the cause to increase or decrease the temperature of a body. Temperature is an effect of heat.

Understanding question

There is a hot iron nail and a liter of boiling water. Which one has more heat energy? Why?

Difference between heat and temperature

Heat	Temperature
1) Heat is a form of energy which gives sensation of warmth.	1) Temperature is degree of hotness or coldness.
2) It depends on the kinetic energy of the molecules and their mass.	2) It depends only on the kinetic energy of the molecules.
3) It is a cause.	3) It is an effect.
4) It is measured in Joule.	4) It is measured in ℃, ℉, K.

Thermometer

We can feel hotness of a body by touching but can't measure its degree of hotness. We use thermometer to measure it. Thermometer is an instrument which is used for measuring degree of hotness of a body, i.e., temperature of the body.

Structure of a thermometer

A simple thermometer consists of a thick walled glass tube and a capillary tube of fine bore. Its both ends are closed. A cylindrical structure is provided at one end of the tube called bulb. The bulb has a shining white liquid metal

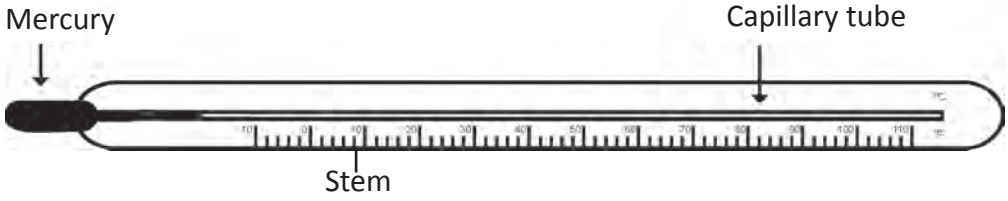


Fig. 6.1

called mercury. Mercury is a good conductor of heat since it is a metal.

When the bulb of a thermometer is placed in contact with a hot body, the mercury is heated and starts to expand. When it expands, its level rises in the capillary tube. If the mercury is heated more and more, its level gradually rises in the capillary tube. The temperature is measured according to the rise of mercury level in the capillary tube. The working of thermometer is based on the principle that "A liquid expands on heating and contracts on cooling".

Liquids used in thermometers

a) Mercury

Mercury is a liquid metal. It expands uniformly on heating. It has shining white color so rise and fall of mercury can be easily noticed in the capillary tube. Its boiling point is 357^0C, so it is useful to measure a high temperature. As its freezing point is -39^0C, it cannot be used in a very cold region.

b) Alcohol

Alcohol is a colorless liquid. It expands six times greater than mercury on heating. It is quite cheaper than mercury. It can be distinctly visible by coloring. It can measure very low temperature as it melts at -115^oC. Since alcohol boils at 78^oC, it is not useful to measure high temperature.

Understanding question

A mercury thermometer is used to measure the temperature of boiling water. Why? A mountaineer prefers an alcohol thermometer, why?

Calibration of thermometer

The process of marking a scale on a thermometer is called calibration. At first, two fixed points are marked in the stem.

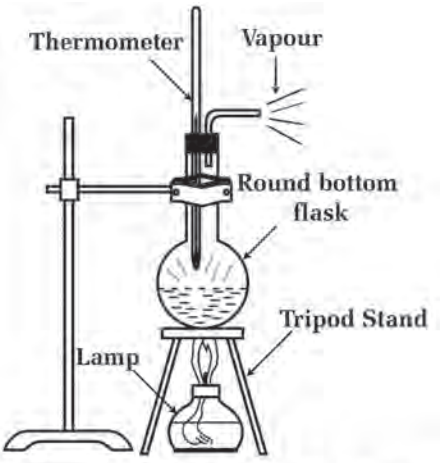
Upper fixed point

The temperature at which pure water boils at Standard Atmospheric Pressure (i.e. 760 mmHg) is called upper fixed point. This is 100^oC or 212^oF.

Activity 2

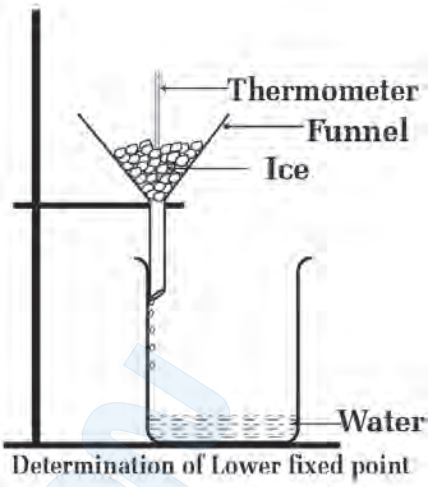
Fill about half of a Round Bottomed Flask (RB Flask) with water. Fix a thermometer and an L-shaped glass tube through a two-holed cork on the mouth of the flask. Heat the flask over a tripod stand with a burner as shown

in figure. The level of mercury rises as water is heated and stops at a point.



Delerminaiton of upper fixed point

Fig. 6.2



Determination of Lower fixed point

Fig. 6.3

Note the constant temperature when the water is boiling. This is boiling point of water (100oC or 212oF) which is upper fixed point.

Lower fixed point

The temperature at which a piece of pure ice melts at Standard Atmospheric Pressure (i.e. 760 mmHg) is called lower fixed point. This is $0^{o}C$ or 32^{oF}.

Activity 3

Put some pieces of ice in a funnel. Fix the funnel above a beaker with the help of clamp and stand as shown in figure. Insert a thermometer in the ice so that its bulb can be covered with ice. The level of mercury goes down and stops at a point. Note the constant temperature at which the mercury stops. This is melting point of water ($0^{o}C$ or $32^{o}F$) which is lower fixed point.

After finding the upper and lower fixed points, the distance between the two points is divided into a number of equal parts. If we choose Celsius scale, the interval between upper and lower fixed points is divided into 100 equal parts and each part shows one degree Celsius. Similarly, in Fahrenheit scale, it is divided into 180 equal parts and each part shows one degree Fahrenheit.

Transformation of unit of temperature

Generally, there are two types of scales of temperature.

a) **Celsius scale:** In this scale, the lower fixed point is 0^oC and the upper fixed point is 100^oC.

b) **Fahrenheit scale:** In this scale, the lower fixed point is 32^oF and the upper fixed point is 212^oF.

In Celsius scale, the interval between the upper and lower fixed points is divided into 100 equal parts. But in Fahrenheit scale, the interval is divided into 180 equal parts. 0^o in Celsius scale corresponds to 32^o in Fahrenheit scale.

$\therefore\ 0^oC = 32^oF$ ____ = _____

The relation between Celsius and Fahrenheit scale is given by following equation as $\frac{C - 0}{100} = \frac{F - 32}{180}$

Example 1

Convert 37^oC into Fahrenheit scale.

Here, $C-0/100 = F-32/180$

Or, $37-0/100 = F-32/180$

or, $F = 37/100 \times 180+32$

$= 66.6+ 32 = 98.6$

Therefore, $37^oC = 98.6^oF$

Example 2

Express -40°F in to Celsius scale.

Here, we have the relation,

$C-0/100 = F-32/180$

$C/100 = -40-32/180$

$C = -72/180\times100$

$C = -40^oC$

Therefore $-40^oF = -40^oC$

Types of thermometer

There are different types of thermometer depending upon the structure and their uses.

a) Clinical thermometer

The thermometer which is used to measure the temperature of human body is called clinical thermometer. The clinical thermometer has both Celsius and Fahrenheit scales. In Celsius scale, the stem of thermometer is calibrated from 35°C to 42°C and from 94°F to 108°F in Fahrenheit scale. The normal human temperature is 37°C or 98.6°F.

Just above the bulb, there is small constriction or kink in the stem. When temperature rises, mercury can pass through the constriction but cannot pass immediately through it as temperature falls. The mercury falls only after jerking it gently. The shape of the thermometer is not round but prismatic. Due to this shape, we can see magnified view of the thread of the mercury in the capillary tube when observed from a suitable angle. Nowadays, digital clinical thermometer has been used. In this thermometer mercury or alcohol is not used.

b) Laboratory thermometer (simple thermometer)

It is a simple thermometer. It is simply cylindrical and long in structure. Mercury is used in this thermometer. When its bulb is placed in contact with a hot body, the volume of mercury increases and hence the level of mercury begins to rise. And the mercury falls when its bulb is cooled. Generally, it has the temperature range from -10°C to 110°C. The capillary tube in the thermometer is made up of a fine bore and thin walled bulb is present so that the temperature could be measured accurately.

Experimental work

1) Take a clinical thermometer and measure the temperature of your body.
2) According to activity 2 and 3, find out boiling point of water and melting point of ice.

Summary

1) Heat is sum of molecular kinetic energy of a body.
2) The degree of hotness of a body is called temperature.
3) Heat always flows from a body having higher temperature to a body having lower temperature.
4) Heat is a cause whereas temperature is an effect.
5) An instrument which is used to measure temperature of a body is called

thermometer.

6) In general, two scales are used in thermometer, Celsius and Fahrenheit.

7) The thermometer used to measure temperature of human body is called Clinical thermometer.

8) The thermometer used in laboratory is called simple (laboratory) thermometer.

9) The working principle of a thermometer is that liquid expands on heating and contracts on cooling.

10) Conversion relation of degree Celsius and degree Fahrenheit is C-0/100 = F-32/180

Exercise

1) Fill in the blanks with appropriate words.

a) The sum of ……of all molecules of a body is called heat.

b) The hotness or coldness of a body is called ……..

c) …….is used to measure the temperature.

d) The boiling point of water in Celsius scale is…….

e) The temperature of human body is…… ^{o}F.

2) Choose the correct answer.

a) Which energy of the molecules in a body does heat depend on?

i) Potential energy ii) Kinetic energy

iii) Mechanical energy iv) Heat energy

b) In which unit is heat measured?

i) Newton ii) Kelvin iii) Degree Celsius iv) Joule

c) What is the boiling point of Mercury?

i) 78^{o}C ii) 100^{o}C iii) 212^{o}C iv) 357^{o}C

d) What is the temperature of human body?

i) 35^{o}C ii) 37^{o}C iii) 42^{o}C iv) 108^{o}C

e) What is the range of the temperature measured by a simple thermometer?

i) 0 °C to 100 °C ii) 10 °C to 100 °C

iii) -10 °C to 110 °C iv) 10 °C to 110 °C

3) Differentiate between.

a) Heat and temperature

b) Clinical thermometer and simple thermometer

c) Celsius and Fahrenheit scale d) Lower and upper fixed points

4) Answer in brief.

a) What is heat?

b) What is meant by temperature?

c) What are the liquids used in the thermometers?

d) What is the formula to convert Celsius into Fahrenheit scale?

5) Convert the followings.

a) 98.6 °F to Celsius scale b) -40 °C to Fahrenheit scale

c) 32 °F to Celsius scale d) 100 °C to Fahrenheit scale

6) Explain the construction of a thermometer with a figure.

7) Give reason.

a) Alcohol thermometer cannot measure the temperature of boiling water, why?

b) Which thermometer is preferred for a mountaineer between mercury and alcohol thermometer, why?

c) There is constriction made in a clinical thermometer, why?

d) The wall of the bulb in a thermometer is made thin, why?

Unit

7

Light

Light is a form of energy which enables us to see objects. We are able to see the things around us and enjoy natural beauty due to the light. Light travels in a straight path through a medium. The narrow part of light is represented by a straight line. The path of light is represented by a straight line with an arrowhead which is called ray of light. The collection of parallel rays of light is called a beam of light.

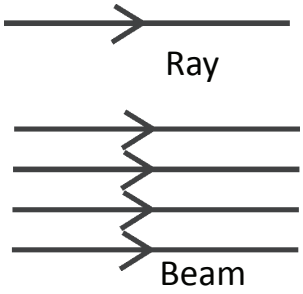


Fig. 7.1

Mirror and its types

Have you used mirror to see your face and comb hair? How does the mirror look like? A mirror is made of glass. Its one surface is made smooth where as the other side is polished to block the light. An image is formed when an object is placed in front of it. The image of an object is formed due to reflection of light coming from a source by a reflecting surface of mirror.

Fig. 7.2

Mirror is an instrument which reflects light falling on it and forms image of the object.

Generally mirrors are of two types: i) Plane mirror ii) Spherical mirror.

i) Plane mirror

(ii) Spherical mirror

i) Plane mirror

If the reflecting surface of a mirror is flat and smooth, this type of mirror is called a plane mirror. Plane mirrors are used as looking glass at home

and in bathroom. To draw a mirror, we draw a straight line as reflecting surface. On the other side we shade to indicate non-reflecting surface of the mirror.

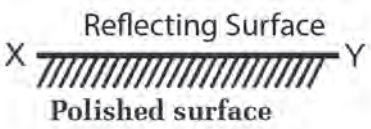


Fig. 7.3

Activity. 1

Hang a mirror on wall. Stand in front of it and look at your image. Find the size and nature of the image. Move few steps back and find your image. Your image also moves back. Again move near to the mirror, where do you see the image? Now, raise your left hand and see. Which hand has been raised in the image? Why does this happen?

Characteristics of image formed by plane mirror

The image formed by a plane mirror is erect, virtual (that cannot be obtained on a screen), of the same size as the object and formed at a distance equal to the object distance. The image thus formed on a plane mirror is laterally inverted (or left appearing right and right appearing left).

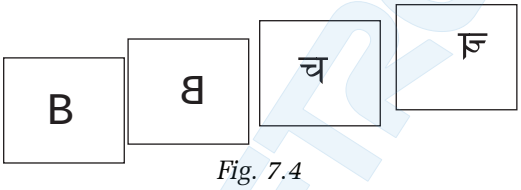


Fig. 7.4

b) Spherical mirrors

We use plane mirrors as a looking glass in our home, parlors etc. But all mirrors do not have plane surface. Some mirrors have surface depressed in the middle while some mirrors have raised surface in the middle. Mainly, there are two types of spherical mirrors:

i) concave mirror ii) convex mirror

Activity 2

Take a steel spoon and observe its surface. The inner surface of the spoon is depressed which is called concave surface. Look at the outer surface which is raised at the center, called a convex surface.

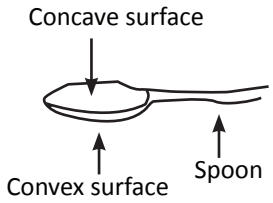


Fig. 7.5

i) Concave Mirror

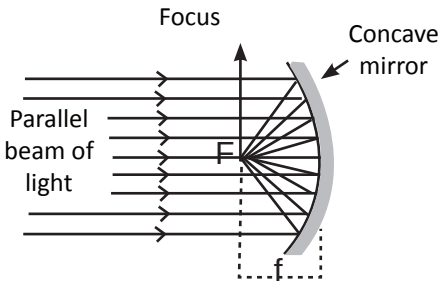


Fig. 7.6

The mirror which has raised outer part and uniformly depressed middle part is called concave mirror. The parallel beam of light is converged at a point after reflection on a concave mirror. This point is called focus. Concave mirror is also called a converging mirror because it converge parallel beam of light incident on its surface. Similarly, rays of light coming from its focus are reflected back parallel to its principle axis.

Understanding question:

The reflector in a torch light is of a concave shape and the bulb is placed at its focus. What is its benefit?

ii) Convex mirror

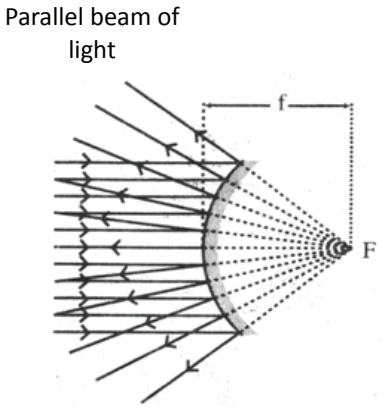


Fig. 7.7

The mirror which has depressed outer part and uniformly raised middle part is called convex mirror. A parallel beam of light is diverged after reflection on the surface of a convex mirror. So, it is also called diverging mirror.

The rays of light reflected back from a convex mirror appear to be coming from a point. This point is called focus of the convex mirror. It forms an erect and diminished image. The image of large objects located at a far distance is formed at near with diminished size.

Understanding question

Drivers use convex mirror as a side mirror to have a view of the traffic behind. Why?

Activity 3

Take a concave mirror and look at your face on its surface at a distance of 50cm. How is the image seen? Bring the mirror nearer and again look at the image. What difference do you find between the images before and after shifting the mirror? Again bring the mirror nearer and look at your face if the image is erect or inverted. Is the image enlarged or diminished than before? What can be learnt about the mirror from this experiment?

Real and virtual image

Activity:4

Take a concave mirror and turn it towards a window. Hold a white cardboard paper in front of the mirror at distance of 20- 30 cm. so that the reflected light from its surface could fall on the paper. Adjust the mirror to form a clear image of the scene on the board. Measure the distance between the mirror and the paper which is equal to focal length of the mirror. The image formed by the concave mirror on the paper is real image. Use the convex and plane mirrors instead of concave mirror for this experiment. Have you got a similar image?

The image that can be obtained on a screen is called real image. It is formed by the actual intersection of the reflected rays.

An image which cannot be obtained on a screen is called virtual image. It is formed by apparent intersection of the reflected rays but they don't intersect each other in real. A concave mirror can form a real image but convex and plane mirrors form virtual images.

Difference between real and virtual image

Real image	Virtual image
1) It can be obtained on a screen.	It cannot be obtained on a screen.
2) It is formed at the point of actual intersection of reflected rays.	It is formed at the point where the reflected rays appear to meet.
3) It is always inverted.	It is always erect.
4) It is always formed in front of mirror.	It is always formed behind the mirror.

Some important terms related to spherical mirrors

Some terms are frequently used while doing different activities using spherical mirrors. They are explained as below:

a) Pole of mirror

The geometrical center of reflecting surface of a mirror is called the pole of mirror. It is denoted by P. All the distances are measured from this point.

b) Center of curvature

A spherical mirror (Concave or Convex) is a part of whole sphere of glass. The center of the sphere from which the mirror is formed is called center of curvature. It is denoted by C.

c) Radius of curvature

The radius of the sphere in spherical mirror is called the radius of curvature. It is the distance between the center of curvature (C) and pole of the mirror (P). It is denoted by R.

d) Principal axis

A straight line passing through the center of curvature(C) and pole of the mirror (P) is called principal axis.

e) Principal focus

A parallel beam of light incident on a concave mirror gets converged at a point after reflection. This point is called principal focus. It lies on the principal axis in front of the mirror. The parallel beam of light is diverged after reflection on the surface of convex mirror but appears to be coming from a point. This point is called the focus of convex mirror. The focus of a convex mirror lies behind the mirror and it is denoted by F.

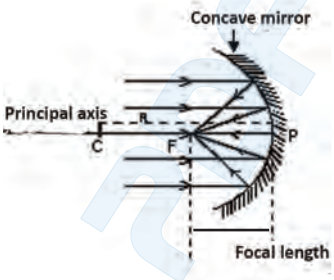


Fig. 7.8

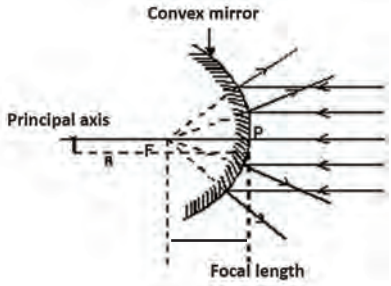


Fig. 7.9

f) Focal length

The distance between principal focus (F) and pole of a mirror (P) is called focal length. It is denoted by (f) and measured in meter.

Image formed by spherical mirror

The diagram that represents the image formed by a spherical mirror is called a ray diagram. Ray diagrams ascertain the size, location and distance of image formed by a spherical mirror.

Rules used to draw ray diagrams in concave mirror

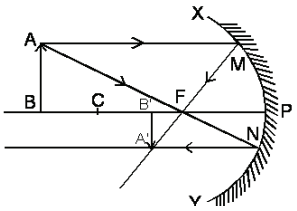


Fig. 7.10

i) The rays of light parallel to the principal axis passes through the focus after reflection.

ii) The rays of light passing through the focus

(F) reflect parallel to the principal axis.

iii) The rays of light passing through the center of curvature reflect through the same path.

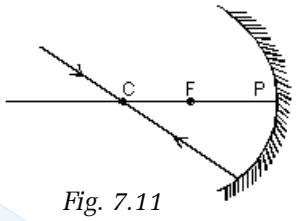


Fig. 7.11

Procedure to draw ray diagram for a concave mirror

Activity 5

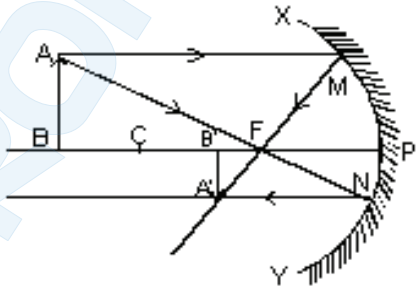


Fig. 7.12

i) Draw a circular arc XY with the help of a compass.

ii) Mark C for the point at which compass needle stands.

iii) Locate the middle point P of mirror XY.

iv) Draw a straight line passing through P and C.

v) Shade the outer surface of XY.

vi) Locate the mid-point of CP and let it be F.

vii) Place an object at the required point, i.e., place the object AB beyond C as shown in figure.

viii) Follow the rules mentioned as below.

a) Draw a straight line AM parallel to the principal axis.

b) Draw a straight line passing through M and F.

c) Draw another straight line passing through A and F and produce it to the point N in XY. AN is an incident ray passing through the focus hence it reflects parallel to PC. Draw a straight line parallel to PC which intersects MF at A'.

d) Draw A'B' perpendicular to the principal axis. Here A'B' is the image of AB.

e) Measure the size and position of A'B'.

The image is diminished, inverted and real which lies between F and C.

Ray diagram for concave mirror

The size, position and nature of image formed by a concave mirror depend up on the position of the object. So, the nature of image of an object placed at different positions from a concave mirror is described below

i) Object at infinity

When an object is placed at infinity, its image is formed at focus. The image is real, inverted and highly diminished in size.

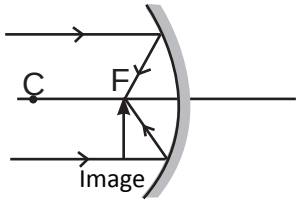


Fig. 7.13

ii) Object at a point beyond C

When an object is placed at a point beyond C, its image is formed between C and F. The formed image is inverted, real and diminished.

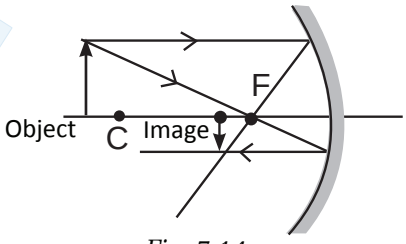


Fig. 7.14

Rules used to draw ray diagram in convex mirror

i) The focus and the center of curvature are located behind the convex mirror.

ii) A ray of light parallel to the principal axis when reflected on the surface of convex mirror appears to be coming from the focus.

iii) A ray of light coming along the line through the center of curvature reflects back along the same path.

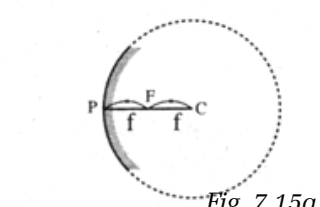


Fig. 7.15a

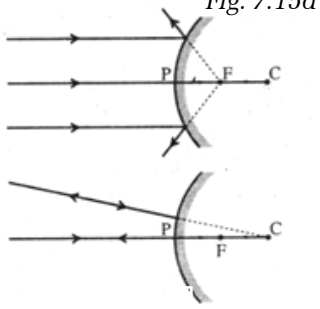


Fig. 7.15b

Ray diagram for convex mirror

The image of an object is formed behind the convex mirror. The image formed by a convex mirror is always virtual, erect and diminished.

i) Object at infinity

When an object is placed in front of a convex mirror at infinity, the image is formed at its focus behind the mirror. The image is virtual, erect and highly diminished.

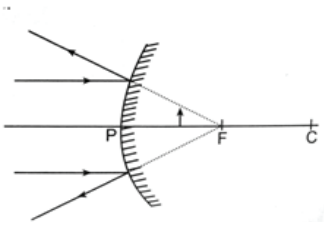


Fig. 7.16

ii) Object between P and infinity (object in front of a convex mirror)

When an object is placed at any point in front of a convex mirror, its image is formed between P and F behind the mirror. The formed image is erect, virtual and diminished.

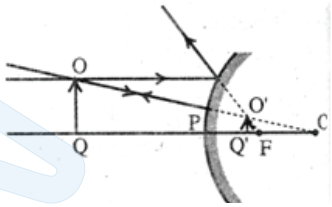


Fig. 7.17

Uses of spherical mirrors

a) Uses of concave mirror

i) Concave mirrors are used in torch lights, searchlights and head lights of vehicles where the light needs to be focused at the distant objects.

ii) Doctors use concave mirrors to observe the interior part of some organs like ear, nose, mouth, throat, etc.

iii) It is used to see the enlarged image of our face for doing make-up or shaving.

iv) It is used as reflectors in telescopes.

v) It is used in solar cookers. It converges the sunlight at a point where the cooker is placed.

b) Uses of convex mirror

i) It is used as side mirrors of vehicles to view objects behind the vehicle.

ii) It is used in street lamps to spread the light in larger area.

Refraction of light

When we see the rivers, lakes, ponds, well, etc., the real depth of water seems to be less than its real depth. Similarly, if we dip a straight stick up to its half-length in water, it is seen to be bent. Why does it seem so?

The medium through which the light travels is called an optical medium. Air, water, kerosene, glass, plastic, etc. are called optical medium because light can travel through them. Light can travel even without medium. Light always travels in a straight line in an optical medium. However, it bends at the interface of two mediums when it travels from one optical medium to another optical medium. The process of bending of light when it travels from one optical medium to another is called refraction of light.

Cause of refraction

The speed of light is different in different media. Higher the density of medium, lesser is the speed of light and vice versa. As the speed of light is different in different media, it bends when it travels from one optical medium to other. The medium whose density is relatively high is called denser medium and that having relatively low density is called rarer medium.

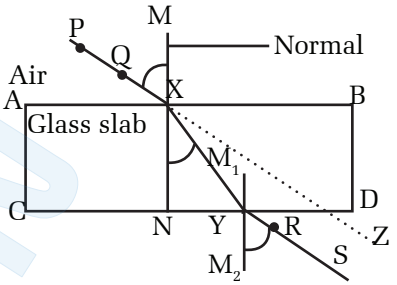


Fig. 7.18

Glass and water are denser media compared to air.

Activity :6

i) Fix a white sheet of paper on a drawing board.

ii) Place a glass slab at the center of the sheet.

iii) Draw the outline ABCD of the slab with a pencil.

iv) Stick two pins P and Q vertically about 8 cm apart on the side of AB as shown in the figure.

v) Stick other pins R and S maintaining the same length on the other side of the slab so that while viewing the pin from CD side, they would lie on a straight line. The last pin S should cover all three pins P,Q, R.

vi) Remove the slab and the pins.

vii) Join the points P and Q and extend PQ to meet AB at the point X.

viii) Join the points R and S and extend RS also to meet the side CD at Y.

ix) Join X and Y.

x) Extend PQ to a point Z with dotted line.

xi) Draw perpendiculars MN and M_1M^2 at the points X and Y respectively.

Here the ray PX travelling from air to glass is called incident ray. The ray of light XY is called refracted ray. And the ray YS is coming out of the slab is called emergent ray. XZ is the original path of the incident ray. The ray of light PX is bent while passing through the air to the glass. Again, the refracted ray XY has been bent at Y while travelling from the glass to the air. In this way, it is proved that light bends when it travels from one medium to another.

Laws of refraction

i) When a ray of light travels from a rarer to a denser medium obliquely, it bends towards normal. Conversely, when light ray travels from denser to rarer, it bends away from normal.

ii) Incident ray, normal and refracted ray lie on a same plane.

iii) The ray of light falling normally to the surface does not bend at all.

Activity: 7

Take a beaker or a glass tumbler and fill the half of beaker with water. Dip a pencil at slanted position as shown in figure. Look at the pencil. How does it seem?

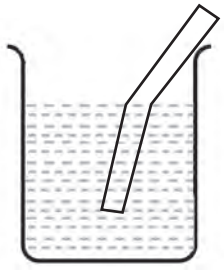


Fig. 7.19

The rays of light coming from the submerged part of pencil bends away at the surface of water and reach to our eyes so that the tip of pencil is appeared to be raised and the part inside water is seen to be bent.

Activity: 8

Take a bowl or a glass tumbler. Place a coin in it. Pour some water into the bowl. The coin appears to have raised up, why? Describe.

The position of a body inside the water is not real when seen from outside. It is because, the ray of light coming from the body bends at the surface of water and falls on our eyes. So, the body (coin) seems to come a bit above.

Similarly, the rays of light coming from the bottom of a container of water are bent at the surface and reach to our eyes. As a result it seems as the bottom has risen or shallower. These are the effects of refraction of light.

Understanding question

Is it possible to spear a fish in the water, why?

Experimental work

Study activity 4 and demonstrate a real image formed by a concave mirror. Also measure the focal length of the mirror.

Project work

For what purposes are the spherical mirrors used in your school, village or city in your surroundings? Study this and write a short note.

Summary

1. Mirror is an instrument which forms an image by reflecting the rays of light falling on its surface coming from source of light.
2. There are mainly two types of mirrors: i) plane mirror ii) spherical mirror.
3. If the surface of a mirror is plane, it is called plane mirror. It always forms a virtual image.
4. There are two types of spherical mirrors: i) concave mirror ii) convex mirror.
5. If the outer part of a mirror is raised and middle part is uniformly lowered, the mirror is called concave mirror. As concave mirror converges the parallel rays of light at a point, it is also called converging mirror.
6. If the outer part of a mirror is lowered and middle part is uniformly raised, the mirror is called convex mirror. Since a parallel beam of light diverge after reflection from the convex mirror, it is also called a diverging mirror.
7. A parallel beam of light reflected from a concave mirror converges at a point. But in convex mirror, a parallel beam of light diverges after reflection in such a way that it appears as coming from a point which is called focus.
8. The image which can be obtained on a screen is called real image and that cannot be obtained on a screen is called virtual image.
9. A concave mirror forms all types of images such as real or virtual, enlarged or diminished according to the position of the object.
10. Convex mirror always forms virtual and diminished image.
11. Concave mirrors are used in torch, search lights, as headlights of motors, as looking glass in parlors and saloons, in telescopes or in solar stoves, etc.

12. Convex mirrors are used to make looking glass of vehicles, reflectors in street lamps etc.

13. The process of bending of light when it passes from one medium to another is called refraction of light.

14. Light bends towards normal when it passes from rarer to denser medium and bends away from normal when it passes from denser to rarer medium. The rays of light falling normally pass without bending.

Exercise

1. Fill in the gaps with appropriate words.

a) The narrow path of light is called.....

b) The point at which a parallel beam of light converges after reflecting on a concave mirror is called.....

c) Convex mirror always forms diminished and ..... image.

d) ..... is used as side mirror on the vehicles.

e) The process of..... light as it travels from one medium to other medium is called refraction.

2. Choose the correct answer.

a) Which mirror is used for looking our face?

i) plane mirror ii) concave mirror

iii) convex mirror iv) spherical mirror

b) Which mirror forms real image?

i) plane mirror ii) concave mirror

iii) convex mirror iv) none of the above

c) What type of image is called real image?

i) that cannot be obtained on a screen

ii) that can be obtained on a screen

iii) an erect image

iv) an inverted image

d) Concave mirror is also called.....

i) plane mirror ii) diverging mirror

iii) converging mirror iv) none of the above

e) What is the process of bending of light when it travels from one medium to other medium called?

i) reflection ii) refraction

iii) focusing iv) diverging

3. Differentiate.

a) concave mirror and convex mirror

b) real image and virtual image

c) rarer medium and denser medium

d) reflection and refraction

4. Define the following terms.

a) Principal axis b) Focus c) Center of curvature

5. Give reason.

a) Plane mirror is used for looking our face.

b) Convex mirror is used as looking glass in vehicles.

c) Half dipped pencil in water is seen as bent.

d) The apparent depth of a pond is less than its real depth.

e) Convex mirror is also called diverging mirror.

6. Answer in brief.

a) What is refraction of light?

b) What type of mirror is called a spherical mirror?

c) Concave mirror is used to make a solar stove, why?

7. **Answer the question with a figure: what type of image is formed by a concave mirror when object is placed;**

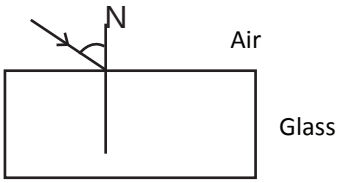
   a) at a point beyond the center of curvature (C)

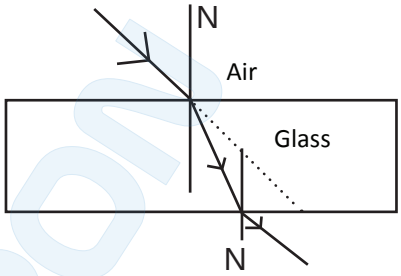
   b) at infinity

8. **Complete the following figures and answer the questions followed:**

   i) What is the name of the process given in figure?

   ii) Write two laws of the process.





unit

8

Sound

Sound is a form of energy. Sound is produced from different kinds of sources in our environment. It is produced due to vibration of objects. When a body of an object is vibrated, waves are produced. Sound energy is transmitted with the help of wave. As soon as the vibration of things stops, its sound also stops.

Sound wave

Sound wave is produced due to the vibration of solid, liquid and gases. The medium (solid, liquid, or gas) is necessary for the transmission of sound wave. How is sound transmitted?

Activity: 1

Stretch a long spring (coil) and hold its two ends by two persons. Gently, strike the holding side of the spring. What is seen in the spring? What does a person feel holding the other side of the spring?

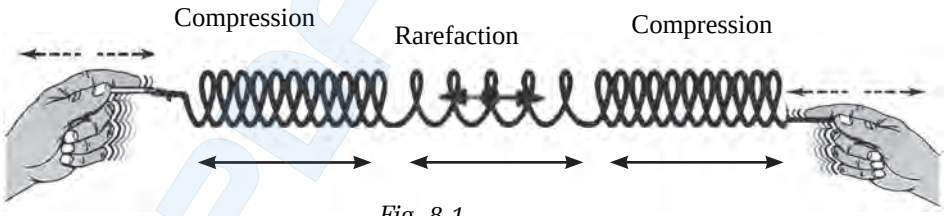


Fig. 8.1

Wave is produced there. The wave travels towards the other end of the spring and push of spring is felt at another side. It returns to the same place where the wave is originated. The wave simply makes a to and fro motion about the mean position of the spring while travelling it toward the other end. When the wheels of wave origin and wheels next to the origin it is called compressed .This process continue up to the end of the spring. After that, the compressed wheels become rare and called rarefaction. The direction of wave propagation and vibration of the string are all in the same directions. This type of wave is called longitudinal wave. When the sound propagates, energy transfers from one point to another. While the threads of the string remain unchanged.

Wave length:

The distance between one compression to another nearest compression or one rarefaction to another nearest rarefaction of wave propagation is called one wave length. The symbol of wavelength is lambda (λ) . It is measured in meter.

Frequency:

The number of vibrations per second is called frequency. Its symbol is f and its unit is hertz (Hz).The bigger units of hertz are kilohertz (KHz) and (MHz).

1000 Hertz (Hz) $=10^3$ Hertz=1 kilohertz (KHz)

1000000 Hertz (Hz) $=10^6$ Hertz (Hz) =1 Megahertz (MHz)

Question to think:

The frequency of sound wave is 50 Hz. What does it mean?

Speed of sound:

If the frequency of sound wave is 50 Hz. It means that 50 waves are produced in every second. That is why, the sound travels the distance equal to 50 wavelengths in one second. Suppose the wavelength is 6.6 m, then it propagates 50 wavelengths (50 x 6.6) in one second.

Therefore, the speed of sound wave (v)=50 x 6.6m/s=330m/s.

Or, the speed (v) =frequency (f) $\times$ wave length (λ)

Or, $v = f \times \lambda$

Example: 1

What will be the speed of sound wave if its wave length is 3.3m with 100 Hz frequency?

Here,

Frequency (f) =100Hz

Speed (v) =?

Wavelength (λ) = 3.3 m

According to formula

$V = f \times \lambda$

or, V =100 x 3.3

or, V =330m/sec

Therefore, the speed of sound is 330m/s.

Example: 2

If the speed of sound is 360m/s and its frequency is 45Hz, What will be its wavelength?

Here,

speed of sound (v) =360m/s. According to formula,

Frequency (f) =45Hz $V = f \times \lambda$

Wave length (λ) =? or, $\lambda = V/f$

or, $\lambda = 360/45 = 8m$

Hence, the wavelength of sound is 8 meter.

Reflection of sound:

When we shout sitting in front of high mountain or cliff or a quiet forest, we hear the sound again. Why does this happen?

When our speech sound strikes with any body or object, it reflects or comes back again. Thus, sound is reflected when it strikes on a surface. This process is called reflection. Reflected sound is known as echo.

Echo:

Reflection of sound can be experienced (heard) in deep wells, long tunnel, deep ridges of the mountains, deep forest, etc. The sound which is obtained (heard) after reflection is called an echo. The shortest distance between source and reflector should be 17 meter to hear an echo. Due to the loss of energy the echo is feeble than the original sound.

Reverberation:

Have you ever spoken in an empty room? How is your speech heard in big and empty room? What difference do you notice between speaking in big empty room and open ground? If the reflection takes place at shorter distances than 17 meter, the reflected sound mixes with the original sound instead of giving a distinct echo. The original sound is heard extended for longer period of time. The process of elongation of original sound is called reverberation. Generally, reflection of sound may also take place in big room, halls and newly built rooms. If the room contains materials or objects reverberation does not occur because certain extent of sound is absorbed by the objects. During reverberation both the sounds are not heard clearly in big halls. The reflection of sound can be prevented in big halls by using

sound absorbents on the wall of the hall. Big halls and music rooms are constructed in such a way that the sounds after striking on the walls create proper reverberation. The appropriate reverberation of the sound makes the music more melodious.

Simple mathematical problems related to echo:

Suppose the distance between the source of sound and reflecting surface is meter. An echo of a sound is heard. To hear the echo, sound has to travel twice the distance. During echo the distance covered by sound is 2d meter and time to hear echo is t and speed is v.

$$\text{Speed of sound} = \frac{\text{distance travelled by sound}}{\text{time taken to travel that distance}}$$

or, $v = 2d/t$

or, $d = v.t/2$

Example: 3

A healthy person hears an echo of his voice after reflecting from distant surface after 0.1 second. If the velocity of sound is 332m/s, how far is the distance between the source of sound and reflecting surface?

Here,

Velocity of sound (v) = 332m/s

Time taken (t) =0.1s

Distance (d) = ?

By using formula,

$d = v.t/2$

or, $d = 332 \times 0.1/2$

or, $d = 16.6m$

Therefore, the distance between source and reflecting surface is 16.6m (approximately 17m).

Practical activities:

Produce sound nearby your school or residential area or jungle, ridge of hill, etc. Is echo produced? Observe. What time does it take to hear echo after sound is produced? Measure the time and find the distance between you and reflecting surface.

Summary:

1. Sound is produced due to vibration of objects.
2. Sound propagates in the form of wave.

3. If the direction of the wave propagation and the direction of vibration of particles of the medium are same, the wave is called longitudinal wave.
4. The distance between two adjacent compressions or that between two adjacent rarefactions is called one wave length.
5. The number of wave produced per second is called frequency.
6. The speed of sound wave = frequency x wavelength.
7. The elongation of original sound due to mixing of reflected sound with original sound is called reverberation.
8. The reflected sound, which is heard without mixing with the original sound is called echo.
9. Echo can be heard if the reflecting object is away from the source, i.e., approximately 17 meter farther.
10. Reverberation occurs if the distance between the source and reflecting surface is less than 17 meter.

Exercise

1. Fill in the blanks with appropriate words.

a. ……. is produced due to vibration of objects.

b. The process of elongation of sound is called ……

c. The reflected sound is called …….

d. To hear echo the minimum distance between the source and reflecting surface should be more than …… meter. .

2. Write short answer

a. What is wavelength? Write its unit.

b. What is frequency?

c. What do you mean by reverberation?

d. What are the effects of reverberation?

e. The frequency of sound wave is 70Hz. What does it mean?

3. What is the difference between echo and reverberation? Write points in a table.

4. If the speed of sound in air is 332m/s and frequency is 10 Hz. What is its wave length? *(Ans: 33.2m)*

5. The speed of sound is 330m/s, its wavelength is3.3 meter. What is its frequency? *(Ans: 100Hz)*

6. The wavelength of sound is 15m and its frequency is100Hz. What is its speed? *(Ans: 1500m/s)*

7. A man sitting nearby a cave of mountain hears the clear echo of his whistle in 0.25 second. How far is he from mountain? (Take v=332m/s). *(Ans: 33.2m)*

Unit

9

Magnetism

Molecular theory of magnets

If a bar magnet is cut into two equal halves, do the poles separate?

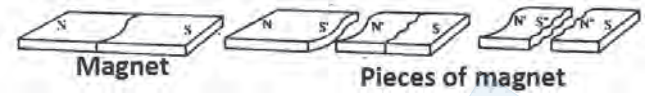


Fig. 9.1

When a magnet is cut into two equal halves; the poles cannot be separated because both pieces of the magnet develop new poles. As we break down and make pieces of the magnet further until a small particle, the north and south poles appear in each small piece of the magnets. Why does it happen?

This can be described on the basis of molecular theory of magnets. It is described below:

1. Molecules of magnet or magnetic material are independent magnet. Magnet can only be made from magnetic materials.

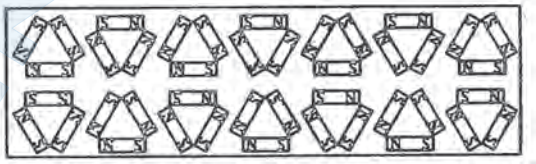


Fig. 9.2

2. In magnetic material, molecular magnets make a chain like structure in which north pole of one molecule and south pole of another molecule are connected in closed ring form. The opposite poles of the molecular magnet are attracted with each other and magnetic force is cancelled inside. Hence, magnetic force is null in each chain. Therefore, the magnetic material does not exhibit magnetic properties.

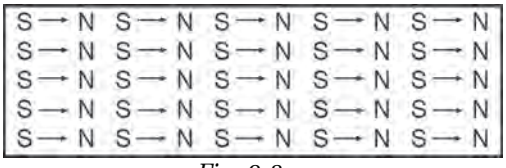


Fig. 9.3

3. In magnets, the molecular magnets lie in parallel fashion pointing North Pole to one end and South Pole to another end. The North Pole of molecular magnet points to one end whereas the south pole point to opposite end. Two ends of the magnet are called North Pole and South Pole. The magnetic force is found higher in these two poles in comparison to middle part.

4. The poles of magnet cannot be separated. The molecules of the magnetic substances retain magnetic property. They are called molecular magnets. When molecular magnets align in rows, then the substances exhibit magnetic property. When the molecular magnets are in zigzag fashion making several chains, they do not exhibit magnetic property. This is called molecular theory of magnetism.

Activity: 1

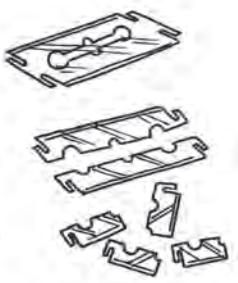


Fig. 9.4

Take a blade and break it into two equal pieces as shown in a figure. Convert a piece of blade into magnet and check whether it is a magnet or not. Break the magnetic blade gently into two pieces and check whether every piece is a complete magnet or not.

Again break the piece of blade into two pieces and check the magnetic property. Furthermore, break these two pieces again into another two pieces. Now, check it, all the four pieces are magnet or not. What conclusion should be drawn from this activity? Write.

The poles of magnet exist in pairs. Only one pole can never be possible. The poles of magnet can never be separated.

Magnetic induction:

Activity: 2

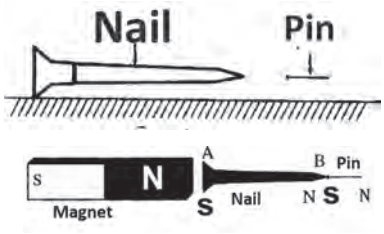


Fig. 9.5

Keep an iron nail on the table and bring a pin near the iron nail and observe. Does the nail attract the pin? Observe. Now, place a bar magnet near the nail at the opposite side of the pin as shown in figure. Does the iron nail attract the pin? Why? Discuss and write conclusion. The magnetic properties are developed in the iron nail due to the effects of magnet. Therefore, the iron nail attracts the pin. In this way temporary magnetic property is developed in the iron nail. It contains North and South Pole like magnet. In this activity, if the magnet is feeble, weak the nail becomes magnet only after touching the nail by the magnet.

The process of gaining or obtaining temporary magnetism in magnetic material due to the effect of a magnet is called magnetic induction.

Magnetic induction occurs in the nail before the magnet attracts it. Then,

the nail becomes a temporary magnet. In the magnetic induction, the end of the nail closer to North Pole becomes South pole and the end of the nail away from North pole becomes North pole. Now, the magnet attracts the nail since opposite poles attract. Similarly, the nail attracts the pin.

Demagnetization:

The process by which a magnet loses its magnetic properties is called demagnetization. The main cause of the demagnetization is destruction of the order of the molecular magnet. The molecular magnets are arranged in a certain order. If the order of molecular magnets is disturbed by any method, the magnetic properties get lost. The magnetic properties of a magnet is destroyed by:

1. heating a magnet,
2. dropping a magnet from a height,
3. hammering a magnet,
4. rubbing the like poles of magnets together, and
5. keeping magnets pointing like poles to same direction for a long time.

Ways of saving magnetic property

The magnetic property of the magnet can be protected by:

1. avoiding the heating of the magnet,
2. avoiding the dropping of a magnet from a height,
3. avoiding the rubbing and hammering of the magnets,
4. keeping the magnets pointing opposite poles together (It is better to keep a soft iron bar between two magnets.), and
5. preventing from the rusting of the magnets.

Practical activities:

1. Take a magnet, compass and iron nail. Keep the nail on a table. Place the North Pole of a magnet close to one end of the nail. Which pole is developed at another end of the nail? Find the pole using compass needle. Now place the South Pole of the magnet close to the same end of the nail. Find the pole at other end of the nail as above. What did you learn from this? Write.
2. On the basis of activity 1, verify practically that the magnetic poles cannot be separated with each other.

Summary:

1. Magnet and magnetic materials are made up of molecular magnet.
2. When all the molecular magnets are set in one direction magnetic material become magnet.
3. The magnetic materials also contain molecular magnets in a closed chain form.
4. The process of gaining temporary magnetism by magnetic materials due to the presence of magnet is called magnetic induction.
5. The process of losing magnetic property by a magnet is called demagnetization.
6. The magnetic property of the magnet is lost due to heating, hammering, dropping, rubbing, etc.

Exercise:

1. Fill in the blanks with appropriate words.

a. The molecules of a magnet are independent …….

b. The pole of magnet cannot be……..

c. The process of obtaining the magnetism by a magnetic material is called…….

d. Heating of the magnet loses its……

2. Distinguish between.

a. Magnet and magnetic material.

b. Magnetic induction and demagnetization.

3. Write a short answer.

a. What is the molecular theory of magnetism?

b. What is a molecular magnet?

c. What is magnetic induction?

d. What are the causes of demagnetization?

e. Write the ways of the conserving of magnetic properties of a magnet.

3. Give a reason.

a. When a magnet is broken into small pieces its poles cannot be separated from each other.

b. On dropping or heating, a magnet loses its magnetic properties.

4. The position of molecular magnet is shown in the below given figure. Answer the following questions on the basis of figure.

a. b.

Fig. 9.6

i. Which figure shows the structure of magnet?

ii. What do you understand by the position of molecules in figure b?

iii. Which principle is showed by this figure?

6. Justify a magnetic induction with the help of practical activity?

Unit
10

Electricity

Simple cell:

Have you ever seen cell? How is the structure of cell? How does it produce electricity?

Activity: 1

Take a clean beaker and pour 100ml water into it. Then add 10ml concentrated sulfuric acid to the water drop by drop slowly. In this way, dilute sulphuric acid is obtained. Now, dip copper and zinc plate into the dilute sulphuric acid without touching with each other. Connect those plates with a lead bulb of a torch by using a conductor wire as shown in the figure.

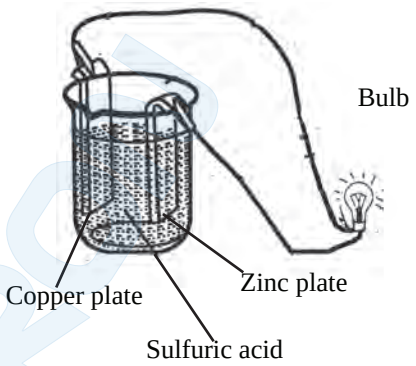


Fig. 10.1

Does the bulb glow? Identify the positive and negative terminals.
In this way, a simple cell can be constructed by using copper plate, zinc plate and dilute sulphuric acid. The zinc plate acts as negative pole and copper plate acts as positive pole. Zinc reacts with dilute sulphuric acid and gets dissolved in it. Electrons are left in zinc plate. Hence it becomes negatively charged. Hydrogen from sulphuric acid becomes positively charged ion and goes around the copper plate. When two plates are connected by a conductor wire to a bulb, the electrons flow from the zinc to copper plate through bulb. Then the bulb glows. We cannot produce electricity for a long time using this cell because it has the following two defects.

1. **Polarization:**

   During chemical reaction within the cell, hydrogen gas is produced and is collected around the copper plate in the form of bubbles. Due to insulation property of the gas, the flow of the current is blocked. This type of effect is called polarization.

Ways to control polarization

i. Copper electrode should be brushed time to time.

ii. A concentrated solution of potassium dichromate (K_2Cr_2O7) is added to the solution.

2. Local action

Generally, impure zinc plate is used to make simple cell. Therefore the zinc plate gets eroded continuously even it is not in use. Thus the life of the cell decreases. This defect of cell is called the local action.

Way to control the local action

i. Pure zinc plate should be used;

ii. Zinc plate should be coated with mercury.

Uses:

It is easy to construct and use when we require the small amount of electricity. But it is difficult to transport here and there because of the liquid acid in it. There is high chance of spilling the acid.

Dry cell:

A cell which is constructed without using any liquid is called dry cell. Simple dry cell is constructed in a zinc container. A carbon rod fixed in the middle part without touching the zinc container. The mixture of carbon powder and manganese dioxide is put inside the can which forms a layer around the carbon rod. The mixture is covered by jelly like paste of ammonium chloride (NH_4Cl).The open end of the zinc can is sealed with wax, tar, or plastic etc. to protect the materials inside it. A brass cap is set on upper end of the carbon rod. The zinc can act as a negative terminal and the carbon rod with brass cap act as a positive terminal.

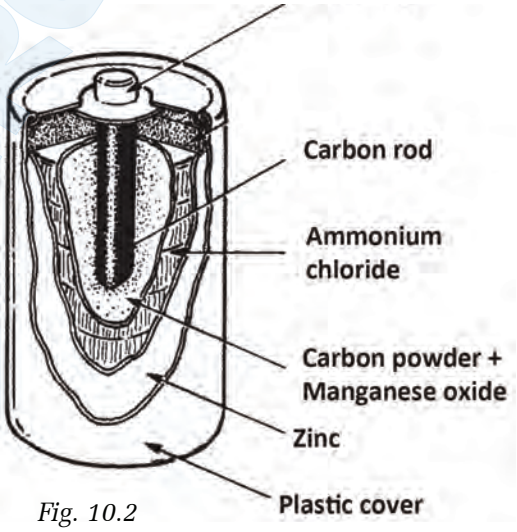


Fig. 10.2

Uses:

1. It is easy to use and transport because no liquid acid is used in it.
2. It can be constructed in a different size.
3. It is easy to use in torch, radio, remote of television, doll, etc.

The presence of manganese dioxide (MnO_2) in this type of cell prevents polarization. But local action takes place which reduces the life of the cell.

House wiring system

Electricity is generated from electric power station. Generally, electric power station is constructed far from the residential area. Electricity is transmitted from power house to a long distance through a wire and supplied to the customer house. The wire carrying electricity to our home can be classified into two types. One is called live or phase wire and another is neutral wire. Before connecting live wire to the meter box, it is connected to main fuse. This fuse is called electricity authority fuse. Main switch controls the whole system of household electricity. It helps to resist or flow electricity in the house. Customers fuse is connected to the main switch. The earth wire is connected from the main switch to the earth. It passes the current to the earth when excess current flows in the circuit. This is called earthing. The live line from the main switch is connected to the distribution board. Current is sent in different appliances through the live wire from distribution board. This is called house wiring system. All the loads are connected in parallel connection in house wiring system. Every load is controlled by different switch.

Some electrical devices

Electricity is a multipurpose energy. Many devices can be operated by using electricity. These devices convert the electrical energy into other forms of energy. Those devices are called electrical devices.

The important electrical devices which are used in our daily life are as follows.

1. Electrical lamp:

The device, which converts the electrical energy into the light energy, is called electric lamp. Electric lamps are of two types.

a. Filament lamp b. Fluorescent lamp or tube light.

2. Heater

The devices which convert electrical energy into heat energy is called heater. For example heater, iron, immersion heater, electrical kettle, etc.

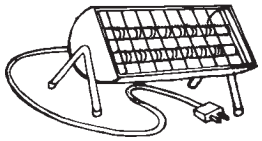


Fig. 10.3

3. Electric bell:

It is a device which runs through electromagnet. At first, a temporary magnet is made with the help of electricity. The sound is produced

by the movement of hammer due to magnetic energy. The switch of electric bell is placed on the outside of the gate. A person coming from the outside can ring the bell to show the signal of arrival. Nowadays, electrical bell is used in school too.

4. **Radio/ Television**

   Radio is one of the most important means of communication. It is operated by electricity or battery. Similarly, television is an important audio –visual device which is operated by using electricity.

5. **Telephone/ Mobile:**

   Telephone and mobile phones are the devices in telecommunication field. These devices are also operated with the help of electricity.

6. **Computer:**

   Computer is one of the most important means in modern time. It also helps to connect the people through the worldwide networks, for example, e-mail, internet, etc. It is also used for the purpose of typing a book as well as reading saved materials.

   All these devices are operated with electricity.

Fuse

Fig. 10.4

When more current passes in the electric circuit, the electric wire may melt due to heat and electric devices may be damaged. Safety measures are to be applied to prevent such type of accident in electric circuit. A weak portion is added to the circuit which melts at low temperature. This thin wire having low melting point is called fuse. It is an alloy of tin and lead. When more current flows in the electric circuit, the fuse wire melts and the circuit is opened. Consequently, electric flow in the circuit stops.

Fuse wire is kept in the small box and connected in the circuit. The capacity of fuse wire should be more than the permissive amount of current in the circuit. It prevents from electric accidents by melting when current overflows through the circuit. So, the fuse of suitable rating should be used. The capacity of fuse wire is determined by the amount of current in the circuit in normal condition. The capacity of fuse wire should be slightly greater than the total current passing through the circuit. When the fuse wire melts, it is necessary to replace it with another fuse wire. Fuse is connected to live wire.

Miniature circuit breaker: (MCB)

Fig. 10.5

MCB is the modified (or developed) form of fuse. It prevents us from electrical accidents by breaking the circuit when current overflows in it. It cuts off the flow of current when more current flows. It is based on the pinciple of electro-magnetic theory. In a fuse, the molten wire needs to be replaced, but MCB can be reset and reused. The circuit again works immediately if we switch on.

Practical activities:

1. Study the activity no 1 and prepare a simple cell.

2. Take a dry cell that is used in a torch or radio. Cut the dry cell vertically with the help of knife or metal cutter or hacksaw carefully. Study its structure. List the names of the materials found inside the cell. Draw a neat diagram and label it to show its structure.

Summary

1. Simple cell is constructed by using copper plate, zinc plate and dilute sulphuric acid.
2. Polarization and local action are the main defects of simple cell.
3. Polarization in the dry cell is removed by using manganese dioxide.
4. The electric wiring done in home, school, industry and factory is called house wiring system.
5. The heater, electric bulb, electric bell, radio, television, telephone, mobile, computer, etc. are the electrical devices.
6. The thin wire which has low melting point and is used in an electric circuit is called fuse wire which is made up of Tin and Lead.
7. MCB is the developed form of fuse.

Exercise:

1. Fill in the blanks with appropriate words.

a. Zinc plate in a simple cell acts as……..

b. Carbon rod in the simple cell acts as…….

c. Polarization does not occur in a dry cell due to the presence of…….

d. A fuse wire is made up of alloy of lead and……..

e. Heater converts electrical energy into……. energy

2. Write short answer

a. What are the defects of simple cell? List them.

b. There is no polarization in a dry cell. Why?

c. What is a fuse?

d. What is MCB?

e. Write the name of electrical devices which are used in your house?

3. How is simple cell made? Write with diagram.

4. Describe the structure of dry cell with diagram.

5. How does a fuse work? Write.

6. What is the difference between fuse and MCB? Write.

Unit

11

Matter

There are different kinds of matter around us. Some matters are pure whereas others are impure. Impure and complex matters can be broken or split into simpler forms. But pure matters cannot be broken or split into simpler substances. These pure matters are called elements, e.g., Hydrogen, Oxygen, Copper, Gold, etc. Copper is an element because it cannot be broken into other matters. There are 92 elements found in the nature and 26 elements have been prepared artificially by scientist. In this way, there are 118 elements including natural and artificial element. The substance made from the chemical reaction between two or more elements is called compound, e.g., water, salt, oil, etc.

Atom:

Atom is the smallest particle of an element which can take part in a chemical reaction. Atoms of the same element are identical in all respects. But the atoms of different elements are different. For example, atom of hydrogen differs from the atom of helium. There are more than 118 elements and each element has its own type of atom. In this way, there are 118 types of atoms.

Molecules:

The smallest particle which has same characteristics as in an element or a compound is called a molecule. A molecule of an element is formed by the combination of two or more similar atoms. For example, an Oxygen molecule is formed by two oxygen atoms. Similarly a molecule of a compound is formed by the combination of two or more dissimilar atoms. For example, a water molecule is formed by the combination of two hydrogen atoms and one oxygen atom.

Structure of an atom:

Atom is the smallest particle of an element. It cannot be further broken into simpler matters with chemical reaction. An atom is made up of three different types of particles called sub-atomic particles. They are: proton, neutron and electron.

Proton and neutron reside in the center of an atom called nucleus. The electrons are found around the nucleus revolving round the nucleus. The circular path through which the electrons revolve round the nucleus is called orbit or shell.

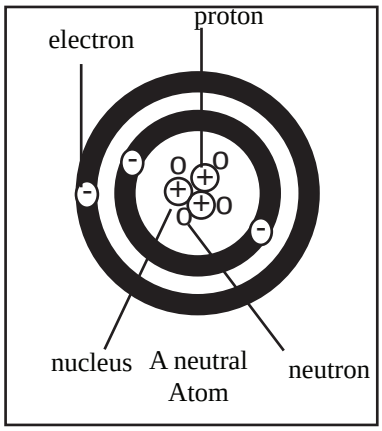


Fig. 11.1

Proton

A proton is a positively charged particle, located at the center of the atom, i.e., nucleus. The mass of one proton is nearly equal to that of one hydrogen atom. The mass of proton is expressed in atomic mass unit (amu).

Neutron:

It is an electrically neutral or chargeless particle located in the nucleus of the atom. The mass of one neutron is nearly equal to the mass of one proton. Therefore, the mass of neutron is expressed in atomic mass unit (amu). Except hydrogen, all elements contain neutrons.

Electron

An electron is a negatively charged particle. It revolves round the nucleus in a fixed path. The path of revolving electron is called an orbit or shell. The mass of an electron is negligible compared to the mass of a proton and neutron. The mass of an electron is nearly 1/1837 parts of the mass of hydrogen atom. Therefore, the mass of an electron is 1/1837 amu.

Atomic mass unit (amu):

The mass of sub-atomic particle is very small. The mass of proton, electron and neutron are not expressed in gram or milligram. Instead they are expressed in different unit, i.e., atomic mass unit (amu).

The mass of one proton = nearly 1 amu.

Now, 1gm Hydrogen $= 6 \times 10^{23}$ atoms of Hydrogen

$= 6 \times 10^{23}$ amu.

Therefore, the mass of 6×10^{23} protons = 1gm.

The mass of one proton is nearly equal to the mass of one neutron but the mass of an electron is nearly 1/1837 parts of the mass of one proton.

Therefore, the mass of 1837 electrons is equal to the mass of one proton.

:. $1\ p^+ = 1n^o = 1837\ e^- = 1$ amu.

Electric charge

Proton and electron have electric charge : positive (+ve) and negative (-ve) charge respectively. It is measured in coulomb. In short it is written as

1 coulomb = 6.25×10^{18} electrons.

A neutral atom consists of equal number of protons and electrons. That is why, generally, atoms are electrically neutral. It is due to presence of equal amount of positive and negative electric charge in the atom.

Comparative study of the proton, electron and neutron

Sub-atomic particle	symbol	mass	Charge	location
Proton	P^+	1amu	+	nucleus
Electron	e^-	1/1837 amu	-	shell
Neutron	n^o	1 amu	nil	nucleus

Atomic number:

The number of protons presents in the nucleus of an atom is called atomic number. In a neutral atom, the number of protons is equal to the number of electrons, so

Atomic number = Number of protons (p^+)

= No of electrons (e^-)

Atomic weight or atomic mass:

The atomic weight or mass of an atom denotes the sum of mass of protons and mass of neutrons present in it. The mass of an electron is negligible.

Atomic weight = Number of protons (p^+) + Number of neutrons (n^o)

Therefore, number of neutrons (n^o) = Atomic weight – Number of protons (p+)

= Atomic weight - Atomic number

:. n^o = At.wt -At. No.

Example: 1

The atomic number and weight of the potassium is 19 and 39 respectively. Calculate, how many numbers of protons, neutrons and electrons are found in it?

Here, Atomic number (p^+) = 19

Atomic weight (e^-) = 39

Then, atomic number = number of protons (p^+) = number of electrons (e^-) = 19

∴ (p^+) = 19,

(e^-) = 19

Again, atomic number = $p^+ + n^0$

$39 = 19 + n^o$

0r, $n^0 = 39 - 19 = 20$

∴ $P^+ = 19$, $e^- = 19$ and $n^0 = 20$

Electronic configuration of an atom:

The proton and neutron are located in the center of the atom or at nucleus. An electron revolves round the nucleus in an elliptical orbit or shell at high speed. The electrons spinning at high speed establish a permanent path (shell). These electrons revolve in a fixed path(shell) at a fixed distance from the nucleus. The fixed paths are named as K, L, M, N, etc. The maximum number of electrons that each shell can hold can be found by using $2n^2$ formula, where n is the number of shell or orbit. For example,

Shell	Number of shell(n)	Number of electron
First shell= K	n= 1	$2n^2 = 2 \times 1^2 = 2$
Second shell =L	n =2	$2n^2 = 2 \times 2^2 = 8$
Third shell =M	n = 3	$2n^2 = 2 \times 3^2 = 18$
Forth shell =N	n =4	$2n^2 = 2 \times 4^2 = 32$

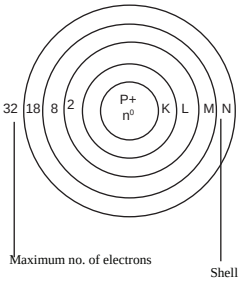


Fig. 11.2

This formula is applied only for a few elements because no atom can hold more than 8 electron in outermost shell.

The electronic configuration, atomic number, atomic mass, number of proton, number of electron and number of neutron of first 20 elements are given below:

Name of elements	Sym-bol	At. no.	At.wt.	P^+	e^-	n^o	Electronic configuration			
							K	L	M	N
Hydrogen	H	1	1	1	1	o	1	-		
Helium	He	2	4	2	2	2	2	-		
Lithium	Li	3	7	3	3	4	2	1		
Beryllium	Be	4	9	4	4	5	2	2		
Boron	B	5	11	5	5	6	2	3		
Carbon	C	6	12	6	6	6	2	4		
Nitrogen	N	7	14	7	7	7	2	5		
Oxygen	O	8	16	8	8	8	2	6		
Fluorine	F	9	19	9	9	10	2	7		
Neon	Ne	10	20	10	10	10	2	8		
Sodium	Na	11	23	11	11	12	2	8	1	
Magnesium	Mg	12	24	12	12	12	2	8	2	
Aluminum	Al	13	27	13	13	14	2	8	3	
Silicon	Si	14	28	14	14	14	2	8	4	
Phosphorus	P	15	31	15	15	16	2	8	5	
Sulphur	S	16	32	16	16	16	2	8	6	
Chlorine	Cl	17	35	17	17	18	2	8	7	
Argon	Ar	18	40	18	18	22	2	8	8	
Potassium	K	19	39	19	19	20	2	8	8	1
Calcium	Ca	20	40	20	20	20	2	8	8	2

The electronic configuration of some elements:

1. Hydrogen

Atomic number = 1

Atomic weight = 1

Shell	K	L	M	N
no. of e.	1	–	–	–

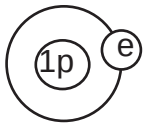


Fig. 11.3a

2. Helium

Atomic number =2

Atomic weight = 4

Shell	K	L	M	N
no. of e.	2	–	–	–

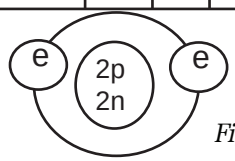


Fig. 11.3b

3. Lithium

Atomic number = 3

Atomic weight = 7

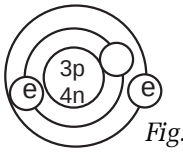


Fig. 11.3c

Shell	K	L	M	N
No of e⁻	2	1	–	-

4. Neon

Atomic number = 10

Atomic weight = 20

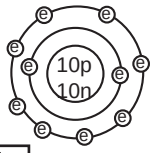


Fig. 11.3d

Shell	K	L	M	N
No of e⁻	2	8	-	-

5. Sodium

Atomic number = 11

Atomic weight = 23

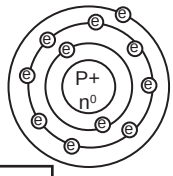


Fig. 11.3e

Shell	K	L	M	N
No of e⁻	2	8	1	–

6. Argon

Atomic number = 18

Atomic weight = 40

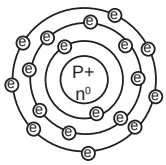


Fig. 11.3f

Shell	K	L	M	N
NO. of e⁻	2	8	8	–

7. Potassium

Atomic number = 19

Atomic weight = 39

Shell	K	L	M	N
No. of e⁻	2	8	8	1

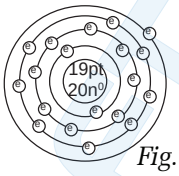


Fig. 11.3g

8. Calcium

Atomic number = 20

Atomic weight = 40

Shell	K	L	M	N
No. of e⁻	2	8	8	2

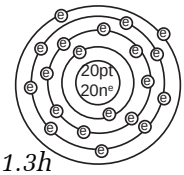


Fig. 11.3h

In reality, the shells through which electrons revolve round the nucleus are not circular as shown in the figure but they are elliptical as shown in the figure 11.5. However, the shell is drawn circular to make it understandable and demonstrative.

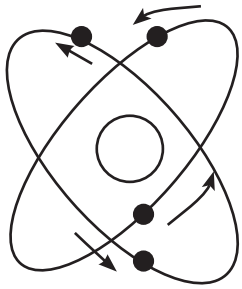


Fig. 11.4

Activity 1

Method of making a model of oxygen atom

Required materials:

Soil (black soil), metal wire or thick thread, water, different colors, brush, glue, card board, etc.

Procedure:

1. Make 24 small beads of clay. Among them 8 beads of each represent proton, neutron and electron and color them with different three colors to identify proton, neutron, and electron.

2. Stick a piece of thick thread or wire to represent a nucleus at the center part of a card board.
3. Stick eight protons and eight neutrons inside the nucleus on the card board.
4. Make two circles around the nucleus using a piece of thick thread or wire and glue them. Stick beads of two electrons on the inner circle and six beads on the outer circle to represent the electrons.

Note: Instead of soil clay beads, we can use the buttons, beads, tika, etc.

Valency

The combining capacity of an element with another element to form a compound is known as its valency. In other words valency is the number of electrons lost or gained or shared during chemical reaction. For example when sodium atom combines with other element, it loses one electron. Therefore the valency of sodium is one. Similarly the valency of oxygen is two because it gains two electrons from another atom while forming compound.

The valency of an element depends on the number of electrons present in the outermost orbit of an atom of that element. Atoms achieve the stable form when the outermost shell (K) contains two electrons and other shell may have 8 electrons in their outermost orbits. If the atom has 1 or 2 or 3 electrons in the outermost orbit, it has capacity to donate 1, 2 and 3 electrons respectively. If the atom has four electrons in the outermost orbit, it has an equal capacity to gain or lose electron. Similarly, if the atom has 7 or 6 or 5 electrons in their outermost orbit; it has capacity to gain 1, 2 and 3 electrons respectively.

The tendency of an atom to have eight electrons in its outermost shell is known as octet rule.

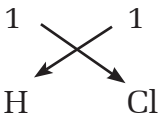
If the outermost orbit (except K shell) contains 1 or 2 or 3 or 4 electrons, the valency of an element is equal to its number of electrons present in it. If outermost shell contains 5 or 6 or 7 electrons, their valency is 3, 2 and 1 respectively.

The electrons present in the outermost orbit of an atom are known as valence electron. An atom with only one (K) shell filled with 2 electrons, does not take part in chemical reaction. Hence its valency is zero, e.g., Helium. This state is called duplet. An atom with eight electrons in its outermost shell, neither gain nor lose electrons. So its valency is zero. Such type of elements does not take part in chemical reaction. This state of having 8 electrons in the outermost shell is called octet, e.g., Neon, Argon, etc.

Molecular formula:

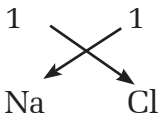
Molecular formula is the group of symbols of elements to represent a molecule of a substance. For example molecular formula of sodium chloride is NaCl. This means a molecule of sodium chloride contains one sodium atom and one chlorine atom. Then the group of symbols of elements is denoted as NaCl.

The symbolic representation of a molecule of an element or of a compound is called molecular formula. In order to write the molecular formula, you must know the elements present in the compound and their valency. The molecular formula is derived by the exchanging valences of the atoms. For example:



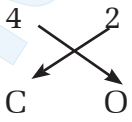
HCl

Hydrogen chloride



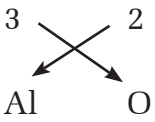
NaCl

Sodium chloride



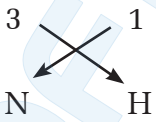
C_2O_4.

Carbon dioxide



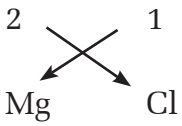
Al_2O_3

Aluminum oxide



NH_3

Ammonia



$MgCl_2$

Magnesium chloride

Molecular weight:

The sum of weights of the atoms present in a molecule is called the molecular weight. Hence, it is calculated by adding the atomic weight of the atoms present in a molecule. For example, since there are two hydrogen atoms in hydrogen molecule, its molecular weight is two amu. Again,

1. Molecular weight of water (H_2O) = 2 x H +1x O

   = 2 x 1 +1 x 16

   = 2+16 = 18 amu

2. Molecular weight of carbon dioxide (CO_2) $= 1 \times C + 2 \times O$

$= 1 \times 12 + 2 \times 16$

$= 12 + 32 = 44$ amu

3. Molecular weight of sodium chloride (NaCl) $= 1 \times Na + 1 \times Cl$

$= 1 \times 23 + 1 \times 35$

$= 23 + 35 = 58$amu

4. Molecular weight of calcium carbonate ($CaCO_3$)

$= 1 \times Ca + 1 \times C + 3 \times O$

$= 1 \times 40 + 1 \times 12 + 3 \times 16$

$= 40 + 12 + 48 = 100$ amu

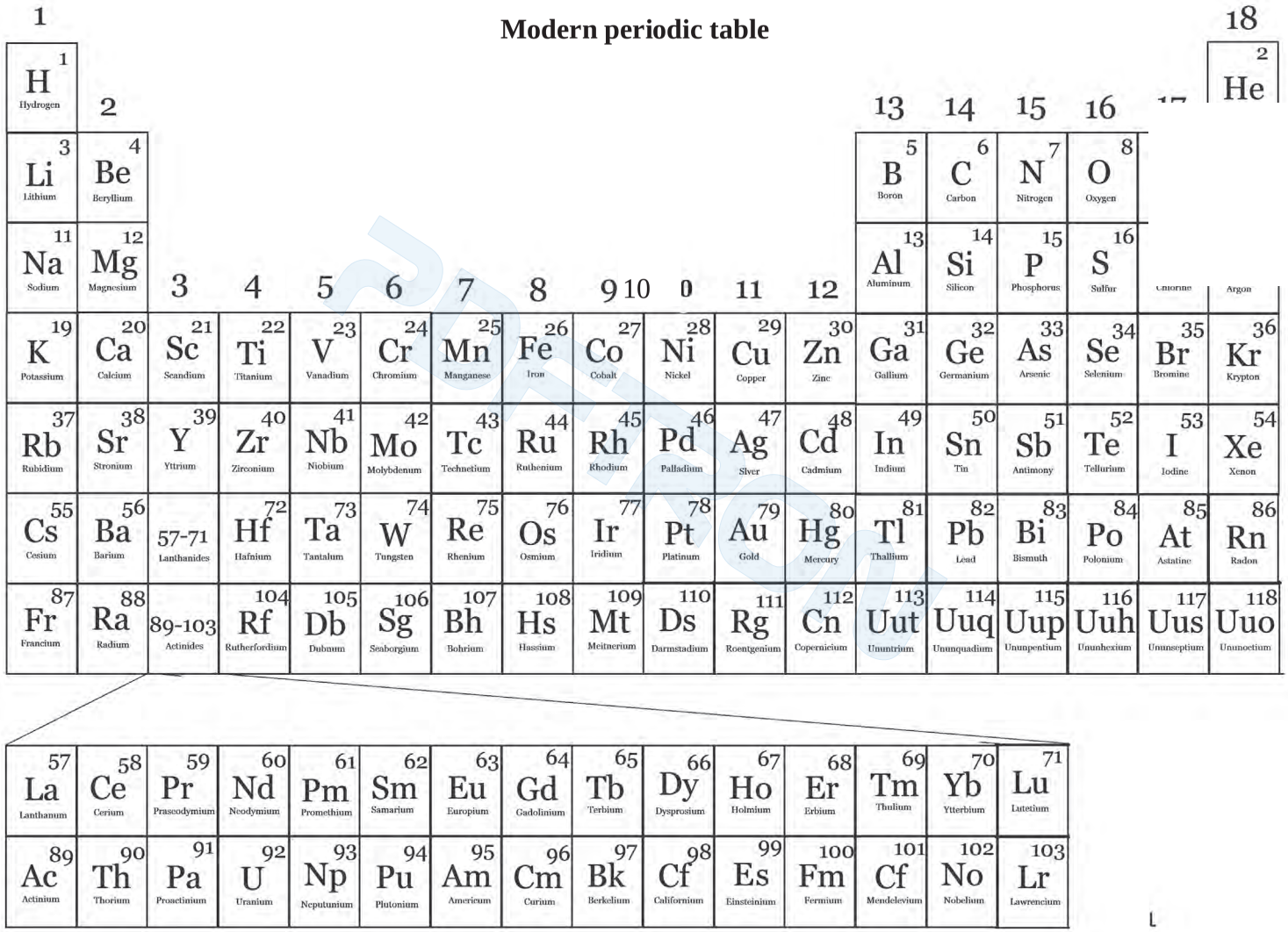
Periodic table:

Altogether 118 elements have been discovered till now which are either natural or man made. The study of these elements separately is difficult. Therefore scientists thought simpler and easier way of studying elements. In doing so, they arranged the elements in group having similar properties. The elements are arranged on the table according to similarities or dissimilarities of their physical and chemical properties. The table which shows the grouping of the elements on the basis of their properties is called periodic table.

Mendeleev's periodic table

Mendeleev constructed a periodic table in such a way that the elements were arranged in increasing order of their atomic weight. In a periodic table, the elements having similar properties were placed in a same group. Mendeleev kept some vacant places in his periodic table for the elements to be discovered in the future. After the continuous study of this periodic table some drawbacks were found out. Scientist have made attempts to remove drawbacks of Mendeleev's periodic table leading to the development of modern periodic table.

Modern periodic table



Chemical reaction

A chemical change brings about change in molecule and produces entirely new substances. The chemical changes occur between atoms and molecules to produce entirely new substances. The chemical change is expressed in a flow diagram with their names which is called chemical reaction.

Word equation

A chemical equation represented in words is called word equation. For example,

Hydrogen + Oxygen ⟶ Water

Potassium chlorate ⟶ Potassium chloride + Oxygen

Formula equation:

A chemical word equation expressed using molecular formula is called formula equation. For example,

$2H_2 + O_2 \xrightarrow{\Delta} 2H_2O$

$2KClO_3 \longrightarrow 2KCl + 3O_2$

Points to be considered while writing chemical equation:

1. The reactant molecules involved in a chemical reaction are written on the left side of an arrow (⟶).
2. The products of the reaction are written on the right side of an arrow (→).
3. The condition of the chemical reaction is written above the arrow.
4. The direction of a reaction is represented by an arrow head.

   For example: Reactants ⟶ products.

   Word equation: Water ⟶ Oxygen + Hydrogen

   Formula equation: $2\ H_2O \longrightarrow O_2 + 2H_2$

Project work:

1. Study the activity 1 and make models of Helium (He), Carbon(C) and Sodium (Na).

2. Make a chart to show the structure of elements having atomic number from 1 to 20.

Summary:

1. Sub-atomic particles such as electrons, protons and neutrons are present in atom. The mass of these particles are measured in atomic mass unit (amu) and their charge in coulomb unit.
2. The mass of a proton of an atom is about 1amu. The mass of a neutron is also about 1amu and the mass of an electron is nearly 1/1837 amu.
3. Proton has positive charge, electron has negative charge and neutron has no charge or chargeless.
4. Atomic number = Number of protons = Number of electrons.
5. Atomic weight = Number of proton + Number of neutron.
6. The protons and neutrons reside in nucleus while electrons move around the nucleus at different distance.
7. The electrons revolve round the nucleus in certain specified shells named K, L, M, N. The maximum capacity of these shells to hold electrons are 2, 8, 18, and 32 respectively. It is determined by the $2n^2$ rule.
8. The combining capacity of an atom of element is called valency.
9. The symbolic representation of a molecule of a substance is called molecular formula. The molecular formula is derived by exchanging the valences of the atoms involved.
10. The molecular weight is calculated by adding the atomic weight of the atoms present in a molecule.
11. The elements are arranged according to the similarity or dissimilarity in their physical and chemical properties in a form of table called periodic table.
12. The chemical changes occur between atoms and molecules to produce a new substance through the process of exchange, combination or decomposition. This process is called chemical reaction.
13. A chemical equation expressed in words is called word equation.
14. A chemical equation expressed by using molecular formula is called formula equation.

Exercise:

1. Fill in the blanks with appropriate words.

a. An atom is made up of proton, neutron and…….

b. The maximum number of electrons that can be held in each shell is determined by…….

c. The combining capacity of an element with another element to form a compound is called…….

d. The group of symbols of elements in molecules of substances is called…….

e. A chemical reaction can be represented in word equation and …….. equation.

2. Write answer in one word.

a. Which is the smallest particle of an element?

b. Which is the smallest particle containing the same characteristic of a compound?

c. What is the sub-atomic particle with a positive charge?

d. What is the sub atomic particle with a negative charge?

e. Write the unit of electric charge.

f. How many electrons can the L- shell of an atom hold?

g. What do you mean by the capacity of an element to combine with other element to form a compound?

h. What do you mean by the total weight of an atom?

3. Match the following

Atoms	Atomic numbers
A. H	( ) 12
B. Li	( ) 8
C. O	( ) 20
D. Na	( ) 1
E. Mg	( ) 3
F. Ca	( ) 11

4. Write down the differences between.

a. Atom and molecule

b. Electron and proton

c. Atomic number and atomic weight

d. Molecular formula and molecular weight

5. Define the following terms

a. Valency b. Molecular formula

c. Word equation d. Formula equation.

6. Write short answer.

a. What is $2n^2$ rule? Write any three examples.

b. What are sub-atomic particles called? Make a table to show the mass and charge of these particles.

c. What do you mean by the circular path that an electron revolves round the nucleus in an atom?

d. What is periodic table? Why was it developed?

7. Which elements are represented by the following nucleus? Write

a. 1p+ 0n°

b. 8p+ 8n°

c. 11p+ 12n°

d. 17p+ 18n°

e. 19p+ 20n°

8. Draw the atomic structure of the first 20 elements.

9. Explain the structure of an atom with a diagram.

10. The atomic number and atomic weight of chlorine element is 17 and 35 respectively. Calculate the number of proton (p^+), neutron (n^0) and electron (e^-).

11. Write down the molecular formula.

a. Sodium chloride b Water c. Carbon dioxide

12. Calculate the molecular weight.

a. Sodium Chloride (NaCl) b. Magnesium sulphate ($MgSO_4$)

c .Oxygen (O_2).

13. Complete the following word equations.

a. Hydrogen + Oxygen ⟶ ……..

b. Potassium chlorate ⟶ Potassium chloride + ……..

c. Water ⟶ Hydrogen + ……

Unit
12

Mixture

We use different types of matters in our daily life. Among them, some are pure substances and some are impure substances (mixture). When we need to get pure substances, we have to separate them from the mixture. The pure substances are obtained when the components of a mixture are separated on the basis of their property. There are different ways of separating a mixture. In this unit, some of the method used to separate mixture are described as follows.

Question to think:

How does a person, living at a sea shore, get clean drinking water?

Distillation:

The liquid is converted into vapor if it is heated up to its boiling point. The vapor thus obtained can be changed into liquid by cooling. The liquid obtained by this process is pure. This process is called distillation. This method can be used for the purification of liquid.

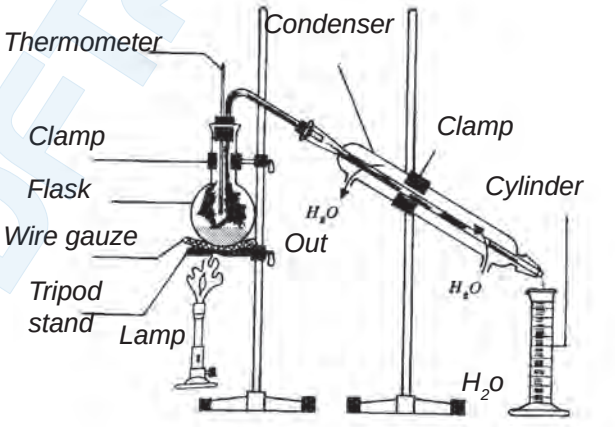


Fig. 12.1

Activity: 1

Separation of salt and water from salt solution

Materials required:

Round bottom flask, Stand, Thermometer, Burner, Tripod stand, Wire gauge, Measuring cylinder, Condenser, etc.

Procedure:

1. Take a clean flask and pour the salt solution into it.

2. Place the flask on the tripod stand and clamp it using a stand.
3. Fit the condenser to the flask as shown in figure.
4. Manage the flow of the cold water inside the condenser as shown in the figure.
5. Put a measuring cylinder just below the end of the condenser to collect distilled liquid.
6. Fit a thermometer to the mouth of the flask to measure temperature.
7. Now, heat the flask with spirit lamp and boil it.

Observation:

When we heat the water inside the flask, it forms vapor which comes out through the side tube inside water condenser. Water vapor gets cooled in the condenser and changes into liquid water which is collected in the flask. When the whole water converts into vapor, salt remains in the flask.

Conclusion:

When the solution is heated the water gets converted into vapor. The vapor passes through a condenser pipe. Where water drops are formed. The water (distillate) gets collected in cylinder. Finally the water vaporizes completely and salt remaines in the flask.

The people living in the Arabian Gulf and sea shore make clean drinking water from salty sea water by distillation process.

Fractional distillation:

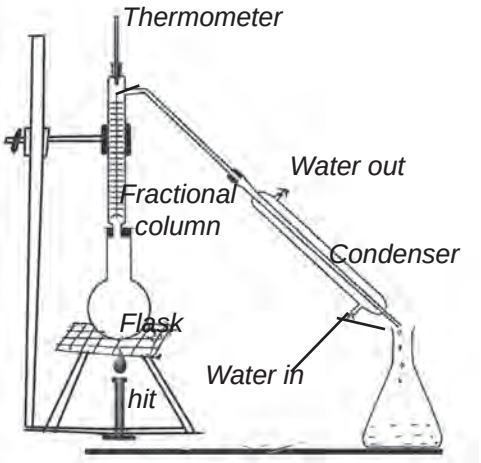


Fig. 12.2

When a mixture contains two or more liquid substances, it is difficult to separate the ingredients. In this situation, the boiling point of those liquids is determined and substances are separated by using fractional distillation process. In this method, the liquid having lower boiling point is separated out first rather than those having higher boiling point. Fractional distillation is carried out using a fractional column. The liquid, which is more volatile (having lower boiling point) will vaporize first, which is condensed and collected in the receiver. The

liquid that is less volatile (having higher boiling point) is distilled latter and collected in a separate receiver. Now a days, the fractional distillation method is used for the purification of petrol from mineral oil.

Chromatography:

Chromatography is derived from the Greek word "kroma" and "grapy". In Greek language, chroma means color and graphy means write. Therefore, chromatography is used to separate different colors from their mixtures. The term 'chromatography' was first discovered by Russian botanist Tswett in 1906 for the separation of colored plant pigments. Now a days, this method is widely used for separation, purification, identification and characterization of the components of mixture, no matter they are colored or colorless.

Application of chromatography:

Chromatography is used for separation and identification of different chemicals in hospital, laboratory and research center. Its main uses are give below:

1. It is used to separate different colors from a mixture.
2. It is used to separate and identify the medicine mixed with blood and urine.
3. It is used to separate the color from the mixture of natural and artificial coloring materials.

Activity: 2

Take a filter paper and make a hole in its center. Make a small roll of another filter paper and insert into the hole of the first filter paper. Place a drop of black ink near the hole and let it dry. Now, put some water in a beaker or Petridis and keep the filter paper with the roll for about one to two hour as shown in the figure. After sometime we can see the separation of different colors present in the black ink. Some colored materials move faster through capillaries of the filter paper than the other color. It is the main way of color separation. Fast moving colors move more distance from the center than that of slow moving colors. Different colored materials have different speed to spread in water. As a result the separation of color is possible. This type of color separation process is called paper chromatography.

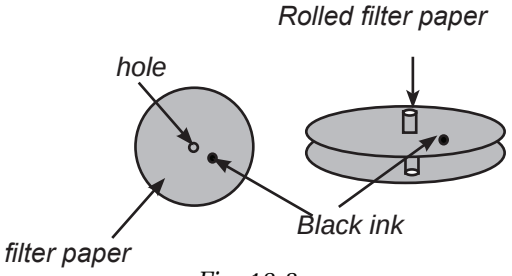


Fig. 12.3

Activity: 3

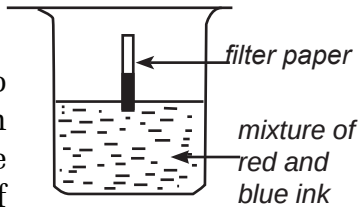


Fig. 12.4

Take a small beaker or glass tumbler. Mix two drops of red ink and two drops of blue ink with 5ml of water in the beaker or tumbler. Now place a strip of filter paper half inside water and half outside water. While doing so, the paper strip should not touch the sides of the vessel. After some time, red ink and blue ink are seen to be separated in the filter paper.

Activity : 4

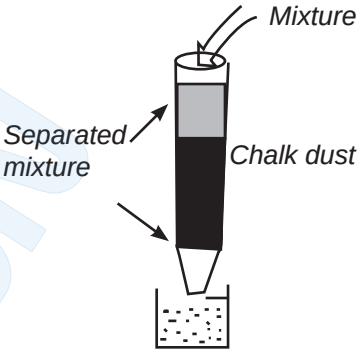


Fig. 12.5

Take a small and short (5-7cm long) glass tube. Heat one of the ends to make it narrower. Put chalk dust or aluminium oxide into the tube through larger end. Put a mixture of colors (red, blue, black). Observe for some time. One of the colors drops down through the lower end of the tube. Collect the colors using a vessel. After sometime another color appears and collect it in another vessel. In this way colors can be separated by keeping them into different vessels.

Practical activities:

1. Study the activity 1 and separate a mixture of salt and water by distillation.
2. Grind a plant flower and leaf to make a paste. Use the solution for paper chromatography and observe. How many colors are separated? Write short notes.

Summary:

1. Distillation is a process in which liquid is converted into vapor by heating and vapor is condensed back to liquid by cooling.
2. The mixture of two or more liquids is separated by fractional distillation.
3. Pure drinking water is made from the salty water of sea by distillation process.
4. The method of separating different colors from a given solution is called chromatography.
5. Chromatography technique is used to separate and identify the chemicals present in colors, blood, urine, etc.

Exercise

1. Write short answer.

a. What is distillation?

b. What type of mixture is separated by fractional distillation?

c. The liquids having the same boiling points cannot be separated from its mixture by distillation, why?

d. What types of mixtures are separated by chromatography?

2 . How will you use simple filter paper to demonstrate chromatography? Explain with diagram

3. How do you separate the mixture by using distillation? Explain with diagram.

4. What is fractional distillation? What kinds of mixture can be separated by this method? Explain with figure?

5. If two substances move with the same speed through a medium, why chromatography process is not suitable? Give reason.

6. How can you get pure water from impure water? Explain with experiment.

Unit

13

Metal and Non–Metal

One hundred and eighteen elements have been discovered: 92 are natural and 26 are artificial. Every element has its own properties. Elements have been classified into 3 types, i.e., metals, metalloids and non-metals. This classification is mainly based on the electrical conductivity of the elements. The metals are good conductors, metalloids are poor conductors or semiconductors and non-metals are insulators or bad conductors of electricity.

Position of metal, metalloids and non-metal in periodic table:

Metals are placed on the left portion of the periodic table. Generally, the elements in the group 1, 2 and 3 are metals. The elements of the group 1 and 2 are highly active metals, e.g, sodium, potassium, magnesium, etc. The elements on the right side of periodic table are non-metals. The elements belonging to the last group (zero group) are inactive gases. Likewise nitrogen, oxygen and chlorine gases are non-metals. Metalloids are in the middle part of the periodic table, e.g., carbon, silicon, etc. Metalloids show the properties of metals as well as non-metals.

Some important metals, non-metals and metalloids

We have been using metals, metalloids and nonmetals for different purposes in our daily life. The introduction, properties and uses of some important metals are as follows:

Gold (Au)

Gold is shiny yellow colored metal. It is found in Free State. It occurs in rocks, sands and alluvial soil. It is extracted from alluvial soil.

Properties:

1. It is yellow, shiny metal.
2. It is good conductor of heat and electricity.
3. It does not react with air and water.
4. It is not affected by simple acids (such as HCl and H_2So_4).

Uses:

1. It is used for making ornaments.
2. It is used for making coins, idol and medal.
3. It is used to prepare medicine.

Silver (Ag):

Silver is found in the free (native) state as well as combined state. Metals which are found in the form of minerals are called ore. The main ore of silver is argentite. It is mainly extracted from argentite ore.

Properties:

1. Silver is a white lustrous metal.
2. It is good conductor of heat and electricity.
3. It is not affected by air and water.
4 Dilute acids have no effect on it but concentrated acid react with it to form compounds.

Uses:

1. It is used for making expensive utensils, coins and medals.
2. It is used to make ornaments.
3. It is used in electroplating and silvering of mirrors.
4. It is used for making electronic appliances (instrument).
5. It is used for filling teeth.
6. It is used in medicine.

Copper (Cu):

It occurs in Free State as well as in the form of ores. Copper is extracted from its different ores. Its main ore is chalcopyrite. Copper has been used since ancient time for making utensils.

Properties:

1 . It is reddish brown in color.

2. It is a good conductor of heat and electricity.

3. It does not get rusted but on exposure to moist air, it becomes deemed.

4. On heating, it forms a black oxide.
5. It reacts with acids.

Uses:

1. Copper is used for making utensils.
2. It is used for making electric cables and electrical appliances.
3. It is used for making alloys like brass, bronze, etc.
4. It is used for making ornaments, medal and idols.
5. It is used for making chemicals and medicine.

Iron (Fe):

Iron does not occur in free state. It occurs in the form of ores. Its main ores are hematite and magnetite. Iron is extracted from its ores. It has important role in our daily life. It is also found in human body and plants.

Properties

1. It is ash colored.
2. Hammering of iron gives shining.
3. It has magnetic properties.
4. It is easily affected by air and water and gets rusted.
5. It reacts with acid.

Uses:

1. It is used for making shovels (kuto, kodalo), sickle, plough, knife, axe and weapons.
2. It is also used for making tools and weapons.
3. It is used for making different type of iron rods, pipes, wires, etc.
4. It is also used for making house, bridge and different means of transportation
5. It is used for making steel.

Aluminum (Al):

Aluminum does not occur in free state but it also occurs as compounds and in the form of ores. Its chief ore is bauxite. Aluminum is extracted from bauxite.

Properties:

1. It is light and white metal.
2. It is the best conductor of heat and electricity.
3. It is not easily affected by air and water.
4. It does not get rusted.
5. It melts at low temperature rather than other metals.

Uses:

1. It is used for making household utensils (pressure cooker, rice cooker), etc.
2. It is light metal so it is used for making aero plane.
3. It is used for making electrical wire and electrical appliances.
4. Aluminum powder is used for making paints.
5. Thin foil or wire of aluminum is used for wrapping goods.
6. The wire of aluminum is used for different purposes.
7. It is used for making coin and alloys.
8. It is also used for making cover of food materials as well as embalming in the inner side of the packing cover (biscuits, chocolate etc).

Silicon (Si):

Silicon does not occur in free state in nature. It is found in excessive amount in the form of compounds. The main source of silicon is sand or silica (SiO_2). It mainly occurs in the form of silicates in soil. Silicon is a metalloid. It has the properties of metal as well as non-metal.

Properties:

1. Silicon is a metalloid.
2. Silicon is a hard brittle solid and brown in color.
3. It is crystalline or amorphous in nature.
4. The crystalline form of silicon is poor conductor of electricity and its amorphous form is insulator.
5. It does not react with air, water and acid.

Uses:

1. It is used for manufacturing glasses.

2. It is used for the manufacture of the different types of soil pots.
3. The compounds of silicon rocks are used for the manufacture of a sandstone house, idols, etc.
4. It is used as semiconductor in electrical devices.
5. It is used for polishing apparatus and manufacturing of colors.

Sulphur (S):

Sulphur occurs in the Free State. Generally, it is found in the places where the volcanoes occur naturally. In a combined state, it is found in the form of sulphides of metal. It is found in garlic, onion, mustard oil, etc. It is a non-metal.

Properties:

1. It is straw like yellow shining solid.
2. It is insoluble in water.
3. It is an insulator of heat and electricity.
4. It burns with air to form sulphur dioxide.
5. It does not react easily with acid.

Uses:

1. Sulphur is used to make sulphuric acid.
2. It is used as a medicine.
3. It is used for making matches, gun powder etc.
4. It is used to manufacture insecticides.
5. It is used in the manufacture of crackers.

Project work:

Observe, metals, non-metals and metalloids used in your locality. Make a list of them and also state their uses.

Summary:

1 . Metals, non-metals and metalloids allocated in the left, right and middle portion of the periodic table respectively.
2 . Metalloid has the properties of metal as well as non-metal.
3. Gold is inactive, yellow and shining metal. It is used for making

ornaments.

4 . Copper is a reddish brown, conductive metal. It is used for making electric wire.

5. Silver is a white luster and good conductive metal.

6. Iron is a black brown and hard metal. It is used for making utensils and rods.

7 Aluminum is a white, light and non- rusting metal. It is used for making aeroplane, goods wrapping, foil, etc.

8 Silicon is used in electronic apparatus in the form of metalloids.

9. Sulphur is used in manufacture medicine, powder, crackers, etc.

Exercise:

1. Fill in the blanks with appropriate word.

a. …….are placed on the left portion of the periodic table.

b. Metalloid exhibits the properties of metals and……..

c. Gold has……..shining color.

d. . ……is the best conductor metal.

e. …….is used for making aeroplane.

2. Write short answers.

a. Where and in which conditions gold is found?

b. Which metal is extracted from hematite ore?

c. Which metal is used for filling teeth?

d. Which metals are used for making an electric wire?

e. What do you mean by sulphur? What are its uses?

f. Write the main uses of sulphur.

3. Write the position of metals, non-metals and metalloids in a periodic table.

4. Write three properties of the following metals.

Gold, Silver, Copper, Iron, Aluminum.

5. Write the uses of the following elements.

Silicon, Sulphur, Iron, Copper.

6. Why aluminum metal is used for making body parts of aeroplane?

Unit

14 Acid, Base and Salt

We eat apple, orange, lemon and '*Amala*' that contain acid. Limestone is a base. It is used to paint and decorate our house. Similarly, the edible salt is a salt. In this way, we are using different types of acids, bases and salts in our daily life.

Acid:

Generally, acid is a substance which has sour taste. However, the meaning of acid is not limited to this concept in chemistry. Some acids do not have sour taste. Most of the acids are sour in taste, e.g., citric acid, hydrochloric acid, tartaric acid, lactic acid, etc. We do not take the taste of all acids because some of them damage our skin. Strong acids are known as '*Tejab*'. Actually, what is an acid?

Acid is a substance which gives hydrogen ion or proton (H^+) when it is dissolved in water. Acids are mainly of two types:

a) Organic acids b) Inorganic acid

The acids which are found in plant and animals are called organic acids, e.g., citric acid, lactic acid, tartaric acid, etc. The acids which are prepared in the laboratory are called inorganic acids e.g. hydrochloric acid, (HCl), sulphuric acid (H_2SO_4), nitric acid (HNO_3), etc.

Properties of acid

1. **Physical Properties**
   (a) Generally, acids have sour taste.
   (b) Acids turn blue litmus paper into red.
   (c) Acids turn methyl orange into red.
   (d) Acids are neutral to phenolphthalein.

2. **Chemical properties**
   (a) An acid reacts with metal to form hydrogen gas.
   (b) Acids react with base to form salt and water.
   (c) Acids give hydrogen ion (H^+) when dissolved in water.

Uses

Acids are used in different purposes. Uses of Some acids are as follows.

Acid	Uses
a. Sulphuric acid(H_2SO_4) Hydrochloric acid(HCl) Nitric acid (HNO_3)	These are used in laboratory, industry and factory for various purposes.
b. Carbonic acid (H_2CO_3)	It is used in soda water, coca cola, beers and some other drinks.
c. Acetic acid/vinegar(CH_3COOH)	It is used to make sour pickles.

Some common acids that are used in our daily life and their sources:

Name of acid	Sources.
1. Citric acid	Lemon, Tomato.
2. Tartaric acid	Fruits like bhogate, etc.
3. Oxalic acid	Chariamilo
4. Ascorbic acid	All citrus fruits like lemon, orange, etc.
5. Lactic acid	Milk, curd, et.c
6. Formic acid	Acid injected by ants.

Base

Bases are the oxides and hydroxides of metal. They react with acids to give salt and water. The bases which are soluble in water are called alkali. Bases give hydroxyl (OH^-) ion when dissolved in water.

Some important OH^- bases:

Name of bases	**molecular formula**
Sodium oxide	Na_2O
Sodium hydroxide	NaOH
Potassium oxide	K_2O
Potassium hydroxide	KOH
Magnesium oxide	MgO
Magnesium hydroxide	$Mg(OH)_2$

Properties of bases

1. Physical Properties

(a) Generally, bases are bitter in taste. We do not take the taste of all bases because hard bases burn our skin.

(b) Some bases are soapy to touch.

(c) Bases turn red litmus paper into blue.

(d) Bases turn methyl orange into yellow color.

(e) Bases turn phenolphthalein into pink color.

2. Chemical properties:

(a) Bases react with acid to give salt and water.

(b) Bases react with carbon dioxide to form carbonate.

Uses:

Some common bases and their uses are as follows:

Name of base	**Uses**
1. Sodium hydroxide(NaOH)	To make soap and paper.
2. Potassium hydroxide (KOH)	To wash clothes To use as chemical fertilizers.
3. Aluminium hydroxide, $(Al(OH)_3$	To use as medicine (antacid)to cure gastric disease.
4. Magnesium hydroxide $(Mg(OH)_2$	To use as medicine to cure gastric disease.
4. Calcium hydroxide $Ca(OH)_2$	To use as laboratory reagent. To remove the hardness of water.
5. Ammonium hydroxide (NH_4OH)	To make chemical fertilizer and plastics.

Salt:

Salt is a neutral substance i.e. it is neither acidic nor basic. Some salts are salty, some are bitter and some are tasteless. Generally, acids react with base to form salt.

Properties of salt:

1. Some salts are salty, some are bitter and some others are tasteless.
2. Salts are neutral to litmus paper, methyl orange and phenolphthalein.
3. Most of the salts are soluble in water.
4. Some salts are colorless whereas some are colorful.

Uses of salt:

Some salts are used in our daily life and their uses are given below:

Salt	Uses
1. Sodium chloride(NaCl)	To use in daily foodstuffs
2. Copper sulphate($CuSO_4$)	To use as an insecticide
3. Magnasium sulphate($MgSO_4$)	As medicine against constipation
4. Calcium sulphate ($CaSO_4$)	To plaster the fractured bones and to make cement
5. Sodium carbonate(Na_2CO_3)	To make soap, detergent and glasses
6. Sodium bicarbonate($NaHCO_3$)	To make baking powder
7. Ammonium sulphate $(NH_4)_2SO_4$	To use as chemical fertilizer

Indicator:

We use different types of chemicals in our daily life. These chemicals cannot be identified easily whether they are acidic, basic or neutral. We need to use some chemical substances to identify them. These chemicals are called indicator.

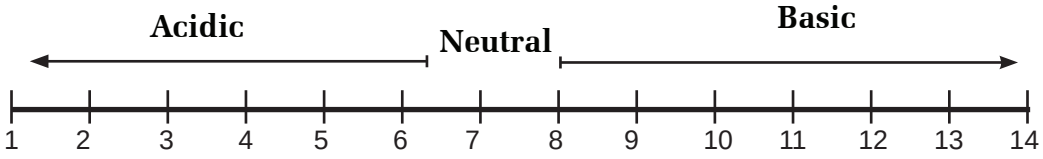
The chemical substances which are used to identify whether a substance is acidic or basic or neutral is called indicator, For example, litmus paper, methyl orange and phenolphthalein, etc. These substances can change their own color and help to identify the acids, bases and salts. The table given below shows how indicators response while introducing acid, base and salt separately.

Indicator	Acid	Base	Salt
Red litmus	Red	Blue	Neutral
Blue litmus	Red	Blue	Neutral
Methyl orange	Red	Yellow	Neutral
Phenolphthalein	Colorless	Pink	Neutral

An indicator is used to identify whether a substance is acidic or basic but it does not measure the strength of acid and bases. Universal indicator is used to identify the strength of acids or base. It is obtained by mixing simple indicators having different colors. The indicators having red or dark red color denote acid and blue or dark blue colors denote base. The green color indicates neutral substances. The color change in universal indicator is measured in terms of pH scale.

p^H - scale:

pH Scale has a series of numbers ranging from 1 to 14. Solution having a pH of 1 or 2 are very strong acids and those having pH 13 or 14 are strong bases. The pH value of neutral substances is 7.



P^H value of the solution is measured by pH meter. The reading of pH value of a solution can be taken directly from the window of the pH meter. In this way, pH scale also shows the strength of acid or base.

Activity: 1

Take three clean test tubes. Put solution of an acid in the first test tube, a base in the second test tube and salt in the third test tube. Dip a red litmus paper in each test tube containing solution of acid, base and salt in turn. Observe. What changes did you see in litmus paper? Similarly, dip blue litmus paper in each test tube and observe. What changes did you see in the litmus paper? Note the result and draw conclusion.

Activity 2:

Take some colored petals of flowers. Mix the flowers and sand. Then crush them in a mortar. Add few ml of alcohol. The colored pigments get dissolved in alcohol. Now, separate the sand and insoluble substances using a filter paper. Collect the filtrate and pour into a bottle. Dip a piece of paper in a solution and remove it. Dry the paper. In this way, litmus paper can be prepared.

Similarly, put an acid in a test tube and base in another test tube. Dip a piece of litmus paper into each test tube and observe. What changes did you observe in color of litmus paper? Write.

Practical activities:

1. Do the activity no. 1 and identify acid, base and salt with the help of litmus paper.
2. Prepare a litmus paper on the basis of activity no. 2. What type of color change did you observe; when a litmus paper is kept into the solution of acid and base? Observe and write.

Summary:

1. The chemical substances which give hydrogen ion (H^+) in water are called acid.
2. Metallic oxide or hydroxide are called base.
3. Salt is a neutral substance which is formed by the chemical reaction between acid and base.
4. Generally, acids have sour taste; bases have bitter taste. The salts are salty or bitter or tasteless.
5. An acid turns blue litmus paper into red and base turns red litmus paper into blue.
6. A substance which is used to identify whether a substance is acidic or basic is called indicator.
7. The strength of an acid or base is measured using pH scale.

Exercise

1. Write short answer.

a. What is acid?

b. Write the name of any three acids which are prepared in the laboratory.

c. What is base? Give any four examples of base.

d. What is indicator? Write any three examples of indicator.

e. What is pH scale? Write the range of the pH value.

f. What is the pH value of neutral substances?

2. Differentiate between

a. Acid and base

b. Indicator and universal indicator.

3. Give a reason

a. Lemon and amala have a sour taste. Why?

b. Why should an acid be handled with caution?

c. Skin burns when we touch nettle. Why?

d. The skin burns when an ant bites. Why?

e. Aluminum hydroxide containing medicine is used for gastric. Why?

4. Write any four properties of acid.

5. Write any four properties of base.

6. Write any three examples of common acid, base and salt. Mention their uses in our daily life.

7. How is salt formed? Write.

8. How can we make a litmus paper from flower? Write.

9. Write any three properties of salt.

10. How do acid, base and salt affect indicators? Show with the help of a chart.

11. Mention the uses of the following chemicals:

a. Carbonic acid b. Acetic acid

c. Sodium hydroxide d. Sodium chloride

e. Ammonium sulphate

Unit

15

Some Useful Chemicals

Water

Water is one of the most important substances found in the earth. About 71% part of the earth is covered with water. It is found in solid, liquid and gaseous state. In the atmosphere, it is found in the form of vapor or steam, frost, cloud, etc. It is also found in the form of snow on high Himalayas and mountains. Water is available on the surface of earth in liquid form, i.e., ponds, river, sea, lakes, etc. Underground water comes out from well, spring, taps and tubels which are used for various purposes. It is used for various purposes, for example, for drinking, bathing, washing clothes, cooking food, irrigation and in factory, etc.

Properties of water:

1. **Physical properties**
   (a) Pure water is colorless, odorless and tasteless.
   (b) Water exists in three forms, i.e., solid, liquid and gas.
   (c) It is a transparent liquid.
   (d) Pure water is insulator of heat.
   (e) It freezes at 0^0 C to form ice and boils at 100^0 C to give gas form.
   (f) Water is a universal solvent.

2. **Chemical properties**

   (a) Water (H_2O) is made up of two parts of hydrogen and one part of oxygen.

   (b) Pure water is a neutral substance. It is neither acidic nor basic in nature.

Hard and soft water

If we use the water from wells, spring, etc. for bathing and washing clothes, the hair may become sticky, dirt may not be removed completely and soap may not give lather. Why does it happen?

There are mainly two types of water: 1. Soft water. 2. Hard water

1. Soft water

The water which gives lather easily with soap is known as soft water. For example, rain water, distilled water, etc.

2. Hardness water

The water which does not give lather easily with soap is known as hard water. For example water from wells, springs, and underground water are the sources of hard water.

Hardness water

Water is an important solvent. Therefore, different chemical substances are found to be dissolved in water. Some of the dissolved substances are useful and others are harmful for plants and animals. The metallic salts are also found to be dissolved in water. These metallic salts dissolved in water cause hardness of water. Mainly salts of magnesium and calcium cause the hardness of water.

Activity 1

Collect water from different sources in your locality. Keep the collected water sample in equal amounts in different test tubes as shown in the figure. Make a solution of soap or shampoo in a beaker. Take a dropper and put five drops of soap solution in each test tube. Now, shake all the test tubes and observe. The water which gave the lather easily is soft water. The water which did not give much lather is hard water. In this way hard and soft water can be identified.

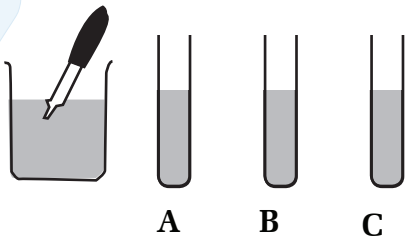


Fig. 15.1

Types of hardness of water:

The hardness of water is of two types.

(a) Temporary hardness.

(b) Permanent hardness.

(a) Temporary hardness of water :

If the water contains dissolved calcium and magnesium bicarbonate salts it gives temporary hardness of water.

(b) Permanent hardness:

If the water contains dissolved chloride and sulphate of calcium and magnesium it gives permanent hardness of water.

Removal of hardness

The hardness of water is removed by converting the dissolved substances into insoluble substances.

Removal of temporary hardness of water

Temporary hardness of water can be removed by boiling the hard water. The temporary hardness of water is due to the presence of dissolved bicarbonates of calcium and magnesium. Bicarbonates of calcium and magnesium can be converted into insoluble carbonates. The insoluble substances are separated by decantation to remove the hardness of water. Now soap gives lather easily with this water.

Activity: 2

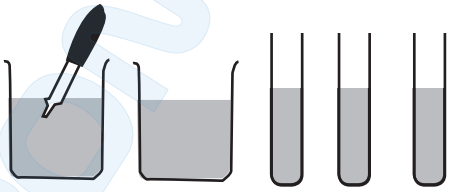


Fig. 15.2

Take a beaker and fill it halfly with water. Add one spoonful of calcium bicarbonate or magnesium bicarbonate salt in water and shake well. Now, take some solution in a test tube. Make a solution of soap or detergent in another beaker. Now add few drops of soap water into the next test tube. Shake it well and observe. Is lather obtained or not? Observe. This solution does not give lather because the water has hardness. Now boil the solution in the first beaker and cool it. After cooling the solution, add few drops of soap solution and shake well. Observe. It gives lather with soap solution. It is understood that the temporary hardness of water can be removed by boiling.

Removal of permanent hardness of water:

Permanent hardness of water can't be removed by boiling. It can be removed by adding washing soda (sodium carbonate, Na_2CO_3) to it. Now, sodium carbonate reacts with calcium and magnesium salts dissolved in water to form insoluble carbonates of calcium and magnesium. The insoluble salts settle down at the bottom of the vessel and hardness of water is removed.

Activity: 3

Fill a beaker halfly with water and add small amount of calcium chloride or magnesium chloride to make solution. Take a small amount of solution in a test tube and add few drops of soap- solution to it and shake it well. It doesn't give lather due to the hardness of water. Now, add one spoonful of sodium carbonate salt in a beaker containing water and shake it. Again, take a small quantity of water in a test tube and add two or four drops of soap

solution and observe. It gives lather with soap solution. It is understood that, permanent hardness of water can be removed by adding sodium carbonate solution.

Sodium carbonate

Sodium carbonate is a versatile chemical. It is commonly known as washing soda. It is a compound of sodium metal. Its molecular formula is Na_2CO_3. It is found in the form of white powder. It is basic in nature.

Uses

1. Sodium carbonate is used in the manufacture of soap.
2. It is used in the manufacture of paper.
3. It is used in the manufacture of different types of glasses.
4. It is used for softening hard water.
5. It is used in the preparation of caustic soda.
6. It is used for different purposes in laboratory.

Sodium bicarbonate

It is a useful chemical and made up of sodium metal. Sodium bicarbonate is also known as baking soda. Its molecular formula is $NaHCO_3$. It is also found in the form of white solid substance. It is soluble in water. Baking powder is prepared by mixing sodium bicarbonate with potassium hydrogen tartrate. In baking industries, it is used to increase the volume of cakes, biscuits, breads, etc.

Uses

1. It is used in the manufacture of baking powder.
2. Baking soda is regarded as edible soda and is used to treat acidity of stomach.
3. It is used in the manufacture of soft drinks.
4. It is used in the fire extinguisher.

Question to think

Why is baking soda used in hotels while cooking rice?

Glycerol:

Glycerol is commonly known as glycerin. It is manufactured from organic compound propane. It lies in alcohol group. Its molecular formula is $C_3H_5(OH)_3$. It is colorless, sweet tasting syrupy liquid. It is soluble in water.

Uses

1. It is used in the manufacture of medicine, printing ink, stamp pad ink, etc.
2. It is used in preparation of body lotions (saves the breakage of skin).
3. It is used in preparation of high quality soap.
4. It is used for making sweets.
5. It is used as humectants (moisture retaining agent) for fruits and food materials.

Activity: 4

Take a little amount of glycerin and rub it in hands and legs. Observe. What does it look like? Put it on tongue and take its taste. How does it taste? Write.

Question to think:

Why do people use glycerin in hands and legs during cold season?

Project work:

Observe the different chemicals used in your home. Write their names and what are they used for? Write in table.

S.N.	Chemicals	Uses
1		
2		
3		

Practical activities:

1. Study activity no. 1 and identify hard and soft water.
2. Study the activity no. 2 and 3 and demonstrate the method of the removal of hardness of water.

Summary

1. Water is an important solvent.
2. Pure water is colorless, odorless and tasteless.
3. Water is of two types: hard and soft water.
4. Water which gives lather with soap is called soft water.

5. Water which does not give lather with soap is called hard water.
6. The hardness of water is of two types: temporary and permanent.
7. Bicarbonates of calcium and magnesium salt dissolved in water cause temporary hardness.
8. Chloride or Sulphate salt of calcium and magnesium dissolved in water cause the permanent hardness.
9. Temporary hardness of water can be removed by boiling.
10. Permanent hardness of water can be removed by treatment with sodium carbonate.
11. Sodium carbonate is known as washing soda.
12. Sodium bicarbonate is known as baking soda. It is used to remove acidity, make soft drinking substances and on baking powder.
13. Glycerol is an organic chemical. It lies in an alcoholic group. It is used for making skin soft and smooth.

Exercise:

1. Fill in the blank with appropriate word.

a. Pure water is …… of heat.

b. Water which doesn't give lather with soap is called……..

c. Temporary hardness of water can be removed by ……..

d. To save the skin of hands and legs from being breakage we use the chemical called .....

e. Sodium bicarbonate is also known as…….

2. Tick the best answer.

a) In which state is water found in the earth?

i. Liquid ii. Solid

iii. Gas iv. Solid, liquid and gas

b) Which salt is dissolved in temporary hard water?

i. Calcium chloride ii. Calcium sulphate

iii. Calcium carbonate iv. Calcium bicarbonate

c) How can the permanent hardness of water be removed?

i. Boiling ii. Filter

iii. By mixing washing soda iv. By adding calcium carbonate

d) Which chemical is used to prepare baking powder?

i. Sodium chloride ii. Sodium carbonate

iii. Sodium bicarbonate iv. Glycerol

3. Differentiate between.

a. Soft water and hard water

b. Temporary hardness and permanent hardness of water

c. Sodium carbonate and sodium bicarbonate

4. Write short answer.

a) What kind of water is called soft water?

b) How many types of hardness of water are there?

c) Write any three properties of glycerin.

d) Write any five sources of water and also name the sources of soft water.

e) What substances cause temporary hardness in water?

5. Make a list of the substances that cause temporary and permanent hardness in water?

6. What should be done to remove the temporary hardness of water? Explain with a chemical reaction.

7. What should be done to identify the hardness of water collected from different sources? Explain with a diagram.

UNIT

16

Living Beings

Some microscopic organisms

Different types of organisms are in the Earth. Some of them are very small and some are very big. We cannot see very small organisms with our naked eyes but it can be seen with the help of microscope. Such types of organisms are called microorganisms. Among such microorganisms, we will learn about bacteria, virus and fungi in this chapter.

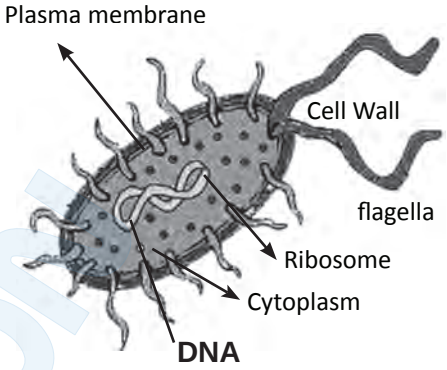


Fig. 16.1

Bacteria

Bacteria are microscopic organisms. The were first identified by Anton Van-Leeuwenhoek in 1676 A.D. They can live in air, water, soil, animal and plant. They are found in almost all part of the earth. Some can survive in extremely cold ice whereas some in boiling water. Their size is ultramicroscopic. Their shapes are different like spherical, rod shaped, coiled, comma, thread shaped, etc. As for example: coccus, bacillus, helical, vibrio, etc.

Actual nucleus is absent in bacteria. It is covered by cell-membrane. Some bacteria also contain cellwall. Some of them have chlorophyll and can prepare their own food by themselves. Some are parasites and hence absorb nutrients from other living beings. Some are saprophytic which gain food from dead organisms.

Some bacteria are found in roots of leguminous plant., eg, Rhizobium. They help in balancing the nitrogen cycle of environment. Some of the bacteria cause different diseases, For example, cholera, pneumonia, diarrhoea, typhoid, etc. Some bacteria destroy crops like rice, maize, potato, etc.

Virus

Virus is an ultramicroscopic organism. Virus is derived from a latin word. Viruses completely depend on living organisms. They cannot live outside the living cell. They show characteristics of both living and non living beings.

They are ultramicroscopic. Among them, some lack nucleus, some lack cytoplasm, some contain DNA (Deoxyribonucleic acid) and some contain RNA (Ribonucleic acid).

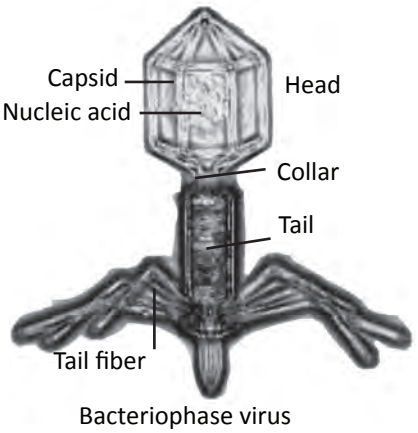


Fig. 16.2

Types of virus

Viruses are divided into three types based on the host cell.

1. Plant virus:Virus which infects plants. Example: TMV (Tobacco Mosaic Virus)
2. Animal virus: Virus which infects animals. Example: Rabies, Rhino virus
3. Bacteriophase virus: Virus which infects bacteria.

Virus can be divided into DNA virus and RNA virus on the basis of nucleic acid.

Virus is transmitted through air, water and food to human and causes diseases such as: common cold, mumps, measles, polio, rabies, etc. AIDS is also caused by virus.

Fungi

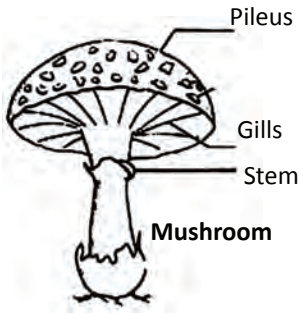


Fig. 16.3

Fungi are chlorophyll-less microscopic plants. Some of them are unicellular like yeast. Some are multi cellular. Long filaments are present in multi cellular fungi. They cannot prepare their own food by themselves. So most of the fungi are attached to other plants and absorb nutrients from those plants. Some of them are parasitic and some are saprophytic. None of the parts like root, stem, leaf is developed in fungi.

Fungi obtain their food from dead and decayed organic matter. These types of fungi are called saprophytic fungi. Some of the fungi sustain their lives being on the surface of plants but do not harm the plants.

Fungi are made up of filaments. This filament is called hyphae. Cells of these are long like thread and attached with each other. Multiple nuclei can be present in their cell.

Reproduction in fungi is mainly by asexual method. Their reproduction occurs through fragmentation, budding, fission, sporulation. Yeast is used to prepare alcoholic beverages (beer, wine). Mushroom is used as food.

Modification of different parts of plant

There are different types of plants in our surrounding. Plants vary from small to a very large size. Similarly, some plants are found in water and some are on land. A lot of similarities are noticed in plants based on their structure. Root, stem and leaf are present as the major parts of a plant. These parts are also modified into different forms according to the location, structure and function to perform different works. This is called modification.

Modification of roots

The underground part of plant is called root. Its colour is usually white, brown and light yellow.

Roots are mainly of two types:

a) Tap root system b) Fibrous root system

Plants change the structure of their simple parts into different forms to grow to exist in the surrounding environment and to perform different functions accordingly. Modification in root of plant is for major three functions.

1. For storage of food 2. For mechanical support

3. For vital functions

(A) For storage of food

Have you ever eaten radish, carrot, turnip? The shape and size of roots of such plants are modified for storage of food. Modification of tap root occurs as following ways:

a) bulged in the middle and narrowed at upper and lower part, for example, radish

b) circular, bulged at the tip and narrowed in the lower part, for example, turnip

c) broad upper part and gradually narrowing towards the lower part, for example, carrot.

Fig. 16.4

2. For mechanical support

Have you ever sat on the platform of Banyan (Baar) and Peepal? Have you seen the roots coming down to floor from the branches of banyan? They have helped to support the big tree of baar. Sometimes many roots of banayan occupy the spaces under the tree. Roots arise from the stem of bamboo and grow towards floor. It

Fig. 16.5

gives pillar like structure. Similarly, plants like maize, sugarcane etc. bear roots from the all sides of stem and grow towards ground. Roots of some plants act as climber and climbs other plants. In this way, root is modified into different structures to support the plants.

3. For vital function

Fig. 16.6

Roots are modified for doing different functions according to the structure of plants. In some parasitic plants roots are developed to absorb nutrients from other plants. The root of plant growing on marshy place comes out of the ground to help in respiration. Some roots arising from the stem of a plant have chlorophyll. They perform photosynthesis. Some of the roots of aquatic plants help to float on water. They have parts for air storage. Example: hydrilla, water hyacinth, etc.

Modification of stem

Stem is a part of plant above the ground. Branch, leaf, flower and fruit arise from it. Stem is also modified into different forms according to its surroundings during the development of plants.

1. Underground modification

Some underground stems store food in a form of thick juicy starch. For example;, potato. Some stems are with tuber, dry, thorn like. For example; steam of ginger, onion and garlic store food material.

Fig. 16.7

2. Sub-aerial modification

Stems of some plants are soft, weak, align parallel to the ground. In some plants, stems are partially underground and partially above the ground. New plant is formed by this part, example, grasses. Buds are developed from some stem and grows into a new plant.

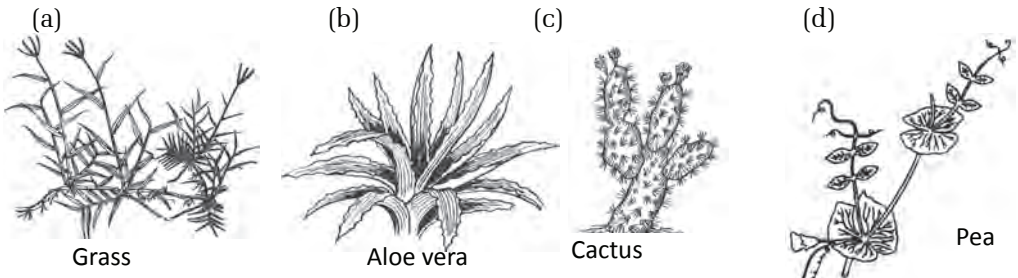


Fig. 16.8

c) Aerial modification

Aerial stem is modified into different shape. In some plant, stem is like a leaf and stores food. For example; cactus. Leaf of this kind of plants develops as a thorn. Some plants have thread like stem. Some plants have hard, twisted, long, cylindrical stem like wood. Green coloured stems prepare and store food. Some plants also store water in their stems.

Modification of leaf

Leaf arises from stems and branches of plants. Leaves are the main parts of plants to prepare food. The leaves of plants modify in different ways and perform special functions.

Tendril is formed partially in some leaves, example; leaf of pea. These tendrils are coiled like wire. Leaves are modified into thorns in some plants. Mainly leaves of xerophytic plants and leaves of cactus are modified into thorns. They reduce transpiration. Thorn also protects plant. Leaves of some plants are dry and like a paper. In some plants , leaf is like a stick. Bladder of leaf is found in carnivorous plant. It helps in trapping small insects and digests them.

In this way root, stem and leaf are modified to perform different functions.

Seed

Seeds are of different shapes and types. Some seeds are hardly visible to eyes whereas some are big. Seeds are also found in different colours. Gram, pea, bean, wheat, maize, rice, mustard, seed of mango are the examples of seed. Generally, seeds are of two types.

(a) Monocotyledon (b) Dicotyledon

Activity 1

Soak the seeds of wheat, maize, gram, pea, bean for a whole day in a vessel. Next day the size of seeds increases since they absorb water. Draw the structures of the seed in exercise book. Slowly remove the seed coat. How many cotyledons do you see in each seed? Observe and draw them.

Structure of seed

Though the shape, size and structure of seeds are different, their fundamental structure is similar.

Monocotyledonous seed

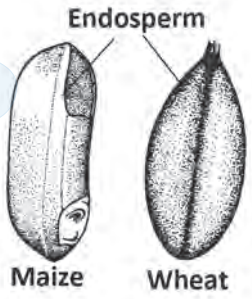
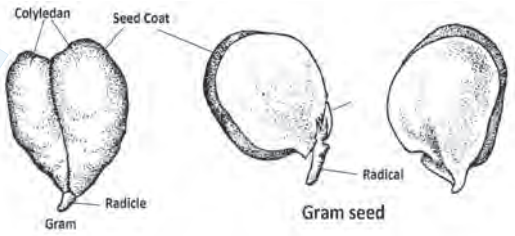


Fig. 16.9

Wheat, rice and maize are monocotyledonous plants. Seeds of these plants have single cotyledon. A small white coloured oval shaped part is noticed at one side of maize seed in which embryo is present. Remaining part of it is covered with yellow or white coloured edible things, which is called endosperm. Maize is a seed with endosperm. Radicle is present in the pointed part of maize grain. Plumule or future stem is present in the broad part of maize. Maize, rice, wheat, barley, millet are the monocotyledonous seeds with endosperm.

Dicotyledonous seed



Seeds of gram, pea, bean, etc are dicotyledonous. The outermost covering of seed is called seed-coat. Its major function is to protect weak part of seed as well. A white scar like part present at the depressed part of seed is called hilum. Seed is attached to a fruit through this part.

A small pore near the hilum is called micropyle. Through this micropyle water enters inside the seed and helps it to germinate. Two thick cotyledons are present inside seed coat, where, food is stored for embryo. We can see small embryo attached to a cotyledon when we dettach the two cotyledons slowly. Embryo has two parts:

a) Radicle or future root b) Plumule or future stem

Radicle develops into root whereas plumule develops into stem. Cotyledons of seed store food for developing embryo. Food is obtained from endosperm.

Usually seed doesnot have endosperm. Therefore food is stored in cotyledons during the maturation of seed. Such seed is called non-endospermic seed, for example, gram, pea, pod.

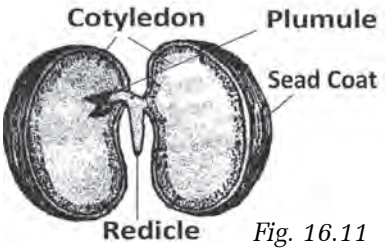


Fig. 16.11

Differences between monocotyledonous and dicotyledonous seed

Monocotyledonous seed	Dicotyledonous seed
1. It contains only one cotyledon. 2. Presence of endosperm. 3. Hilum and micropyle are not visible. 4. Embryo is small. 5. Plumule is very small. 6. Since, seed coat and fruit coat are attached to form whole grain, separate seed is absent.	1. It contains two cotyledons. 2. Absence of endosperm. 3. Hilum and micropyle are visible. 4. Embryo is large. 5. Plumule is large. 6. Seeds present separately inside pods.

Function of seed

Seed is a fertilized ovule. It is also known as passive form of embryo. The functions of seed are as follows:

a) Germination: New plant grows from seed. Root and stem of new plant arises from embryo in a seed.

b) Storage of food: Food is stored in seed. Seed uses the food present in itself while germination.

c) Protection: Seed coat protects embryo.

Dispersal of seed

Seeds need to be dispersed to grow new plant. Plant won't grow if seed is not dispersed. Seed is dispersed in different ways. They are:

a) By air b) By water

c) Fruit bursts itself forcefully d) By human and animals

1. **By air:** Some plants have small and light seed and some have a seed with cotton and plume. These types of seeds are dispersed from one place to another by air. Seeds of silk-cotton, cotton, grass etc are dispersed by air.

2. By water:

Seeds are also dispersed through water. Seeds of coconut, betel nut, lotus, etc. flow undecomposed for many days floating on water. Then they germinate and grow in a favourable condition.

3. **Fruit bursts itself forcefully:**

Some plant's fruit bursts itself forcefully and its seeds disperse in the surroundings, example; balsam, pea, sloth, sesame, etc. These dispersed seeds grow into a plant in favourable environment.

4. **By humans and animals:**

Human beings grow plants by transporting different seeds from one place to another. Some seeds contain spikes. Therefore, these seeds easily stuck on the body of humans and animals, and are transported with the humans and animals from one place to another. Where ever seed falls new plant grows after reaching favourable condition. Seeds of guava, tomato are swallowed and excreted out by humans and animals out. Similarly, birds eat fruit in one place and defecate in another place. In this way seeds are dispersed to other places.Seeds are dispersed by air, water, human, animal, birds and by fruit itself.

Thoughtful question

More types of plants are found on riverside, why?

Germination of seed

Generally, embryo is passive inside seed. If it is activated, new plant will grow from the seed. To grow a plant from seed is only possible in suitable and favourable condition. Suitable air, water and temperature are necessary to grow plant. In this way, the process of developing plant from a seed in favourable environment is called germination of seed. Sufficient amount of air, water and temperature are required for germination of seed, which can be proved by the following experiment.

Experiment 1

Take a glass or a beaker. Fasten a gram or bean seed with a thread in the lower, middle and upper part of elongated waxed wood. Put the wood with seeds in a glass and fill glass with water to the level so that only half of the middle seed gets deep inside water and half is present outside water. Leave the glass for 3/4 days where little amount of sunlight falls. Then add

little amount of water so that the level of water would not decrease. After some days, observe the actual condition of all those 3 seeds and answer the following questions:

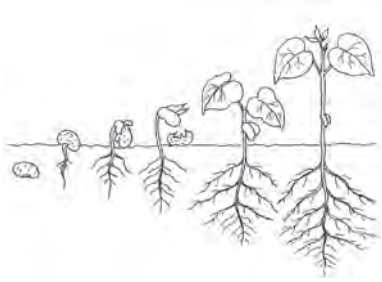


Fig. 16.12

a) Why did small sprout come to the seed submerged into water completely?

b) Why was a big sprout along with leaves seen in the middle seed?

c) None of these changes were seen in upper seed, why?

Thoughtful question

a) Plant does not grow while sowing a seed in a dry field, why?

b) Plant does not grow even if seed is sown in extreme cold place, why?

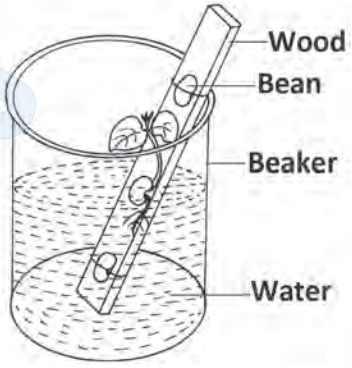


Fig. 16.13

Favourable conditions of air, water and temperature are required for germination of seed.

Life cycle of flowering plant

You might have seen different types of plants in your surroundings. Among them, some plants are flowering and some are non-flowering. Most of the flowering plants consist of flower, bud, leaf, branch, and root. Seeds are produced from these types of plants. The same seed grows into new plant. Food and fruits we use are also obtained from these flowering plants. Flower is a reproductive part of plant. Reproduction takes place in flower.

Flower:

Major four parts are present in a flower, they are: calyx, corolla, androecium and gynoecium.

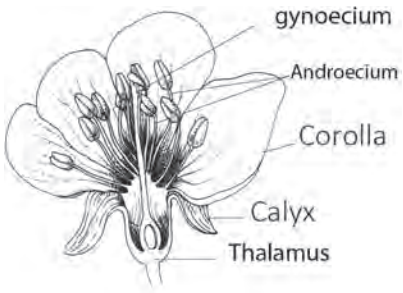


Fig. 16.14

- **Calyx:** The outermost covering of a flower is called calyx. It is formed by a group of sepals. It is generally green in colour. It protects the internal parts in budding stage.

- **Corolla:** Corolla is formed by a group of coloured petals present inside calyx. It has aromatic fluid producing glands. Flower is attractive due to corolla.

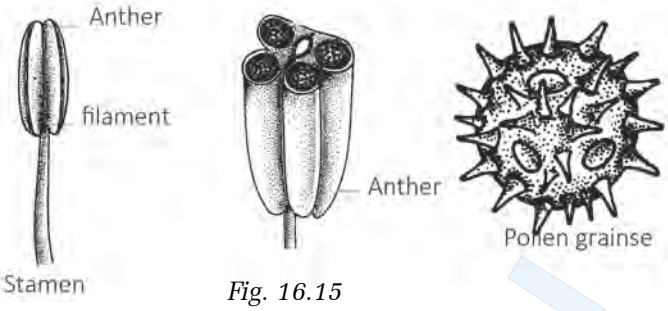


Fig. 16.15

- **Androecium:** It is a male reproductive part of a flower. It is formed by a group of stamens. The lower thin part of stamen is called filament and the upper broad part is called anther. Male gamete and pollen grains are produced in anther.
- **Gynoecium:** It is a female reproductive part of a flower. It is formed by one or more than one carpel or pistil. Ovary, style and stigma are present in each carpel. Lower bulge part is ovary, middle elongated part is style and upper bulge part is called stigma. Ovum is produced after the maturation of ovary. Ovum is a female gamete.

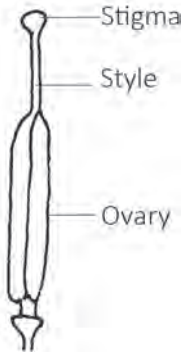


Fig. 16.16

Pollination: The process of transferring pollen grains formed in anther of male reproductive organ to the stigma of female reproductive organ is called pollination. Pollination occurs by two ways:

- Self pollination: The process of transferring pollen grains of one flower to the stigma of same flower is called self- pollination.
- Cross pollination: The process of transferring pollen grains from one flower to the stigma of different flower of same species is called cross pollination.

Fertilization

The process of fusion of male gamete and female gamete to form zygote is called fertilization. Pollen tube comes out from each pollen grain after

pollination and pollen tube makes its own way to the ovary. The tip of the pollen tube bursts in ovule and assimilated. Then male gamete available at the tip of pollen tube and female gamete present in ovule fuse to form zygote. This process is called fertilization.

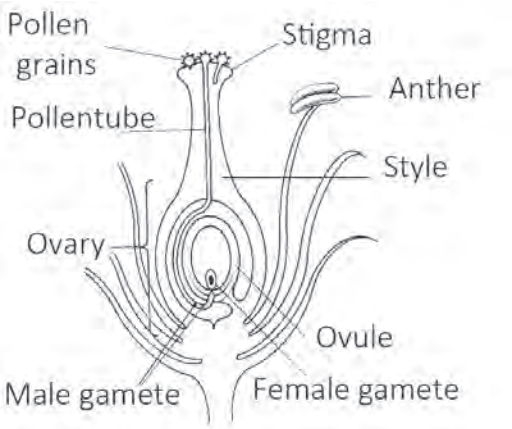
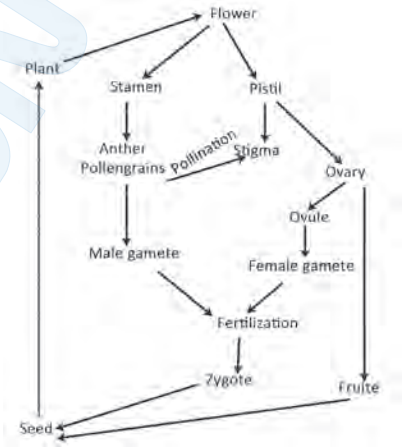


Fig. 16.17

Required changes are occurred in zygote to form embryo. And each fertilized ovum develops into seed. Embryo presented in seed is a form of future plant. This seed germinates for a plant in a suitable environment. A well developed plant possesses seeds after pollination in its flowers. Life starts from seed. A life cycle is completse in this way.



Experimental activity

1. Have a flower of a plant. Observe the structure of calyx, corolla, androecium and gynoecium of the flower and draw them.
2. Keep the seed of monocot plant and dicot plant in a suitable environment for germination. When germination starts, observe it till the green leaves appear. Note down the dissimilarities and similarities found.

Summary

1. An organism with a very simple structure, less developed and hard to see with naked eyes is called microorganism.
2. Bacteria and virus are microscopic organisms.
3. Plant acts being modified into different forms as per its root, stem, leaf, structure and functions. This is called modification.
4. The primary parts of plants such as root, stem and leaf modify mainly to store food, to protect, to form a base and to run different life processes.
5. Seed is a form of future plant.

6. Seed are monocotyledonous and dicotyledonous.
7. Air, water and temperature should be suitable for seed germination
8. Seed is dispersed by air, water, human and animals and also by itself.
9. Plant completes its life cycle through seed, plant, flower, fruit and again forming seed.
10. Flower is the reproductive part of flowering plants. Seed is formed from embryo after developing male gamete and female gamete in it.

Exercise

1. Fill in the blanks with suitable word.

a) The underground part of plant is called……..

b) Seed is ……. only in favourable environment.

c) ……. is formed in anther of flower.

d) The process of transferring of pollen grains from anther to the stigma is called……..

e) Ovary is changed into …… after fertilization.

2. What are the functions of following parts of seed.

a) Seed coat b) Micropyle c) Endosperm d) Radicle

3. Write short notes on.

a) Seed germination b) Dispersal of seed

c) Pollination d) Fertilization

4. Differentiate.

a) Radicle and Plumule b) Monocotyledonous and dicotyledonous seed

c) Hilum and micropyle d) Androecium and Gynoecium

5 Write reason.

a) New plant does not grow from a seed kept in a closed box or bottle.

b) Some of the seeds have cotton or plume.

c) Leaf is modified into thorn where water availability is low.

d) More types of plants are available in riverside and lake side.

6. Write short answer

a) For which functions does the modification of root occur? Write with examples.

b) What are the plants that store food by modifying stem. Write examples.

c) In how many ways are seeds dispersed? Write them.

d) What is the source of nutrients for germinating seed?

e) New seed does not germinate in spite of suitable environment. Why?

7. Give short introduction

a) Bacteria b) Virus c) Fungi

8. What is the modification of plant? Why are different parts of plants modified?

9. Draw a figure of seed and label its all parts.

10. Prove experimentally that plant needs sufficient supply of air, water and temperature for germination.

11. Draw the germination of seed of gram or bean.

12. List the monocot and dicot seeds in the foods that you consume daily.

13. Label the part of following structures.

Seed of bean

(a)

Seed of maize

(b)

Fig. 16.18

UNIT

17

Cell and Tissue

The body of living organism is made up of cell. Microorganisms are made up of only one cell. This type of organism is called unicellular organism. In unicellular organism, all living activities such as respiration, digestion, excretion, growth, movement and reproduction occur in one cell. In advance and multi-cellular organism, these activities are conducted by different kinds of cells. In multi-cellular organism, a group of similar type of cells does the same function and other type of group of cells performs other type of function. Depending upon the function, groups of cells form their shape and size. A group of cells having same shape and size having specific function is called tissue. Tissues are mainly of two types.

Animal tissue

Generally the following types of tissues are found in animal:

1. Epithelial tissue
2. Muscular tissue
3. Connective tissue
4. Nerve tissue

Among the above mentioned different types of tissues, the tissue which makes the outer covering of different organs of our body is epithelial tissue. We will study about the epithelial tissue in this chapter.

Epithelial tissue

The group of cell that makes outermost covering of body or its organ is called epithelial tissue. These tissues appear like bricks, tiles or stones paved on the floor. The following features are found in epithelial tissues:

a) These tissues rest on non-cellular basement membrane.
b) Epithelial cells are arranged in single layer or in multi layer.
c) They lack blood vessels.
d) They consist of special types of gland.

The main functions of epithelial tissues are as follows:

a) Covering
b) Protecting
c) Secreting
d) Excreting
e) Absorbing

On the basis of nature and thickness of cell, epithelial tissues can be divided into different types. Among them, important epithelial tissues are as follows:

a) Pavement epithelium
b) Cubical epithelium
c) Columnar epithelium
d) Glandular epithelium

1. Pavement epithelium

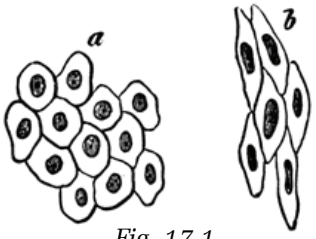


Fig. 17.1

These consist of flat plate like polygonal cells which are closely fitted like tiles paved on the floor. It consists of only single layer of cells. External layer of heart, lungs, kidneys and blood vessels are formed by these types of tissues.

Its functions are covering, protecting and filtering. Similarly, it also allows the flow of fluid and gas.

2. Cubical epithelium

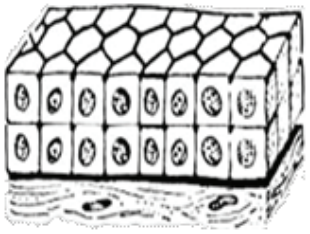


Fig. 17.2

Cubical epithelium tissue is made up of a layer of cube shaped cells. The cells in this tissue are attached to one another by their lateral surfaces. Kidney tubules, thyroid gland and tubules of excretory gland, germinal layer of uterus and opening of respiratory pipe are formed by these types of tissues. It performs functions like covering, protecting, secreting, etc.

3. Columnar epithelium

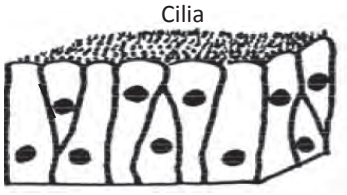


Fig. 17.3

It is made up of elongated cells locating on basement membrane. It has a layer of cell. It is found in the inner lining of ovary, larger ducts of kidney and small intestine. Both cubical and columnar epithelium is found in pharynx, larynx, stomach, etc. Their surface is covered by small hair like cilia. This cilia helps in the movement of fluid around it. These types of tissues are found in secretory organs like gall bladder and salivary gland.

Its main functions are secretion and absorption.

4. Glandular epithelium

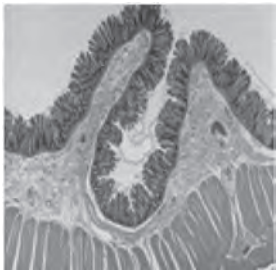


Fig. 17.4

The glands in our body are covered with secreting epithelism cells. The tissue made up of these cells is called glandular epithelium. These cells secret necessary hormones, enzymes, mucus, saliva, digestive juice, etc, requried for our body.

Activity 1

Observation of epithelial tissue

a) Scratch a piece of frog's or hen's outer surface of skin with a small stick.
b) Put the scratched material in a clean slide.
c) Put a drop of iodine and cover with a cover slip.
d) Observe it under the microscope
e) Sketch the seen materials observed under the microscope.
f) Compare this observed structure with the figure of epithelial tissue given in the above chapter.

Plant tissue

Tissues found in plants are mainly of two types:

a) Meristematic tissue
b) Permanent tissue

Meristematic tissue is constantly growing and developing tissue of plants. In this chapter, we will learn about meristematic tissue.

Meristematic tissue

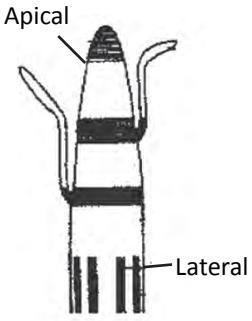


Fig. 17.5

The cells at the tip of plant are dividing rapidly. The growth of plant is due to the division of cells. The cells are closely packed with each other. Therefore, they do not have intercellular spaces. These cells have thin cell wall. Cytoplasm is dense with clear nucleus. The tissue made up of thin cell wall, clear nucleus and a cytoplasm is called meristematic tissue. These tissues can be categorized based on their location.

1. If meristematic tissue is found at the tip of root or stem, it is called apical meristem. It helps to increase the length of the root and stem.

2. If the meristematic tissue is found at the lateral side of root or stem, it is called lateral meristem. It helps to grow the thickness of root and stem.

Activity 2

Soak gram or pea for some days. Small sprout grows from it. Cut the tip of sprout with the help of blade and put it on the slide. Make it thin flat by pressing with another slide. Put a drop of safranin on it and cover with a cover-slip so tightly that no air could pass. Observe the slide under microscope. Show the observed material in diagram.

Interrelationship between cell, tissue and organs in human body

Cell

Cell is the smallest part that builds the body of living organism. The bodies of all the organisms are made up of cell. Unicellular organism completes its life processes in the same cell. In multi-cellular organisms, cells form a group to complete different biological activities. Such a group of cells is called tissue

Tissue

A group of structurally similar cells fixed together to perform specific function is called tissue, example: blood, bone, skin, etc. Different tissues specialized to perform different function are arranged in a group in human body. A group of tissues arranged in such a manner is called organ.

Organ

The arrangement of tissues which act together to perform a specific function is called organ, example: heart, lungs, liver, kidneys, eyes, nose, mouth etc. An organ is a complex structural design to perform special function. Some organs are specialized to perform single function whereas some perform more than one function, example: heart circulates blood of a body by exerting pressure, kidneys filter unnecessary fluid and remove it in the form of urine. It controls the amount of water in the body.

In human body, organs act together in a group to perform different functions. Such groups of organs together make a system.

System

The association of different organs to perform a function is called system. In human body, there are nine types of system. Various organs of a system work together in a group, for example, mouth, oesophagus, stomach, small intestine, large intestine, rectum, liver, gall bladder, pancreas work together in digestive system.

System in human body, its major organs and functions are given in the table below.

SN	System	Organs	Major function
1.	Skeletal system	bones and cartilage	To hold body upright and protect soft organs
2.	Muscular system	muscle, skin	To move out body and cover body
3.	Digestive system	stomach, intestine, liver and pancreas	To digest food and absorb it
4.	Respiratory system	nasal tube and lungs	To exchange oxygen and carbondioxide.
5.	Circulatory system	heart and blood vessel	To circulate blood
6.	Excretory system	kidneys, liver and urinary bladder	To remove unnecessary materials from body
7.	Glandular system	salivary glands, pituitary gland, thyroid gland etc.	To produce hormone and enzyme
8.	Nervous system	brain, spinal cord and neuron	To maintain coordination and communication among organs.
9.	Reproductive system	testes, ovary	To produce offspring

Experimental work

1. Visit a butcher's near your house. Observe various organs like lungs, liver, heart, kidneys, eyes and write down their functions.
2. Study activity 1 and draw a diagram of epithelial tissue.
3. Study activity 2 and draw a diagram of meristematic tissue.

Summary

1. A group of structurally similar cells is called tissue. It performs special types of functions.
2. The outermost part of animal's organ is made up of epithelial tissue.
3. Epithelial tissues are mainly of four types. They are: pavement, cubical, columnar and glandular.
4. Epithelial tissue functions as covering, protecting, secreting, absorbing and excreting.
5. The tissue present at the tip of different parts of plant is called meristematic tissue or meristem.

6. Generally, meristematic tissues are mainly categorized into two types. They are apical meristem and lateral meristem.
7. Apical meristem causes increase in length whereas lateral meristem causes increase in thickness of plant.
8. A group of different tissues associated to perform biological function in human body is called organ.
9. Some organs perform single function whereas some perform more than one function.
10. Liver is the most working organ of our body.
11. A group made up of different organs is called system.
12. There are nine types of system in human body.

Exercise

1. Fill in the blanks with suitable words.

a) The smallest part of a living body is called …….

b) The group of cells combined together is called …….

c) Organ is the group of …….. to perform special function.

d) The meristematic tissue performs ……. of plants.

e) The tissue that covers different organs of animal externally is called ……..

2. Choose the correct answer.

a) What is the tissue called that increases the growth of plants?

i) epithelial tissue ii) meristematic tissue

iii) permanent tissue iv) glandular tissue

b) What is the name of tissue that is formed by the arrangement of flat, polygonal cells as the tiles set on the floor?

i) pavement ii) cubical

iii) columnar iv) glandular

c) Which is the organ that does maximum works in human body?

i) heart ii) lungs

iii) liver iv) kidney

d) Which tissue is found in gland that produces hormone, enzyme?

i) pavement ii) cubical

iii) columnar iv) glandular

3. Give short answer:

a) What is tissue?

b) Where is epithelial tissue located?

c) What is the main function of meristematic tissue?

d) What are the types of meristematic tissue? Write them.

4. Describe the interrelationship between cell, tissue and organ of human body.

5. List the main functions of epithelial tissue.

6. Write short note.

a) Pavement epithelium

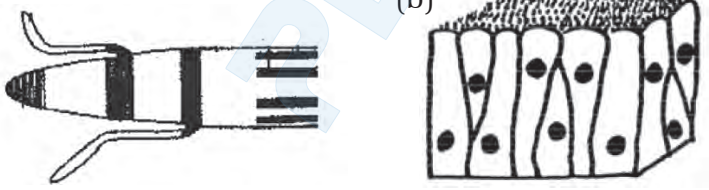
b) Columnar epithelium

c) Cubical epithelium

d) Glandular epithelium

7. Name the parts given in the figure.

(a) (b)



8. Which tissue is shown in the figure given above? Where is this tissue located? Write its one major function.

9. Write two differences between epithelial and meristematic tissue.

UNIT

18

Life Process

Living beings perform different life processes for survival. The processes like respiration, digestion, excretion, reproduction, etc. are running in living beings. These processes are called life processes.

Reproduction

Living beings have fixed life span. All organisms in this earth die. Therefore living organisms reproduce offspring of their own kind to continue their generation. In this way, the process of continuing the generation by reproducing offspring of their own kind is called reproduction. Reproduction takes place in simple unicellular organism and multi cellular organism. There are two types of reproduction in organism.

a) Asexual reproduction b) Sexual reproduction

Asexual reproduction

The reproduction without the fusion of male and female gamete is known as asexual reproduction. This process is only carried by single parent. The offspring produced from this process are similar to their parent and this process completes in short time. Generally, asexual reproduction occurs only in simple and unicellular organisms. The types of asexual reproduction are as follows:

1. Fission

The cell of unicellular organism divides into two and then two into four by simple cell division and increases the number. This type of asexual reproduction is called fission. If a cell divides into two daughter cells, this is called binary fission.

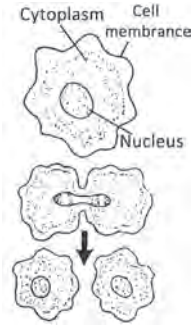


Fig. 18.1

Example: bacteria, diatom, amoeba, paramecium, etc. reproduce by this process.

If one cell divides into many daughter cells, it is known as multiple fission, example: chlamydomonas, plasmodium, etc.

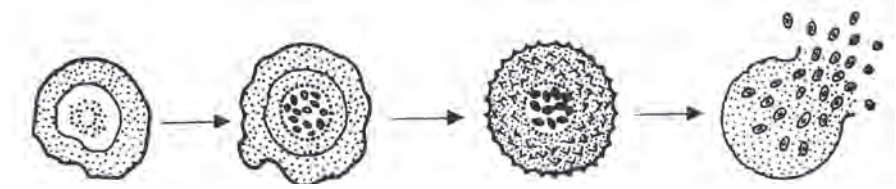


Fig. 18.2

2. Budding

Fig. 18.3

The process of formation of a bud at one side of a cell or body is called budding. Later, the bud detaches from mother cells and grows into a new organism. Example: hydra, yeast, etc.

3. Regeneration

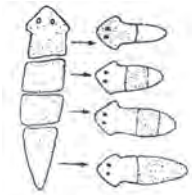


Fig. 18.4

The process of breaking of body of organism into two or more than two fragments and development of a new organism from each fragment is called regeneration, example: hydra, tapeworm, planaria, etc.

4. Fragmentation

Fig. 18.5

In this process, a living body is fragmented into two or more than two pieces and each piece is converted into new organism, example: spirogyra etc.

5. Sporulation

Fig. 18.6

In simple plants, spores are produced inside sporangia. Under favourable environment, mature spore germinates and grows into a new plant. This type of asexual reproduction is called sporulation.

6. Vegetative propagation

New plants are propagated from root, stem, leaf, etc. of an advanced plant. This process is called vegetative propagation, for example: sweet potato reproduces through root, potato, ginger, dahlia, rose by stem and begonia, bryophyllum by leaf.

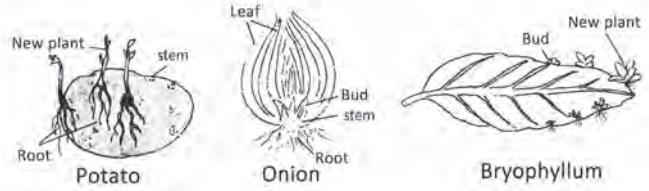


Fig. 18.7

Advantage of asexual reproduction

a) It is simple and short.

b) Only one parent is enough.

c) Genetic characteristic is preserved.

d) Offspring are identical.

Sexual reproduction

In organism, the process of reproducing offspring by the fusion of male gamete (sperm) and female gamete (ovum) is called sexual reproduction. It takes place in most of the animals and advanced plants. Male and female are generally separated. Such kind of organism is called unisexual, example: human, bird, frog, etc. Some organisms can produce both male and female gametes in their body. Such kind of organisms are called bisexual or hermaphrodite, example: hydra, earthworm etc. Some flowers of plants are unisexual and some are bisexual. Pumpkin, papaya are unisexual whereas mustard, pea, buck-wheat are bisexual.

Sexual reproduction in plants

Flower is the reproductive organ of advanced plants. The male organ of flower is called androecium. The female reproductive organ is called gynoecium. Androecium produces pollen grain whereas gynoecium produces ovum. The process of transferring pollen grain produced in androecium to the gynoecium is called pollination. After that, fusion of pollen grain and ovum occurs. This process is called fertilization. Seed is produced after the growth of zygote. Plant grows from this seed.

Sexual reproduction in animals

In sexual reproduction, fusion of male and female gamete takes place. This process is called fertilization. In animal, fertilization is of two types:

a) External fertilization

b) Internal fertilization

The process of fusion of male gamete and female gamete outside the animal body is called external fertilization and that inside the animal body is called internal fertilization. External fertilization takes place in fish, frog, etc whereas internal fertilization takes place in human, bird, insect, etc. After the fertilization of male and female gamete, zygote is formed. Zygote develops in the form of embryo which after definite time develops into a baby.

Advantages of sexual reproduction

1. Increment in the number of organism and continuation of generation.
2. New characteristics are developed in the offspring.

Human blood circulatory system

The necessary nutrients, oxygen, hormones, etc. are transported through blood to different parts of our body. Similarly, the wastes (CO_2, urea, uric acid) are also transported by the blood to excretory organs for their removal. To perform this function, there is continuous circulation of blood in the body. This process is called blood circulatory system.

Human blood circulatory system has three main parts, they are:

1) blood 2) heart 3) blood vessels

1. Blood

Blood is red, fluid connective tissue. Blood comprises two main components, plasma and blood cell.

Plasma: Plasma is light yellow coloured fluid. A blood contains 55% plasma. It consists 90% water and 10% protein, fat, minerals and carbohydrate. The function of plasma is to transport diffused nutrients from intestine to different parts of the body. Similarly, it helps to transport CO_2 released from respiration process from tissues of lungs. It also transports hormones to different tissues.

Blood cell: Blood cell is mixed with plasma. It is solid substance. Blood cell is also mainly of three types, such as red blood cell, white blood cell and platelets.

Red Blood Cell (RBC): There are more red blood cells than other blood cells in blood. They are very small in size. They lack nucleus. They consist of haemoglobin. Due to the presence of haemoglobin, blood is red. Haemoglobin absorbs oxygen from lungs. Red blood cells are formed in red bone marrow. The old red blood cells get destroyed in the liver and spleen. Its life span is approximately four months. The deficiency of red blood cells causes anaemia.

White Blood Cell (WBC): White blood cells are colourless and larger than red blood cells. They have no definite shape. They contain nucleus. They are also produced in bone marrow. White blood cells destroy disease causing germs in our body. When the number of white blood cells increases excessively in our body, leukemia or blood cancer is caused.

Platelets: Platelets are small non nucleated blood cells. They help to clot blood after an injury. They are also produced in the bone marrow. Their life span is only two to three days. Less platelets in the body lead to more blood flow after an injury and may lead to anaemia.

2. Heart

Heart is an organ made up of strongest muscle. It lies inside the chest and in between two lobes of lungs. 2/3 part of the heart lies in left part and 1/3 part lies in right part. It is covered with thin membrane called pericardium. Inside the pericardium thick transparent fluid (pericardial fluid) is present. This fluid protects the heart from external pressure. There are four chambers in the human heart, they are:

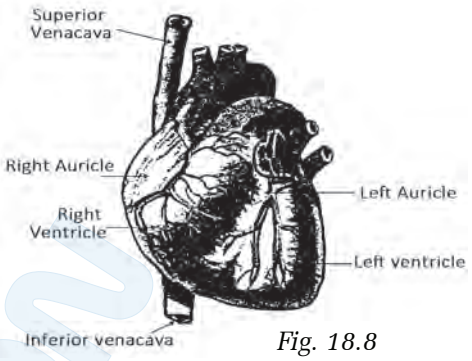


Fig. 18.8

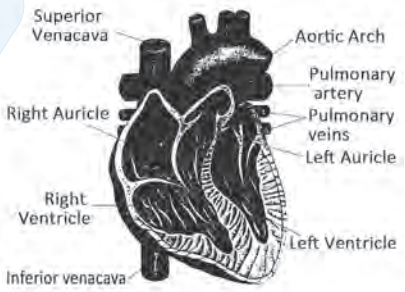


Fig. 18.9

1. Right auricle
2. Right ventricle
3. Left auricle
4. Left ventricle

Right auricle and right ventricle lie on one side as upper and lower chamber respectively and left auricle and left ventricle lie on other side as upper and lower chamber respectively. Thick muscular wall is present in between these right and left chambers. It prevents the intermixing of blood between left and right sides. These four chambers work as a single organ. The right auricle collects the deoxygenated (impure) blood from the body. The left auricle collects the oxygenated (pure) blood from the lungs. The muscle of heart contracts and relaxes in a rhythmic manner. This is known as heart beat. It enables the heart to pump blood to all parts of our body. The blood vessel which carries blood from the heart to the lungs is called pulmonary artery. The blood vessel which carries blood from lungs to heart is called pulmonary vein. Blood moves from auricle to ventricle when heart pumps blood but blood does not return back from ventricle to auricle. This is because there is presence of valve between auricles and ventricles. There are four valves in the heart, they are:

1. Tricuspid valve: between right auricle and right ventricle

2. Mitral valve (Bicuspid valve): between left auricle and left ventricle

3. Pulmonary valve: between right ventricle and pulmonary artery

4. Aortic value: between left ventricle and Aorta.

3. Blood vessels

In our body, there is presence of blood vessel to circulate blood. These blood vessels are of three types:

1. Arteries
2. Veins
3. Capillaries

1. Arteries

The blood vessels which carry blood from heart to different parts of body are called arteries. They are present in inner part of the skin. Arteries are made up of thicker muscular wall than that in veins. They are branched into many smaller branches called arterioles.

Fig. 18.10

2. Veins

The blood vessels which collect blood from different parts of the body and carry it to the heart is called vein. These are made up of thin muscle than that in arteries.

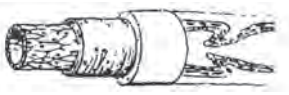


Fig. 18.11

3. Capillaries

On the top of artery, minute blood vessels are present. They help to transport blood to different tissues. Similarly there are minute blood vessels which collect the blood and carry to the vein. These blood vessels are called capillaries.

Fig. 18.12

Blood circulation

The deoxygenated (impure) blood from different parts of body through vein is collected from superior and inferior venacava to the right auricle. The valve opens and the blood moves from right auricle to right ventricle. The blood is then pumped to lungs through pulmonary artery. In lungs, the blood takes oxygen and gives carbon dioxide. Likewise, the oxygenated

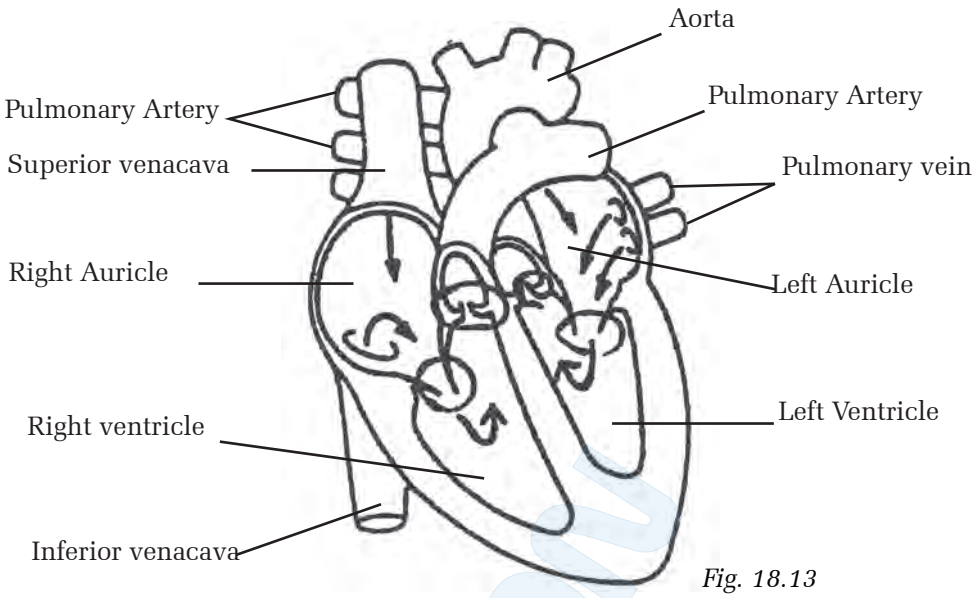


Fig. 18.13

blood reaches left auricle through pulmonary vein. The blood moves from the left auricle to the left ventricle. From the left ventricle, the blood is pumped to various part of the body through aorta. In the same way, the blood from various part of the body is collected through capillaries and move to right auricle through vein. In this way, human blood circulation process completes.

Photosynthesis

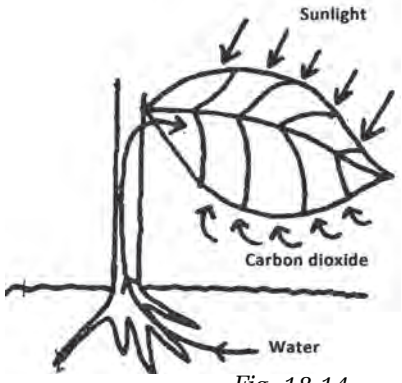


Fig. 18.14

Living organisms need food to live. But only green plants can prepare their own food. Other organisms depend upon the plants directly or indirectly for food. The green plants prepare their food taking CO_2 from air and water from soil in the presence of sunlight with the help of chlorophyll. This process of preparing food by plant is called photosynthesis. This process takes place in green leaf. The energy required for this process is taken by chlorophylls in the green leaves from the sunlight. In this process, glucose and oxygen are produced.

Carbon dioxide + water + light $\longrightarrow$ glucose + oxygen

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

For photosynthesis, the plants take water from the soil through roots and CO_2 through stomata of leaves. The glucose prepared by plant is converted into starch and deposited into cells. The oxygen produced by this process is passed out through stomata.

Requirements for photosynthesis in plant

1. **Chlorophylls:** Plants with chlorophyll can perform photosynthesis. Chlorophyll is present in the chloroplast of green plants. It utilizes the solar energy and convert it into chemical energy. Photosynthesis is not possible without chlorophyll. Therefore, chlorophyll is very important substance.

2. **Carbon dioxide:** Carbondioxide is a necessary raw material for photosynthesis. The source of carbon for a plant is CO_2 in the air. The plant takes CO_2 from atmosphere through stomata in leaves. Without, carbondioxide plants cannot survive in other carbon containing molecules.

3. **Water and minerals:** Water is another important raw material. The hydrogen in the water combines with carbondioxide to prepare carbohydrate. The plant absorbs water from the soil through root and deliver it to leaves through stem. The minerals necessary for preparation of protein substances is also taken from the soil with water.

4. **Solar energy:** The main source of energy is the sun. While preparing food by green plants, the solar energy is converted into chemical energy. The chlorophyll in the leaves of plant absorbs the solar energy and utilizes for preparing food.

Demonstration of starch present in the leaf of green plants

Activity 1

Required materials: green leaf, forcep, container (for putting hot water), 90% ethanol, iodine, plate, water, spirit lamp, dropper, beaker, etc.

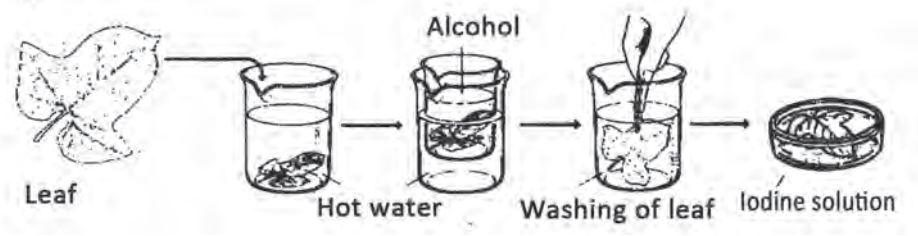


Fig. 18.15

Method:

Pluck a healthy green leaf from a plant and dip it in boiled water for 5 minutes. This makes the leaf soft. After that, dip the leaf in luke warm ethanol (90% ethanol) for sometime. Then, take out the leaf and wash it with clean water. Put iodine in a plate and soak the leaf in it. It will turn the leaf into bluish-black colour. Due to the presence of starch, the colour of leaf changes after putting iodine.

Necessity of sunlight for photosynthesis

Activity 2

Required materials: potted plant, black paper, forcep, container to keep hot water, beakers, 90% ethanol, iodine, plate, water, spirit lamp, dropper, etc.

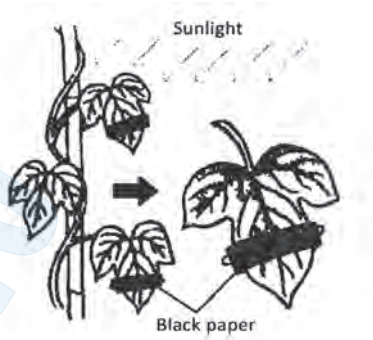


Fig. 18.16

Method:

Put a potted plant in a dark room for two days. Pluck a leaf from that plant and perform starch test as in activity 1. Observe the colour of leaf. Did you find difference in the colour of leaf?

In the above potted plant, paste black paper (as in figure) in the middle of a leaf and keep the potted plant in the sun for some hours. Then, pluck that leaf and remove the black paper and perform starch test. Observe carefully which parts of leaf has changed its colour. Starch is not seen in covered part but is seen in rest parts. It proves that green leaves prepare starch only in the presence of light.

Necessity of carbondioxide for photosynthesis

Activity 3

Required materials: potted plant, polythene bag, small rope, caustic potash (potassium hydroxide) and materials for performing starch test as in activity

Method:

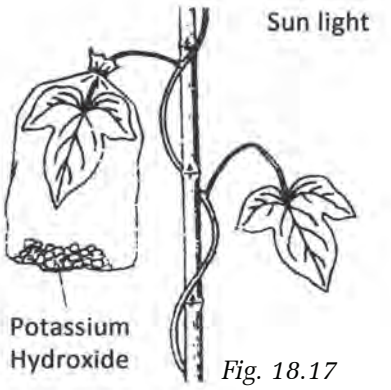


Fig. 18.17

Keep the potted plant in a dark room for two days. In a polythene bag, keep a few potassium hydroxide and insert a leaf in the bag (as shown in figure) and tie the bag to

the leaf with thread.. Now, keep it in sun for some hours. After some hours, pluck the leaf covered by bag and another leaf not covered by bag and then perform starch test. Which leaf has starch and why, write conclusion with reason. Find out why potassium hydroxide is kept inside the bag?

Oxygen is produced in photosynthesis

Activity 4

Required materials: beaker, test tube, glass, funnel, aquatic plant (hydrilla), water, stand, etc.

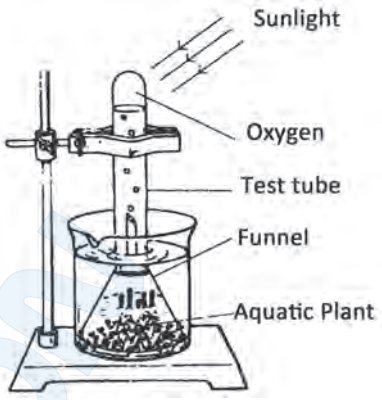


Fig. 18.18

Method:

Put some fresh hydrilla or aquatic plant in a large beaker or glass container filled with water. Cover the plant by keeping a funnel in inverted position as shown in figure. Fill a tes tube with water and invert it over the top of funnel. While keeping the test tube, air should not enter inside the test tube. Put these materials in sunlight for sometime. After sometime, bubbles of gas emerge and are collected in test tube. The level of water in the test tube falls down.

Test for gas

At first, burn a match stick. When you take the matchstick near to the test tube filled with gas, it will burn more brightly. From this, we can know that the gas is oxygen.

Experimental activity

a) Touch your wrist slowly. Can you feel its pulse? What is the rate of pulse per minute? Count. Run for a while and then count the pulse and find the rate per minute. What differences did you get and why? Discuss.

b) Wake up early in the morning and pluck a leaf of a plant. Similarly, in the evening at 2-3 pm pluck another leaf from that plant. Now, perform starch test for both the leaf. What differences did you get?

c) Keep a potted plant in sun light and another in a dark place. After two week, see which plant grows fast. What is the reason behind it? Write with conclusion.

Summary

1. The process of reproducing offspring of own kind to continue their generation is called reproduction.
2. The two types of reproduction are asexual and sexual reproduction.
3. In asexual reproduction male and female gamete are not necessary. It takes place by fission, budding, regeneration, fragmentation, sporulation and vegetative propagation.
4. The reproduction that takes place by the fertilization of male and female gamete is called sexual reproduction.
5. The blood circulatory system consists of blood, heart and blood vessels.
6. Blood consists of plasma, red blood cell, white blood cell and platelets.
7. Nucleus is absent in red blood cell. The haemoglobin of blood carries oxygen.
8. Nucleus is present in white blood cell. It destroys disease causing germs.
9. Platelets help in clotting of blood during wound.
10. Heart consists of four chambers. They are right auricle, right ventricle,left auricle and left ventricle.
11. The blood vessel that carries oxygenated blood to various parts of our body is artery.
12. The blood vessel that carries impure blood from various parts of body to the heart is called vein. Capillary connect arterioles and venules in the form of network.
13. The process by which plants with chlorophyll prepare their own food from carbondioxide and water in the presence of sunlight is called photosynthesis.
14. Photosynthesis produces, glucose and oxygen. The glucose formed by this process converts into starch and gets stored in a cell.

Exercise

1. Fill in the blanks with suitable words.

a) The process of giving continuation to generation is called……

b) The process of producing new individual from plant's root, stem or leaf is called …….

c) Blood is red fluid …… tissue.

d) Our heart consists of ……. chambers.

e) The blood vessel that carries blood from heart to various parts of body is called …….

f) The process of preparing food by plants is called …….

2. Choose the correct answer from the given answers.

a) What is the process in which body of living organism breaks and develops into a new individual called?

i) fission ii) budding

iii) regeneration iv) sporulation

b) Which disease is caused in the deficiency of red blood cells?

i) marasmus ii) kwashiorkar

iii) blood cancer iv) anaemia

c) Which blood cell helps to clot blood at wound?

i) red blood cell ii) white blood cell

iii) platelets iv) all of the above

d) Which is the blood vessel that carries pure blood?

i) artery ii) vein

iii) venacava iv) capillaries

e) Which gas evolves during photosynthesis?

i) carbondioxide ii) oxygen

iii) nitrogen iv) inert gas

3. Write the difference between.

a) Sexual and asexual reproduction

b) Unisexual and Bisexual organism

c) Binary fission and multiple fission

d) External fertilization and internal fertilization

e) Red blood cell and white blood cell

f) Artery and vein

4. Write in short.

a) Fission	b) Budding	c) Regneration
d) Sporulation	e) Artery	f) Vein
g) Capillary	h) Photosynthesis	

5. Give short answer.

a) What is vegetative propagation? Write with examples.

b) What are the features of asexual reproduction?

c) What are the advantages of sexual reproduction?

d) Where is haemoglobin located? Write down its function?

e) What are the materials required for photosynthesis? Make a list.

6. Describe the structure of human heart with a diagram.

7. How does blood circulation take place in human body ? Write.

8. Describe an experiment with a diagram to show the necessity of sunlight for photosynthesis.

9. Describe an experiment, which shows the role of carbondioxide in photosynthesis, with a diagram.

10. Describe an experiment along with a diagram to show that oxygen is evolved during photosynthesis.

11. What do you mean by starch test? How can it be performed? Explain.

Unit

19

Structure of the Earth

The Earth is made up of rock, sand, soil, etc. The rocks are found in earth crust. They are of different kinds. The color, structure and density of different rocks can be different. Rocks are made up of different types of minerals. Soil is made up of minerals and humus.

Minerals

The naturally avilable solid matters found in earth crust are called minerals. They have similar physical and chemical properties. Mostly, minerals are found in the form of compound. Sometimes, they are found in the form of element. Hematite, chalcopyrite, etc. are minerals found as compound whereas gold, sulphur and diamond are minerals found as element.

1. Metallic minerals

Metal containing minerals from which metals can be obtained are called metallic minerals. These minerals are compounds of metals. So, we can obtain metals from metallic minerals. The useful metallic minerals are called ores. We can obtain metals from these ores. For example, hematite is iron ore and chalcopyrite is copper ore.

2. Non-metallic minerals

The minerals from which metals cannot be obtained are called non-metallic minerals. These minerals are used to make cement, chemical fertilizers, etc. Although metals like sodium, potassium, calcium, etc. are found in some minerals metals cannot be extracted from minerals so as to use them. Non-metallic minerals are used to prepare chemicals, homes, road, bridge, etc. These are also used as gems in jewelry to make sculpture and as fuel.

Characteristics of minerals

Minerals have their own characteristics. Minerals can be identified by the study of their characteristics.

1. Minerals have their own color. Hematite is reddish brown and chalco pyrite is golden green.
2. Minerals have their own lusture. Commonly, metallic minerals have lusture.

3. Minerals are hard.
4. Minerals are crystalline.

Uses of minerals

1. Metals can be extracted from minerals.
2. Different chemical substances can be prepared from minerals.
3. Decorating materials can be prepared by using minerals.
4. Minerals are used to construct road, bridge, buildings, etc.
5. Minerals are used as fuel in vehicles and other machines.

Some important minerals found in Nepal

Mineral is one of the major material for industrial development. It is important for the development of a country. The establishment and development of iron, steel, cement and metal based industries depends on availability and use of minerals. Some minerals found in Nepal are given below:

Iron

In Nepal, iron had been used to make domestic utensils and weapons for long time. The iron was extracted from mines using traditional method in Ramechhap and Rolpa district. Hematite and magnetite are the main ores of iron found in Nepal. Iron is found at Ramechhap, Fulchoki (Lalitpur), Labdi (Tanahun) and Gikhabang (Chitwan).

Copper

Copper is the metal which traditionally was extracted in Nepal. The main ore of copper is chalcopyrite. Copper mines were the main income generating source of villagers of hilly region in the past. Copper was used to make domestic utensils, temple, etc. Copper is found in Makawanpur , Dhading, Solukhumbu, Udayapur, Tanahun, Baglung, Bhojpur and Dadeldhura. The copper is used to make electric wire, domestic utensils, temple, sculpture, medals, etc.

Lead

Lead mine has been found in Ganesh Himal, Fulchoki of Lalitpur, Khairabang of Makawanpur and Solukhumbu. The main ore of lead is Galena. It had been used by Himalayan people from the past.

Zinc

Zinc was not used in ancient time. But it is an important metal today. Zinc

mines are found in Ganesh Himal, Fulchoki, Makawanpur, Sankhuwasabha etc. It is used for electroplating iron and to making alloys like bronze.

Limestone:

Limestone is a mineral which has been used for many years. In Nepal, the cement and lime industries are main industries based on minerals. The mines of limestone are found in different parts of Nepal. The mines of limestone are mainly found in Udayapur, Chobhar, Surkhet, Arghakhanchi, Dhading, Kavre, Dang, Sindhuli, etc.

Graphite:

The mines of graphite are found in different parts of Nepal. Current survey has shown that graphite is found in Ilam, Dhankuta, Sindhupalchok and Sankhuwasabha. Its main use is to make pencil, colour and lubricants.

Soil

Most of the Earth's surface is covered by soil. Soil is the habitat for animals and plants. Plants get required minerals from soil to prepare food. Insects, reptiles, bacteria, fungi, etc. complete their life cycle in soil. Therefore, soil provides appropriate environment for living beings in the Earth. Soil is a mixture which is made up of small pieces of rocks, sand, minerals, living organism and fossil of dead bodies.

Process of formation of soil

1. Rivers, rivulets, glaciers, etc. carry large sized rocks along with their flow. These rocks collide with each other during flow of water and break down. This process continues for a long time. Small particles, dust, gravel, sand, etc. are formed. As a result soil is formed. This is the process of soil formation.
2. Rocks become hot during day and cold during night. By the process of heating and cooling the rocks break down into small particles. The soil is formed from these small particles of broken rocks.
3. River water passes into the pores of rocks. Similarly, rain water also passes through them. The water helps to break down the rocks into small pieces. By this process the soil is formed.
4. Some plants grow through the fractures of rocks. These plants gently weaken the rocks. As a result, the rocks start to break down. In this way soil is formed by breaking the rocks.
5. The surface of rock erodes when air flows with high speed. Then the sand like particles eroded from rock are converted into soil.

Structure of soil

Soil is made up of broken rocks and organic matters. Generally, it contains small particles of rocks and minerals. It also contains water, air and organic matters. Different types of soil have different composition. There are different layers in the structure of soil. More organic substances are found in the top layer. Middle layer contains some organic matter, insects, roots of plants and others. Minerals, iron, aluminum, etc. are found in the third layer. Main rocky matter is found in the last layer from the top. Thus, soil is formed from decayed plants and other biological substances, air, water and rocks, etc.

Activity 1 :

Take a clean glass bottle. Fill it halfly with water. Bring a pinch of soil and put it into water. Shake the bottle gently for a short time. Put the bottle in plain surface and don't shake it. Observe the bottle after sometime. What did you see?

Fig. 19.1

The soil in the bottle is separated into different layers. Heavy rocks settle down in the bottle. Small pieces remain above the heavy rocks. In this way we are clear from the experiment that soil is formed from different substances.

Soil profile

A photograph taken to expose the types of soil from outer surface to inner part of the land in a particular place is called the profile of soil in that particular place. Generally, upper part of soil contains small particles, organic matter, rotten animals and plants, remains of plant and animal bodies. Hard, large and compact rocks are found in inner layer of land. The profile of soil varies from place to place.

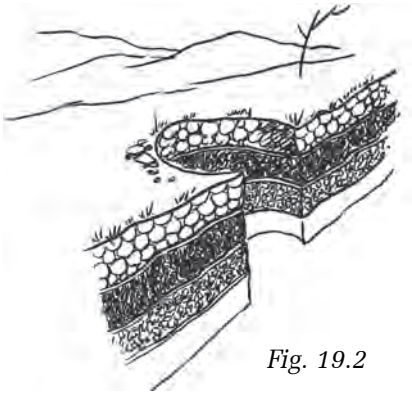


Fig. 19.2

Soil erosion and deposition

Have you seen landslide? What happens there? You might have seen cracked land at river banks. You have seen soil carried by water in rivers. Sliding of land, damaging of soil, cracking of land by the action of water, air, etc. is called erosion. Similarly, the eroded soil is delivered to another place by rivers and streams and deposited in the place. This process of eroding and depositing of soil is called deposition. Erosion and deposition process

occur side by side or together. Erosion is caused by high speed of rain, air, river water and water wave in ocean, etc.

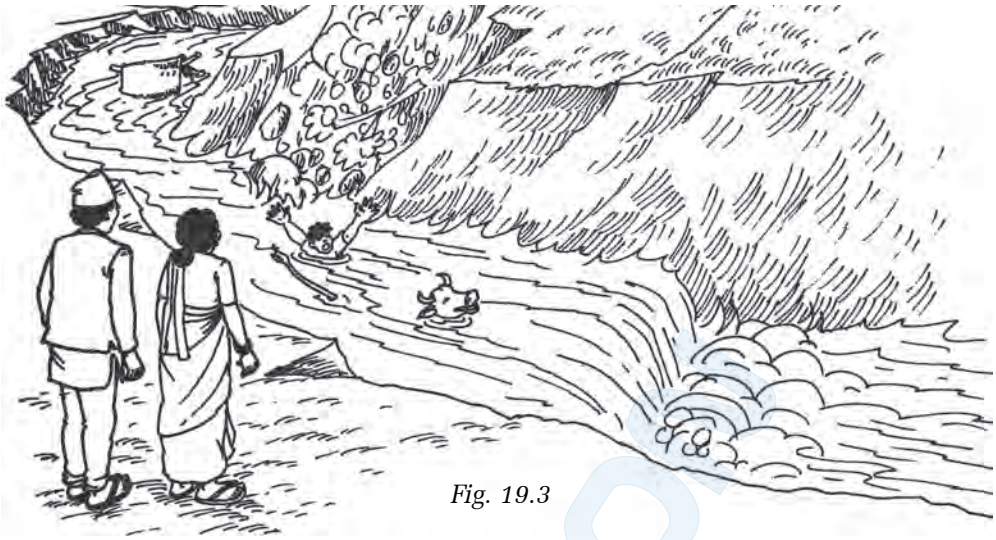


Fig. 19.3

Moving air and storm transport soil, sand from one place to another place. These substances are also carried with the flow of water from one place to another place. This type of events occur on the surface of barren land, naked land and rocks. Likewise, fast moving river water erodes the river banks and carries sand and soil to other places. Then the soil and sand are deposited on plain area. Rivers have made plains at turnings. Similarly, high springs also cut and erode the land. They carry the eroded materials. Rivers carry soil, sand, plant and dead bodies of animals to sea during flooding.

Rainwater also erodes soft rocky soil. The eroded soil is carried to other places mainly to ocean with flood. The river water is muddy and sandy during rainy season because it causes erosion and carries eroded soil. Rain water weakens the sloppy land which causes landslide. Plain land is formed by the deposition of sand, soil and other materials.

Sea water also cuts the soil at seashore which is carried to other places of the sea. Oceanic storm or wave erodes the rocks of seashore and nearby places. The eroded materials are carried to other place along with the flow of water and deposited in other places. In this way air and water (rain, river, sea, etc.) cause erosion and deposition.

Conservation of soil

Soil is the main natural resource. It is necessary to conserve soil. A huge amount of soil is being lost year by year due to rain water from Nepal

because we have sloppy land in mountain regions. Similarly, unscientific cultivation and deforestation are causing the loss of thousands of tons of soil by the action of water. Therefore, we can apply the following measures to conserve soil:

1. Deforestation should be controlled.
2. Trees should be planted in barren land and naked area.
3. Fruits and grass plants should be planted on sloppy hills.
4. Terrace farming should be adopted in hilly region as far as possible.
5. Bamboo and other plants having strong root system should be planted along the river banks.
6. Overgrazing should be controlled in sloppy area.
7. Blasting in mountains should be banned while constructing roads, industries, buildings and factories,etc.
8. Retaining walls should be constructed along the river banks.

Project work

1. Visit the bank of a river or rock exposed area with your teacher as field trip. Observe sand, rocks etc. Then, find out how minerals are mixed to them. Collect some rocks bring them to school and study.
2. How has been erosion taken place in hills and riverbanks nearby your habitat? Study and prepare a short report.

Experimental work

Study activity 1 carefully and find out the structure of soil nearby your habitat. Carrying out the experiment as given in the activity.

Summary

1. The mineral from which metal can be extracted is called metallic mineral. The minerals which do not contain metals are called non-metallic minerals.
2. Mineral has color, lusture and hardness. It contains crystalline particles.
3. The main minerals found in Nepal are Iron, Zinc, Copper, Lead, Limestone, Granite, etc.
4. Soil is made up of minerals, rocks, sand, living beings and fossils of dead bodies.
5. The damaging of land by landslide, flood, etc. is called erosion. The leaving and piling of soil, sand, etc. on different place is called deposition.

6. We can conserve soil by afforestation, terrace farming, preparing dam at river banks, and planting trees, fruits and grass.

Exercise

1. Fill in the blanks with suitable words.

a) The particles of minerals are of ……..shape.

b) The main ore of iron is ……

c) The industries based on lime stone are ..... and lime.

d) Erosion and ……happens side by side (together).

2. Write short answer

a) What are main minerals found in Nepal.

b) Write the uses of minerals.

c) How is soil formed? Write your answer.

d) What is soil erosion?

e) What do you mean by deposition?

3. Write differences between metallic and nonmetallic minerals.

4. What are the components of soil? Explain soil profile with neat figure.

5. Where are the minerals found in Nepal? Show the purpose of these minerals in a chart.

Unit

20

Weather and Climate

How is the climate in your location? Is rainfall high or low there? In fact, climate includes temperature and state of rainfall. The climate differs from place to place. The climate between our country and Arabian countries is different. There is difference in the climate in different places within our country too. For example, the climate of Himalaya, Hill and Terai is not the same. Some places are hot and other places are cold. In some places more rainfall occurs whereas rainfall is very low in other places.

The micro form of climate is weather. Weather changes continuously. Different places may have different weather. Out of two different places, one may have rainfall whereas the other may have sunny environment at the same time. Some places may be moist and others may be dry. Weather of a place also differs from time to time. Sometimes a place may be hot and sometimes it may be cold on the same day. In the same place we feel hot for some days while we feel cold for some other days.

The atmospheric condition at a place in certain period of time is called weather. The average condition of weather of a particular place is called climate.

Generally, the world's climate can be divided into three types: tropical, temperate and tundra or cold. Each of them has different sub divisions of each of them. Climate directly affects life of plants, animals and human beings.

Factors affecting climate

The climate is affected by different factors. Distance from equator, height, slope, distance from sea, oceanic current, forest, rivers, lakes, local wind and human activities etc. affect climate. Three factors among them are described below:

a) Distance from equator

An imaginary circular line which divides the earth into northern half and southern half is called equator. Since the earth is spherical, the sunlight

falls straightly to the equator throughout the year. Therefore, this area is very hot. As we go away from equator towards north or south, the sunlight does not fall straight. The inclined light rays should pass through thick layer of atmosphere. So, they loose heat resulting low temperature. Therefore as we go far from the equator, the coldness gradually increases. The polar region is covered by snow and ice throughout the year due to extreme coldness.

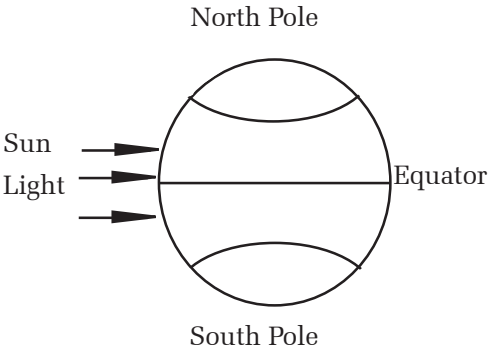


Fig. 20.1

b) Altitude and slope

As the altitude of land increases, the temperature decreases. It is due to atmospheric pressure and greenhouse effect. Similarly, with the decrease of altitude the temperature increases. In the altitude of every 160-165 meter from the sea level, the temperature decreases by 1^0. Altitude is the main cause of being hot at Terai region and cold in Himalayan of Nepal. We see more rain falls on the slope of mountain facing opposite to the monsoon but less rain falls on the slope of mountain that doesn't face the monsoon. Since Nepal lies to the north from equator the southern slope is hot. Comparatively northern slope is cold because it rarely faces the sun light.

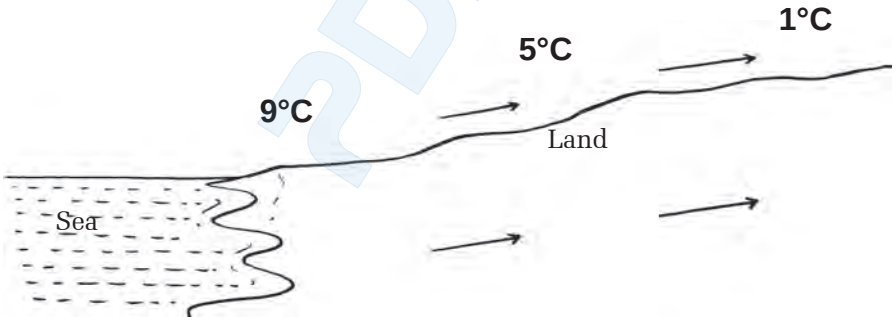


Fig. 20.2

c) Distance from Sea

Water heats us and cools slowly while land heats up and cools fast. When land cools, the sea remains hot. Likewise, when the land heats up, the sea remains cold. The places nearby sea is neither cold nor hot because hot air flows from sea to the land during cold season and cold air flows from

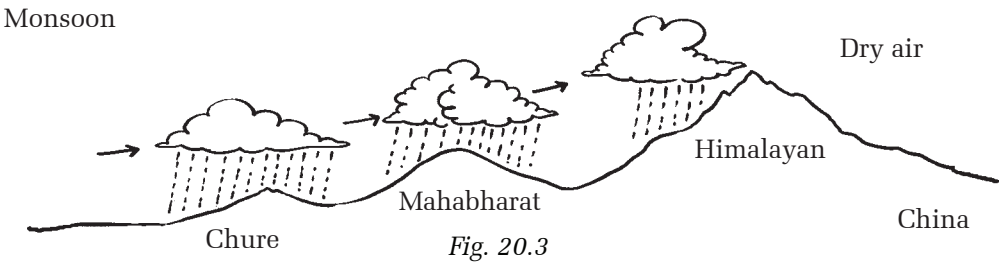


Fig. 20.3

sea to the land during hot season. There is moderate and suitable climate. Rain falls frequently nearby the sea because moist air flows in this region.

Climate of Nepal

Nepal lies approximately from 26 degree to 30 degree northern latitude. It lies in tropical zone since the tropical zone expands 30 degree north and 30 degree south from the equator. Even though Nepal lies in tropical zone the climate varies from place to place due to altitude.

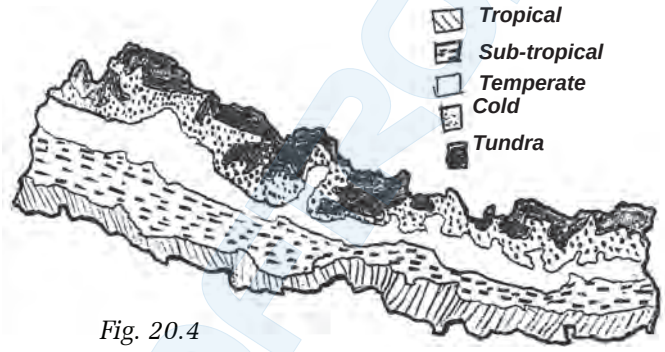


Fig. 20.4

There is tropical climate in Terai region where the altitude varies from 60m to 1200m from sea level. The temperature reaches above 40^0C in summer season and falls below 6°C in winter. The Cold current flows during December and January. Rest of the time is hot or warm in the terai. Evergreen dense forest is found in this region due to tropical climate and fertile land.

Warm climate is found in valleys and lowlands ranging the altitude 1200 m to 2100 m from sea level. The temperature reaches 30^0 C in summer and falls to freezing point in winter. Deciduous forest is found in this region.

Temperate climate is found in mid hills ranging the altitude 2100m to 3300 m from sea level. In summer the temperature reaches 20°C and it falls below 0°C during winter. Coniferous plants are found in this region.

Cold climate is found in the Mountain region having altitude from 3300m to 5000m from sea level. The temperature reaches up to 15 ^{0}C in summer and falls below 0°C during winter in this region.

Snow falls throughout the year in Himalayas above 5000 meter from sea level. The temperature remains below 0 ^{0}C throughout the year. No plants grow in this area. This type of climate is called Tundra Climate.

In Nepal, enough rain falls during summer season due to monsoon. The winter is dry but some rain falls by the action of western wind coming from equatorial sea. This moist air comes from west. Therefore more rainfall is more in the western region than in the eastern region during winter.

Thar desert and Arabian desert lie west to Nepal. Western part of Nepal is hotter than eastern part due to hot air coming from these deserts. Himalayan range highly affects the climate of Nepal. Permanent rivers have been originated and protected our country from dryness due to heavy rain fall in Nepal. The Himalayan range blocks the cold air coming from poles during winter season. It gives cold air during summer season.

Monsoon

When monsoon comes the rainfall starts. The mid monsoon period is June to August. In this period heavy rainfall occurs. Pre-monsoon starts from April. Little rainfall is noticed during post monsoon. In this way, the monsoon is not rain but it is the moist periodic or seasonal wind that causes rain.

During winter season, the sea remains hot whereas the land becomes cold. Therefore the air pressure above sea level is low and the air pressure above land is high. The air flows from land to sea in winter. This wind is dry since it flows from land. Hence, it does not cause rainfall. This is called winter monsoon.

Sea becomes cold and land becomes hot during summer season. The air pressure is high above sea and low above land. The air flows to land from sea. It contains water vapor and hence causes rainfall. This is called summer monsoon.

Monsoon flows towards the sea for six months and towards the land for the rest months. Therefore, it is called periodic wind. Monsoon climate is found in south-east Asia, China, Korea, etc. The monsoon is dry during winter and it is moist during summer season. It is the feature of monsoon.

Monsoon comes from the bay of Bangal which lies in south-east direction from Nepal. More rain-fall is noticed in eastern region due to this monsoon. Comparatively rain fall is low in western part of Nepal during summer. The average annual rainfall in mid hills is 150-250 mm. This area is opposite to the monsoon.

Pokhara valley is the rainiest place in Nepal because its south east part is

open and Himalayan range lies in northern part. Manang is the rain shadow of Nepal where least rainfall occurs.

Effects of monsoon

The rain water is the main source of irrigation in monsoon based countries like Nepal. Rain water is very important for agriculture. It is used for irrigation which increases agricultural production. It helps to increase the level of underground water and hence supplies drinking water for us. Springs of water originates. The water flow in rivers increases due to monsoon and hydroelectricity production increases accordingly. It makes feeling of coldness during mid-summer.

Heavy rainfall due to monsoon causes flood, landslide, soil erosion, sinking of plain area etc. It has caused heavy loss of life and property every year.

The effects can be minimized by constructing retaining wall, afforestation, conservation of forest and other vegetation.

Project work

How are plants affected by the diversity of climate? Study the effects of climate on plants nearby your habitat and prepare a report.

Summary

1. The average state of atmospheric condition in a year is called climate.
2. The main factors affecting climate are distance from equator, altitude, slope and distance from sea.
3. Nepal lies in tropical monsoon climatic zone. But the tropical, temperate, cold and tundra climates are found in Nepal due to the variation of altitude.
4. Monsoon is a periodic wind which flows from land to sea in winter and from sea to land in summer. Rainfall is caused by the monsoon which flows from sea to land.
5. Monsoon comes from Bay of Bangal in Nepal, i.e., south-east part of Nepal.
6. The problems like flood, landslide, soil erosion, etc. are caused by heavy monsoon rainfall.

Exercise

1. Fill in the blanks, with suitable words.

a) The annual average state of weather is called …….

b) The sunlight in equatorial region falls ……. throughout the year.

c) For every ……. to ……. meter altitude from the sea level, temperature decreases by 1°C.

d) ……. slope is sunny in the context of Nepal.

e) Monsoon comes to Nepal from …….

2. Select right answer from the giver answers.

a) Which of the following statement is true?

i) Weather and climate are the same.

ii) Climate is determined by weather.

iii) Climate determines weather.

iv) Weather and climate do not have relationship.

b) What does equator do?

i) divides the earth into eastern and western hemisphere

ii) gives time

iii) divides the earth into northern and southern hemisphere

iv) causes rainfall

c) Which of the following wind is called monsoon?

i) local wind ii) mountain wind

iii) wind which causes flood and landslide

iv) Periodic wind that goes to sea from land and to land from sea

d) How much rainfall occurs in the slope opposite to monsoon?

i) low rainfall occurs ii)high rainfall occurs

iii) equal rainfall occurs iv)no rainfall occurs

e) Which part of Nepal has highest rainfall?

i) Illam ii) Gorkha

iii) Pokhara iv) Manang

3. Give short answers to following questions.

a) Define climate.

b) What is the efffect on climate due to the distance from sea?

c) What is the cause of being cold in polar region?

d) Which factor affect the climate of Nepal?

e) What type of climate is found in hilly region of Nepal?

4. Give reasons.

a) Winter crops grow well in western part of Nepal.

b) Paddy production is good in Jhapa.

c) Low rain fall is noticed in Manang.

d) Flood and landslide disaster is high in eastern hilly regions.

5. Give long answer.

a) Explain the factors that affect the climate.

b) How is monsoon originated? Write down its effects.

Unit

21

Earth and space

Human beings have had some queries since their origin. Their queries are: how was the earth formed? How were the bodies like sun, star, moon and planet formed? How many such bodies are there? How long will they survive? Likewise, people have been thinking about when and how the earth was originated? How were beautiful mountains, lakes, rivers, hills, sea, plain etc. formed on the surface of the earth? There is no common opinion about the origin of the earth.

Some hypotheses about the origin of the earth

Universal principle has not been found about the origin of the earth. Scientists have presented their own opinions. Some hypotheses are described below:

1. **Plantesimial hypothesis**

   This theory was propounded by French scientist George Buffon in 1749 A.D. as the first theory. According to this theory a revolving star in the universe collided with the Sun. The broken parts of the sun became planets and moons including the earth.

2. **Nebular hypothesis**

   Nebular hypothesis was put forward by German philosopher Kant in 1755 A.D. Laplace modified the hypothesis in 1796 A.D. According to this hypothesis there was a vaporous mass revolving in the universe before 45 million years ago. During the period of revolving, it got cooled and contracted. Because of the contraction small masses were ejected from the large revolving body. These small objects started to revolve round the larger object. In this way the large object became the Sun and small objects became planets.

3. **Tidal hypothesis**

   This theory was propounded by Jeans and Jeffrey in 1917 A.D. According to this theory, a large star reached nearby the Sun. A tide was originated on the Sun due to the attraction of this star. That tidal matter cooled and broken into small pieces which became planets and satellites. In this way, the Earth was also originated.

4. Solar system from Milky Way

According to this theory, the dust particles in Milky Way galaxy attracted with each other and combined together. A large object was formed which is called the sun. Afterwards, small objects like planets, satellites were also formed similarly.

Causes of origin of living beings in the earth

It is estimated that the earth was originated before 4.5 Arab (4.5 billion) years ago. There was no suitable environment for living beings at the time of origin of the earth. Because of different movements and changes; suitable environment for living beings was created in the earth. The main causes of origin of organism in the earth are as follows:

1. Availability of air (O_2, N_2, CO_2 etc.) necessary for organisms,
2. Availability of water in suitable amount for organisms,
3. Availability of suitable temperature etc.

The change of position of the earth and the sun

The earth takes 24 hours to rotate about its own axis and 365 days to revolve around the sun. An imaginary line passing through earth's center which joins North Pole and South Pole is called axis. The path through which the Earth revolves around the sun is called orbit. The axis of the earth inclines at an angle of 66.5 degree on orbital plane. It is not perpendicular to the orbital plane. Therefore the axis of the earth revolves round the sun making an angle of 66.5^0. The following effects are seen in the earth due to the inclination of axis at 66.5^0.

1. The length of day and night is not equal at all the time and places except at equator. Sometimes, day is longer and night is shorter whereas sometimes day is shorter and night is longer.
2. Season keeps on changing in the earth.
3. The sunlight does not fall straight all the time at a place. It greatly affects climatic condition.
4. The sun does not rise exactly in the east and does not set exactly in the west.
5. The height of the sun at noon differs day by day.

Season change

The revolution of Earth around the sun completes in 365 days. The earth revolves in an elliptical path. Sometimes the earth lies near the sun and

sometimes it goes farther from the sun during revolution. The different parts of the earth are heated differently. Hence, change in season occurs. Four seasons appear in every year. These seasons are:

i. Summer ii. Autumn

iii. Winter iv. Spring

The sunlight falls perpendicularly on tropic of Cancer on June 21 (approximately Asadh 8). Most of the parts in northern hemisphere face towards sun at that time. Therefore the day is long and night is short in northern hemisphere. The northern hemisphere is hot and southern hemisphere is cold in this period. That's why summer season occurs in northern hemisphere and winter season occurs in southern hemisphere.

The sunlight falls perpendicularly on equator on September 23 (approximately Asoj 7). The length of day and night is equal in all parts of the earth at this time. The climate is neither hot nor cold but moderate at all places. In this time the autumn season occurs in northern hemisphere and spring season occurs in southern hemisphere.

The sunlight falls straight on tropic of Capricorn on December 22 (approximately Poush 7). The day is short and night is long in northern hemisphere at this time. Likewise, day is long and night is short in southern hemisphere. The summer season occurs in southern hemisphere and winter season occurs in northern hemisphere at that time.

Again the sunlight falls straight on equator on March 21 (approximately Chaitra 8). The length of day and night becomes equal all over the world. The climate is neither hot nor cold in both the hemispheres. In northern hemisphere spring season occurs and in southern hemisphere autumn season occurs.

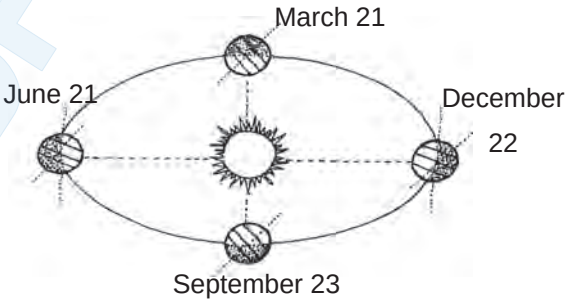


Fig. 21.1

This cycle runs continuously in the earth year by year.

Phases of the moon

You might have seen the variation in the size of moon in the sky at night. Sometimes the shape of moon looks like sphere, sometimes half sphere and sometimes other shapes. Why does this happen? Do you know?

Planets and satellites do not have their own light. They reflect sunlight and become bright. The moon also does not have its own light. It reflects sunlight to the earth and gets bright. The part of the moon which faces towards the sun determines the shape of the moon. Light reflecting area is visible from the earth and remaining part is invisible.

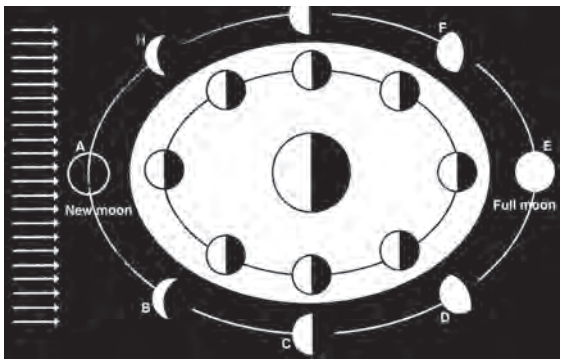


Fig. 21.2

On full moon day at the time of sunset in the west full moon is seen in the east. Moon takes 27 days to revolve around the earth. While the moon is revolving around the earth, at the same time the earth is also revolving around the sun. Therefore the moon takes 29.5 days to return back to the same position after completing one revolution. Therefore, every day the moon rises 50 minutes later. In this situation, 50 minutes delay in each day makes the sun and the moon shine at the same time after 15 days. In this condition the moon cannot be seen from the earth. This position of the moon is called new moon. The day after new moon day the rising of the moon cannot be seen but moonset can be seen in the west. The bright part of the moon gradually increases and the moon shines at the time of sunset after 15 days. The whole part of the moon is seen bright. This condition of the moon is called full moon.

The bright part of the moon changes day by day. The different bright shape of the moon that is seen day by day is called phases of moon. After the new moon day, bright part of the moon gradually increases and reaches to the full size. This period is called bright half. After full moon day, bright part of the moon gradually decreases and cannot be seen in new moon day. This period is called dark half. The time period between two consecutive full moon days or two new moon days is called synodic or lunar month.

Project work

Observe the shape of bright part of moon daily for 1 month. Draw a chart showing the phases of moon that you have observed. Display the chart in the class and show it to your teacher.

Summary

1. The real cause of the origin of the earth has not been found. But George Buffon's Planetsimal hypothesis, Nebular hypothesis of Kant and Laplace Tidal theory propounded by Jeans and Jeffrew have been taken as reliable theories of origin of the earth.

2. Living beings have been evolved in the earth because there is air, water and suitable temperature for survival.
3. Change in season occurs due to the change in position of the sun and the earth.
4. The process of change of bright part of the moon day by day is called phases of the moon.
5. If the whole part of the moon is seen bright, it is called full moon. If there is no brightness in the moon, it is called new moon.

Exercise

1. Fill in the blanks with suitable words.

(a) It is believed that the earth was formed before ……year.

(b) The angle formed by the axis of the earth on its orbital plane is ……..

(c) The time period of increasing the bright part of the moon and reaching to optimum condition is called …… .

d) The day and night is equal all over the world on September 23 and ……

2. Write short notes on.

a) Nebular hypothesis b)Season change

c) Phases of moon d) Milky Way theory

3. What are the causes of the origin of living beings in the earth? Write in short.
4. Explain the tidal theory propounded by Jean and Jeffrey.
5. What effects are seen in the earth due to the inclination of the axis on its orbital plane making an angle 66.5 degree? Write.
6. What are the phases of the moon? Explain with diagram.

7. Write differences.

a) Full moon day and new moon day

b) Bright half and dark half

c) Axis and orbit

d) Summer and winter season

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Unit

22

Environment and its Balance

Natural resources and human dependency

Earth is the common habitat of human beings and of different organisms. Thus all the living beings get their food and shelter from natural resources available in the earth. Human beings get air, water, food, shelter, medicine etc. from natural resources. It shows the relation and dependency between humans and natural resources. The relation between natural resources and humans is described below:

(a) Food

Animals need energy to survive. Organisms get their energy from food. Human beings cultivate crops for their living. They cultivate rice, wheat, maize, mustard, buck-wheat, etc. These plants prepare their own food by photosynthesis process. Animals get their food from these plants. Therefore, humans totally depend upon natural resource for food.

(b) Habitat

Human beings live on land. If there is no land, there is no place for human beings to live. Human beings utilize land, plants, minerals, etc. for habitat. They obtain wood from plants and trees and brick, pebbles, sand, marble, from land for making habitat. These different materials are also taken from natural resources.

(c) Medicinal plants

Medicinal plants are very important plants for human being. People can make different kinds of medicine from medicinal herbs. Harro, Barro, Amala, Bojho, Sarpagandha, Jatamasi, Panchaunle, Yarsagumba are important medicinal plants. These medicinal herbs are available in the form of natural resource. Growing population and increasing needs have led to degradation of some medicinal plant. About 800 species of medicinal plants have been estimated in Nepal. About 70 varieties of medicinal herbs are exported to other countries from Nepal. Cultivation of these medicinal plants has also been affected with deforestation. Some medicinal plants are in the state of extinction.

d) Air

Air is very important element for living. Human beings need air to live. Fresh air keeps human beings healthy. Human beings take in oxygen from environment and exhale carbondioxide during respiration process. Human beings use various chemicals for industry, construction, transportation, agriculture, etc. These chemicals make the environment polluted. Similarly, the impure air released out from industry, factory, home, hotel, etc makes environment polluted. During respiration, inhalation of impure air leads to various diseases.

e) Water

Water is one of the important natural resources. Without water, organism does not exist. Water is necessary for building of human body. Human body is made up of 60% water approximately. Scarcity of water causes negative impact on human, plants and animals. Water is used for cooking, cleaning, farming, irrigation, etc. Human has built big city near river or near the source of water. This clarifies the relation between human civilization and water. Pure water is necessary for healthy life. Therefore, human also should save the water sources. The chemicals released out from industries and factories, garbages, faeces, etc. mixes in the sources of water and makes them polluted. The use of polluted water by humans leads to various diseases which makes life difficult.

(f) Land

All living organisms in the earth depend upon the soil. Humans make their habitat on land and food is also produced from land. Humans depend upon soil to produce crops, fruits, green vegetables, etc. If necessary foods are not produced in soil, there will be scarcity of food for humans as well as other living organisms. Therefore, land is very necessary resource for humans. Humans should save land to save themselves. If the nature of land gets depleted, the situation of plants, agricultural products and air also gets changed. If this increases, it leads negative effects to humans.

Short description of national parks, reserves and conservation area

In Nepal, for the conservation of natural resource, protected and conservation areas have been established specifically. Protected area consists of national park and wildlife reserve. The protected areas of Nepal in different areas are as follows:

a) National park

The area separated for the conservation and management of natural environment like wild life, birds, wild flora, habitat of wild life and landscape is called national park. In this area, we can visit, study and conduct research about the wild life only by taking permission and paying entry fee. Till the date, 10 national parks have been established in Nepal. They are:

1. Chitwan National park

This national park was established in 2030 B.S. Its area is 932 square kilometer. It covers the land of Chitwan, Makawanpur and Parsa district. This is the first national park of Nepal. This national park has been kept under world heritage list since 2041 B.S. In this area, Sal trees are mostly found. We can find different wild animals like Bengal tiger, Rhino, Elephant, Bear, Leopard, Alligator, Magar Crocodile, Ghoral, Python, Spotted deer, Ratuwa, Laguna, Red monkey and Langur in Chitwan National Park.

2. Sagarmatha National Park

This national park was established in 2032 B.S. Its area is 1148 square kilometers. It lies in Solukhumbu district. This national park consists of world's highest peak Sagarmatha and Lhotse, Nupse, Pumari, Aamadublum and Thamsherku mountains. In this park, trees like Gobre Salla, Thigre Salla, Dhuppi, Bhojpatra and Laligurans (Rhododendron) are found. Wild animals like Musk deer, Deer, Mountain bear, Thar, Ghoral, etc. are found in this park. Different types of birds such as Danphe (Lophophorus), Chilime, Kalij, Snow Cock, Laal-chuchche, Himchuchche are also found. This national park has been kept under world heritage list since 2039 B.S.

3. Langtang National Park

It was established in 2032 B.S. Its area is 1710 square kilometer. It covers the sections of Rasuwa, Nuwakot and Sindhuplachok districts. Wild flora like Saal, Khote Salla, Laut Salla, Langtang Salla, Gobre Salla, Kharsu, Gurans, etc. are found in this area. Also Snow Leopard, Red Panda, Musk deer, Mountain bear, Thar, Ghoral, Red monkey, Langur, etc. and different species of birds are found in this park. Sacred holy place Gosainkunda is ocated here.

4. Rara National Park

It was established in 2032 B.S. Its area is 106 square kilometer. It lies in Mugu and Jumla district of Karnali zone. Rara lake lies in this national park. Rara Lake is the largest lake of Nepal. The lake is surrounded by

coniferous forest. This area is favorable habitat for birds. Birds from Syberia and Mansarowar come to this area in winter. Himalayan bear, Thar, Ghoral, Musk deer, Black boar, etc. are found in this national park.

5. Bardiya National Park

This park was established in 2032 B.S. It has the area of 968 square kilometes. This park lies in Bardiya district of Nepal. Most of the area of this park is covered with Saal forest and grassland. In this park Tiger, Leopard, Krishnasar, Gaur, Spotted deer, Stag, Laguna, Alligator, Magar crocodile, Dolphin, Wild elephant as well as different species of birds are found.

6. Shey-Phoksundo National Park

It was established in 2040 B.S. Its area is 3555 square kilometer. It is located in Dolpa and Mugu district. This is the largest national park of Nepal. The wild animals like Snow leopard, Hare, Himalayan bear, Thar, Musk deer, Himalayan mouse are found in this area. There is Phoksundo lake in the park. It provides natural beauty to the national park. There are Shey gumba (monastery) and other buddhist monasteries.

7. Khaptad National Park

It was established in 2040 B.S. Its area is 255 square kilometer. This park is located in Bajhang, Bajura, Doti and Achham districts of Seti zone. Salla, Khasru, Reed forest and grassland have added the beauty of this park. The wild animals like Ratuwa, Musk deer, Ghoral, Leopard, Wild Dog, Wild Cat, Red Monkey and the birds like Danphe, Munal are also found there.

8. Makalu Barun National park

It was established in 2049 B.S. Its area is 2330 square kilometer. It is located in Sankhuwashabha and Solulkhumbu districts. Sunpati and Aromatic grasses, Wild flowers, Sungabha, Wild rose, Gobre salla, Thigre salla, Bhojpatra, Rhododendron, Arkhauli, Phirphire and Champ are found there. Habre (Red Panda), Snow Leopard, Tibetan hare, Himalayan bear, Thar, Musk deer, Himalayan mouse, Ghoral, Himalayan Thar and Leopard are also found there.

9. Shivapuri Nagarjun National park

It is situated in Kathmandu, Nuwakot, Dhading and Sindhupalchok. It was established in 2058 B.S. The area of this park is 159 square kilometer. Different species of mushroom and butterfly are found here. Clouded Leopard, Leopard, Salak of different species, Wild cat, Himalayan bear,

Ghoral, Red Monkey, Langur, Mongoose, Wild boar, Ratuwa, Spotted deer, birds, etc are also found in this area.

10. Banke National park

Banke national park was established in 2067 B.S. This is situated in Banke district. The area of this park is 550 square kilometer. This park consists of Saal, Sissau, forest of Khayer and grass land. Tiger, Alligator, Elephant, Leopard, Wild boar, Spotted deer, Deer, Gaur, Ratuwa, Laguna, etc. are found in this area. Different species of local and migrated birds are also found here.

b) Wildlife Reserves

A separate reserved area for the protection and management of wildlife and their habitat is called wildlife reserve. The wildlife reserve is established for the conservation of natural environment, protection and management of fauna and flora, endangered animals, conservation of habitat and for scientific study and research. In wildlife reserve study and research can only be carried out with permission of concerned authority. No one can enter the reserve for entertainment. To date three wildlife reserves have been established in Nepal. They are as follows:

1) Suklaphanta Wildlife reserve

This was established in 2032 B.S. Its area is 305 square kilometer. This reserve is located in Kanchanpur district. Saal, Sissau and forest of Khayer and grass land are present here. Bengal tiger, Wild boar, Bear, Leopard, Gaur, Antelope (Barasinge), Stag, Spotted deer, etc. are found in this area. Antelope (Barasinge), which is in the verse of extinction from the world, is conserved here. Many Magar crocodiles are found in Rani lake and other small lakes located in this reserve. Local and migrated birds of different species are also found in this reserve.

2) Kosi Tappu Wildlife Reserve

This was established in 2032 B.S. It has extended in 176 square kilometer area. This reserve are situated in Sunsari, Saptari and Udayapur districts. This reserve is surrounded by rivers both in the east and the west. Its main objective is to conserve and to increase the number of Arna (Wild Buffalo) which is taken as the rare animal in Nepal. Forest of Sissau and Khayer is found in this reserve. This reserve is the main living place of different wild lives. Like Wild boar, Laguna, Alligator, Dolphin and internally migrated birds, etc.

3) Parsa Wildlife Reserve

This was established in 2040 B.S. Its area is 499 square kilometer. This reserve has extended in Chitwan, Makwanpur, Parsa and Bara districts of Narayani zone. This is situated in the east to the Chitwan National Park. The major animals in this reserve are Wild elephant, Tiger, Gaurigai, Leopard, Deer, Wild boar, etc.

c) Hunting reserve

Hunting reserve was established to control the population of specific wildlife as well as for their long term use. In this area, hunting of particular animal can be done in a particular time after taking permission from concerned authority. Permission for hunting is granted after determining the number of wild animals in the reserve. The main purpose of this is to better manage the wildlife. National Park and Wildlife Conservation department announced hunting reserve for purpose of proper use as well as conservation of wildlife. Only one hunting reserve is there in Nepal.

Dhorpatan Hunting Reserve

It was established in 2041 B.S. It has 1325 square kilometer area. This reserve is spread in Rukum of Rapti zone and Baglung and Myadgi districts of Dhaulagiri zone. The major animals found in the reserve are Naur, Jharal, Thar Himalayan bear, etc. Here, animals and birds whose number is more are decided and allowed to hunt. It also helps to protect the habitat of animals and birds. Managing hunting in a proper way can earn foreign currency.

d) Conservation Area

For the conservation of natural resource, conservation of wild animals and their habitat, conservation of economic, cultural and religious heritage and long term use and conservation of their source, conservation area has been established. Annapurna Conservation Area is the first conservation area of Nepal. Till now 6 conservation areas have been established in Nepal. They are as follows:

1) Annapurna Conservation Area

Annapurna Conservation Area lies in the north west part of Pokhara city. Annapurna conservation area was established in 2043 B.S. under nature conservation fund. Its area is about 7,629 square kilometer. This area is rich in biological diversity. Nature conservation fund is conducting resource conservation, society development, tourism management, conservation education and extension programme, etc. for the conservation of this area.

2) Kanchanjan Conservation Area

Kanchanjanga Conservation Area was established in the year 2054 B.S. It has 1650 square kilometer area. This area is extended upto Tibet in the north of Taplejung district and upto India in the east. This area is the living place of endangered species of wild animals. Himalayan larch, Gobre Salla, Thigre Salla, Dhuppi Salla, Laligurans (Rhododendron) and other plants are found in this area. Among 30 species of Rhododendron found in Nepal, 24 species are found here. Different types of wild life like Himalayan leopard, Kasturi Mriga, Himalayan black bear, Jackle, Naur, Ghoral, etc. are present here.

3) Manaslu Conservation Area

Manaslu Conservation Area was established in 2055 B.S. Its area is 1633 square kilometer. It is situated in Gorkha district. Annapurna Conservation Area is located in the west of this conservation area and it is extended up to tibet in the north. Mammals like Kasturi Mriga, Snow leopard, Himalayan Thar, Naur, etc. are the important animals of this area. Manaslu Himalaya is the most attractive centre of this area.

4) Apinampa Conservation Area

Apinampa Conservation Area was established in 2067 B.S. It lies in Darchula district. High on Himalayan range Api and Nampa are the main features of this area. High Himalayan ranges, Himalayan medicinal plants and birds of different species are the specialties of this area. Kasturi Mriga, Snow leopard, Himalayan Thar, Naur, Himalayan black bear, Jackle, Clouded leopard, Leopard and birds of different species are found here.

5) Gauri-Shankar Conservation Area.

Gauri-Shankar Conservation Area was established in 2066 B.S. Its area is 2179 square kilometer. This is situated in Dolakha, Sindhupalchok and Ramechhap districts. Khimti, Bhote koshi, Sunkoshi, Tamakoshi rivers are originated from this area. Rare animals like different species of birds, Snow leopard, Red Panda (Habre), Brown jackle, Kasturi Mriga, Python, etc. are found in this area. Different types of plants and medicinal herbs are also found here.

6) Krishnasar Conservation Area

Krishnasar Conservation Area was established in 2065 B.S. Its area is 16.95 square kilometer. It was established to conserve rare Krishnasar. This conservation area is situated in Bardiya district.

Activity 1

Visit any conservation area or national park or wildlife reserve near your house and prepare a report including its characteristics.

Status of forest

'Green forest is Nepal's wealth' was a slogan in the past. From 2026 to -2037 B.S. more than half (53.5%) of the Nepal's land was covered with forest. Now, forest covers 39.60% of total land. In terai and inner part of terai, enough trees of Saal, Sissau, Khayer, Simal were found. Nowadays, their number is decreasing. The increasing population has resulted the gradual loss of forest. As migration of people to terai has increased, the forest of this area is decreasing. In village, people use wood, bamboo, Khar to build house and stables. Similarly, Bet is used to make swing, chair, clothes hanger and rack for keeping shoes and books. Nowadays, Bet Bamboo, Khar are difficult to find in the forest. In hilly region of Nepal trees of Champ, Katus, Chilaune, Bamboo, Tejpatta, etc. are found. In the northern Himalayan areas, trees of Salla, Dhuppi, Laligurans, Bhojpatra, etc. are found. In Himalayan area, population is very low. The plants on high hills and mountains are found in sloppy land, therefore these cannot be destroyed. Thus, the natural forest is protected in this area. With the increase in population, the needs of people are also increasing. To fulfill the needs of people they cut down trees haphazardly. Forests are cut down for wood, firewood, grasses and farming. Overgrazing of cattle has led to deforestation. This type of deforestation leads to desertification.

Importance and need of forest

Forest has special importance among the Nepal's natural resource. We can get grass, wood, fire wood, fruits from forest. Forest protects the soil of slopes of hilly areas. It protects soil from erosion. Plants make the land moist and fertile. It helps to increase the fertility of land. Plants release oxygen in environment and utilize carbondioxide to prepare food. It helps to keep balance of oxygen cycle and carbondioxide cycle in the environment. In this way, plant plays an important role to keep balance in environment. Different birds and animals in forest can be observed and studied. It also helps to enhance tourism industry. Thus, forest plays important role in our life.

Forest products

Forest products are important natural assets for human beings. People get wood, firewood, herbs, grass, etc. Forest absorbs water and preserves it. Forest stops flow of soft soil available on the surface of land. It protects from erosion. Similarly, it keeps the balance in atmosphere by releasing out oxygen and taking carbondioxide. It gives shelter to the wild life.

a) Timber trees

Nepal can be divided into terai, hill and Himalayan region geographically. In these regions, different kinds of geographical features and climate are found. Different types of vegetation are found in these regions. Soil of terai is fertile. In terai, Saal, Sissau, Simal, Jamun, Saaj, Harro and Barro are found. The hilly region is occupied by trees like Banjh, Phanlat, Katus, Champ, Okhar, Chilaune, etc. In high himalayan region, plants like Rani Salla, Thigre Salla, Bhojpatra, etc. are found. Some of them are used as wood to make furniture whereas most of them are used as fuel and for building house, stable, etc. Weak wood are used for fire wood. Small plants grow into trees. Trees give us wood. We should not cut tree haphazardly for wood. If a tree is cut, we should plant a new one in that place. Plants can be used for wood, firewood, etc.

Activity 2

What types of plants are found in your area? For what purpose, those plants are used? Observe and write it in the table below:

S.N.	Name of plant	Useful part	Uses
1.			
2.			
3.			

b) Medicinal plants

We can find different types of plants in the forest of Nepal. Some of them are used to prepare medicine. Such plants are called medicinal plants. About, 800 species of medicinal plant are reported to be found in Nepal. Medicinal plants such as Harro, Barro, Amala, Rajbriksha, Sarpagandha, Asuro, etc are found in hot place like terai of Nepal. Areas including Mahabharat peak as well as in cold climate, Chutro, Dhaturo, Chiraito, Bojho, Sugandhwal, Timor, etc are found. Medicinal plants like Panchaunle, Padamchal, Jatamasi, Yarsagumba etc. are found in high hills and high mountain area where climate is always cold. Nowadays, medicinal plant is cultivated. The medicinal plant available in our country is exported to other countries. About 70 species of medicinal plants are estimated to be exported abroad. Sarpagandha, Jatamasi, Laghupatra, Panchaunle, Bhyakur, Eklebir etc. are the medicinal plants which are exported to foreign countries. Deforestation has reduced the production of medicinal plant. The uncontrolled and illegal collection and export of the medicinal plants has resulted to the extinction of some valuable medicinal plants.

Activity 3

Name the kinds of medicinal plants found in your area. For what medicine have the plants been used? Ask your elders and experienced person and write:

S.N.	Name of medicinal plant	Useful part	Uses

Protected plants in Nepal

The situation in which the number of plants and animals continuously decreases leading to the condition of extinction is known as rare situation. The living animals and plants that tend to extinct from earth are Champ, Jatamasi, Yarsagumba, etc. Government should enforce the law to protect the existence of such living beings. There are different plants which are being protected by law in our country. Among them some are prohibited to collect. Some are forbidden to export in foreign countries. In our country, Panchaunle, Kutki, Jatamasi, Sarpagandha, Sugandhwal, Saal, Satti Saal, Vijaysaal, Simal, etc. are banned to export abroad. Among them some can be exported by taking permission.

Animals and birds

a) Current status

The habitat of wild animals is forest. Due to deforestation, the existence of birds and animals are in risk. About 170 species of wild animal are found in Nepal. Among them, Tiger, Rhino, Elephant, Snow Leopard, Bear, Samber Deer, Deer, Musk Deer, Arna, Ghoral, Wild Boar, Rabbit, Four-Horned Antelope, Fox, etc. are major wild animals. In Nepal, more than 860 species of birds are found. Forest is the habitat for most of them. The birds like Titra, Danphe, Munal, Kalij, Luinche, Chyakhura, Lampuchhre, Dhukur, Nyauli, Peacock, Eagle, Baaj, Dhanesh, Crane, Maina, Vulture, etc. live in the forest. Nowadays, the habitat of wild animals and birds is being destroyed. Destruction of habitat has affected these organisms. Due to this, the number of Tiger, Snow Leopard, Rhino, Elephant, Barasinge, Musk deer, etc is decreasing day by day. Similarly, smuggling and poaching of birds and animals has led to decrease in their number. Recently, Black Buck and Hispid Hare are in the state of extinction. Similarly, Elephant, Rhino, Tiger, Arna, Snow Leopard, Antelope (Barasinge), Musk Deer, etc. are also in the verse of extinction. 26 species of mammal, 9 species of bird and 3 types of reptiles found in Nepal are declared as protected species.

b) Importance and need

Wild animals and birds are the symbols of natural beauty. They preserve natural beauty. They maintain balance in the environment and ecosystem. Due to the destruction and extinction of wild animals beautiful structure of nature is being damaged. This results in disadvantage to future generation. Wild animals support tourism business. Tourists are curious to observe rare animals and the animals not found in their countries. For that, they spend a lot of money and come to our country. This supports the economic development of our country. Job opportunity will be increased for local people which helps to improve their living standard. Therefore, natural beauty and rare animals should be conserved.

Animals and birds going to be extinct

Some wild animals in the position of becoming extinct are started to extinct due to destruction of forest and their habitat and some are becoming rare. Animals like Krishnasar, Dwarf Wild Boar, Wild Donkey, Wild Rabbit, etc. are going to be extinct. Similarly, Wild Elephant, Rhino, Tiger, Arna, Snow Leopard, Barasinge, Kasturi Mriga, Dolphin, etc. are becoming rare. These animals are kept in the list of protected species. Some wild animals declared as protected species in Nepal are as follows:

a) Ek Singe Gainda (One-Horned Rhinoceros)

One-horned rhinoceros is found in Chitwan and Bardiya National Park of Nepal. This is kept under protected species because it is a rare animal. It lives in the place of dense grass land and forest of Saal. It lives on grasses. It bears only one offspring in one delivery. Human poaches it for its horn, hoof and skin. Thus, this animal is in endangered situation.

Fig. 22.1

(b) Pate Bagh (Bengal Tiger)

Bengal tiger is found in forest of terai in Nepal. Specially Bengal tiger is found in Chitwan National Park, Parsa Wildlife Reserve, Bardiya National Park an Suklaphanta Wildlife Reserve. Tiger lives in dense forest, grass-land and the place with enough water. They live on animals like Spotted deer, Wild boar, Antelope, Laguna, Ratuwa Mriga, etc. It produces 2 to 6 cubs in one delivery. Tiger has also been kept under endangered species due to its poaching.

Fig. 22.2

(c) Hatti (Asiatic Elephant)

Elephant is found in the terai region of Nepal. The plain jungle area below the Chure Hill is the main habitat of elephant. Elenphant is found from Jhapa to Parsa, Bardiya and Suklaphant in the east. This is upto 3.5 metre tall. It eats tree, grass, bamboo, crop etc. It gives birth to a single baby in one delivery. It has long tusks. It has been found that elephants are illegally hunted by human for their teeth. It is also a rare and protected animal in Nepal.

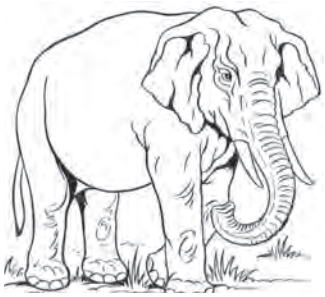

Fig. 22.3

(d) Habre (Red Panda)

This animal is found in the forest situated above approximately 3500m and in the forest of bamboo, Khasru, Nigalo. This is a bigger attractive animal than a cat. It lives on fruit, grass, bamboo, Nigaloko muna etc. Human poaches for its beautiful skin furnished with a fur. That's why its number has been decreased and eventually is in the position of extinction. This animal is found in Kanchanjangha and Taplejung district.

Fig. 22.4

(e) Ajingar (Python)

Python is a big snake. It usually lives in tree trunk of dense forest and dried leaves. Sometimes, it also lives in grassland near the river, lake etc. Its body colour is white, black and multi- coloured. Its length is upto 7 metre. This is not poisonous. It swallows small animals, lamb of deer, rabbit, goat's kid, etc. Its head is big and eyes are small. Its poaching for skin is resulting its extinction.

Fig. 22.5

(f) Thulo Dhanes (Giant Pied Hornbill)

Giant Pied Hornbill is a big bird found in the forest of terai. It has got a casque on the top of its massive bill, which makes it more attractive. Its habitat is destroyed along with the destruction of tall trees in terai. This bird is also on the verge of extinction. Its number has been decreasing because of poaching hunted for bone and fat.

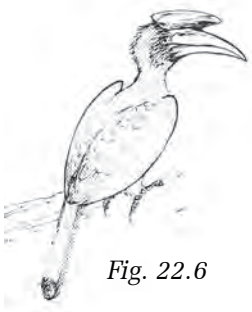

Fig. 22.6

Project Work

Observe the animals and birds in forest, national park, reserve or conservation area or zoo near your residence. Prepare a report including the names of animals and their habitat, present status, food and ongoing steps and works to be done for conserving them.

Summary

1. Human beings depend upon natural resource for air, water, habitat and food.
2. For the conservation of natural environment as well as living organisms and vegetation, national park, wildlife reserves, hunting reserve and conservation areas are established.
3. Till now, in Nepal 10 national parks, 3 wildlife reserves, one hunting reserve and 6 conservation areas have been established.
4. We can get grasses, wood, firewood, medicinal herb, etc. from forest.
5. In the terai region of Nepal, Saal, Sissau, Khayer, Simal trees are found. In hilly region Champ, Katus, Chilaune, Okhar and in mountain regions Rai salla, Thingre salla, Bhojpatra, etc. are found.
6. Medicinal plants like Panchaunle, Padmachal, Jatamasi, Yarsagumba, etc. are found in the mountain region of Nepal.
7. Due to the destruction of habitat animal like tiger, rhino, elephant, snow leopard, python, Dhanes, vulture, etc. are prone to extinct.
8. In Nepal, 26 mammals, 9 birds and 3 reptiles are kept in the list of conservd species.

Exercise

1. Fill in the blanks with suitable words.

(a) Forest is …… for wild animals.

(b) In total ……..…. wildlife reserve has been established in Nepal.

(c) …… species of bird are declared as protected species in our country.

(d) In high mountain region, Rai salla, Thingre salla and ……., etc. are found.

(e) Bengal tiger is found in …… forest of Nepal.

2. Give reason.

(a) Forest and wild life are closely related.

(b) Due to the different adverse activities of human, wildlife feels difficulty to live.

(c) National park and reserve help for the conservation of wildlife.

3. Write short answer.

(a) Why is forest destructed?

(b) What should be done to protect forest?

(c) What types of medicinal herbs are found in our country?

(d) Describe about the importance of medicinal herbs.

(e) What type of effort is given for the wildlife conservation in our country?

4. What are the differences between national park and wildlife reserve? Write.

5. Write down the names and utilities of the medicinal herbs found in your locality.

6. What is national park? List the national parks in Nepal.

7. What is wildlife reserve? Write the names of wildlife reserves found in Nepal.

8. What is hunting reserve?

9. Write down the names of conservation areas in Nepal.

10. What can you do to conserve forest and environment in your surroundings? Write in brief.

Unit

23

Environmental Degradation and its Conservation

Environment is the base of all organisms for their existence. Human has direct relationship with the environmental factors like air, water, soil etc. Human performs the development and construction activities like construction of houses building, industry, factory, road, canal, etc on the surface of earth. Due to these human activities, the quality of air, water, soil and many other natural resources has begun to decrease. The reduction in the quality of environmental factors or negative effects on these resources is environmental degradation.

Effects on environment due to human activity

Human beings use different natural resources to fulfill their needs. To fulfill the needs of over population, human beings use air, water, soil, forest, etc. extensively. Similarly, different resources have been utilized in developmental activities. Conducting developmental works haphazardly neglecting environmental factors results in adverse effect in environmental sustainability. This is called environmental pollution.

Environmental pollution

The activity that results a significant degradation in environment and damaging the useful aspect of environment by affecting it directly or indirectly is environmental pollution. Pollution can be categorized as below:

1. Air pollution

Gases like nitrogen, oxygen, carbondioxide, argon, etc. are in atmosphere. If the gases mix with external polluted things, their actual state will get damaged. Smoke, dust, carbondioxide, sulphurdioxide, carbon monoxide, etc. released from vehicles, factories, industries lead to air pollution. Conversion of fresh air into dirty and stinky air is called air pollution.

Causes of air pollution

Various causes lead to air pollution. Among them some major causes are as follows:

(a) Smoke, dust and waste produced from vehicles cause air pollution.

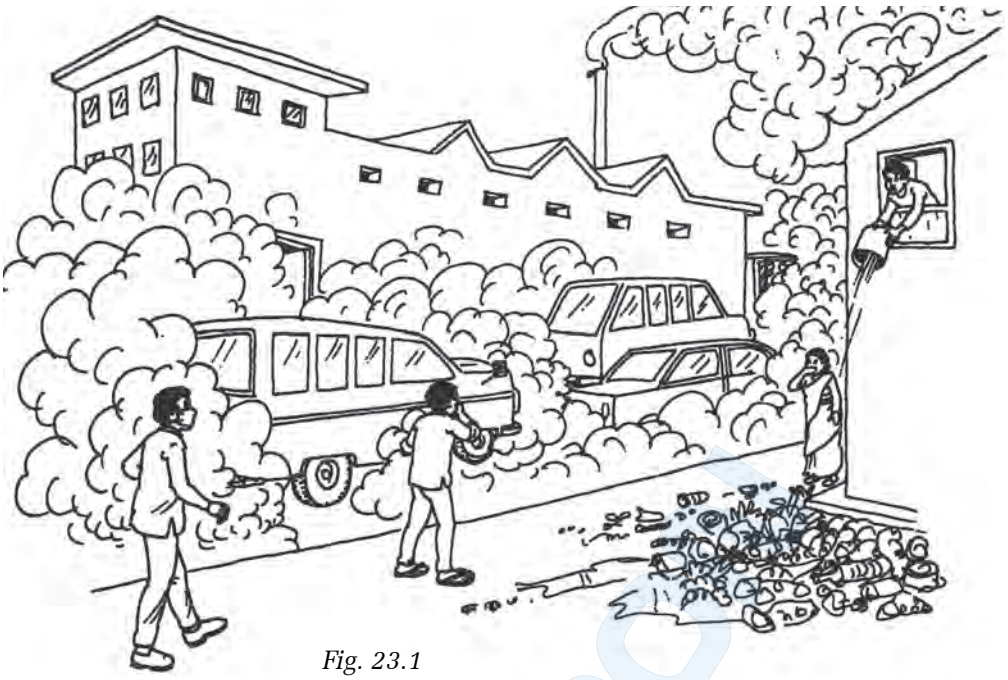

Fig. 23.1

(b) Smoke, dust and poisonous gas produced from factories and industries cause air pollution.

(c) The smoke due to the use of fire wood, dried cow dung, wheat stalk, etc causes air pollution.

(d) The dust due to mining of minerals and road construction.

(e) In cities, garbage is thrown elsewhere so that bad smell from rotten garbage causes air pollution.

Effects of air pollution

(a) Air pollution affects human health adversely by causing diseases related with respiration, eye, lungs and chest etc.

(b) Air pollution causes loss in plants and damage in cultural heritage manifested.

(c) Air pollution causes the disease like burning of eye and asthma.

(d) Air pollution causes increase in the temperature of the earth.

(e) Air pollution causes acid rain.

2. Water pollution

River, spring, lake, pond, underground water, etc. are major sources of water. Due to different human activities water sources get polluted. Waste from industries, chemical fertilizers or pesticides used in field, sewage, other remaining of waste, etc. are sources of water pollution. Quality of water

changes directly or indirectly when these wastes mix to the sources of water. In this way, harmful things mixed to water source affect the actual quality of water and change its current situation. This is called water pollution.

Causes of water pollution

Water pollution is the result of different causes. Among them, some major causes are as follows:

(a) In city areas, the pipelines of water and sewage are constructed in the same point in some places. When sewage pipe breaks suddenly, dirty water may mix to drinking water pipe and water gets polluted.

(b) Activities like washing clothes, washing utensils and letting cattle bath in the source of water make the water source polluted.

(c) The garbage released from factories and different places, other polluted materials, sewage, etc directly mix with the water source such as river, lake, natural pool, pond, etc. making it polluted.

(d) Farmers use chemical fertilizers, insecticides, pesticides to increase crop production. The chemical fertilizer and fluid of insecticides slowly mix to water source resulting water pollution.

(e) From hospital, laboratory, industry, automobile workshop, etc. wastes as well as chemicals are released when they mix to water source, water pollution occurs.

Effects of water pollution

The different effects of water pollution are as follows:

(a) Polluted water causes diseases like cholera, dysentery, jaundice, typhoid,etc.

(b) Polluted water harms plants and aquatic animals.

(c) It affects the photosynthesis process of plants.

(d) Polluted water spreads bad smell.

(e) Due to polluted water some young plants as well as aquatic animals die out.

3. Land pollution

Generally, the adverse change in quality of soil is called land pollution. Land pollution spoils the fertile soil of land. There are different causes of land pollution.

Causes of land pollution

(a) Use of greater amount chemical fertilizer in farm.

(b) Use of insecticides in farm excessively.

(c) Throwing of garbages and waste product in soil.

(d) Undecomposed materials like plastic, glass and metals in soil leads to land pollution when they are thrown randomly.

(e) The undecomposed waste material thrown by the hospital, health post, lab, factories cause land pollution.

Effects of land pollution

(a) Earthworm and microorganism that improve the quality of soil die out.

(b) The fertility of soil is reduced.

(c) Decrease in crop production.

(d) Bad smell from polluted land causes stinking environment.

(e) Damages the structure of land. The water produced from them also gets polluted.

4. Noise pollution

The loud sound in the environment is called noise pollution. Production of unnecessary sound is also a sound pollution.

Causes of noise pollution

(a) Unnecessary sound and noise produced in market and crowded area, city with more vehicles, places with more number of industries, cause noise pollution.

(b) Noise pollution is caused due to construction of road, building, etc.

(c) Playing radio, television, musical instruments loudly causes noise pollution.

(d) Unnecessary production of sound from cement factory, flour mills, metal industry causes noise pollution.

(e) Noise of people in cities, publicity through mikes, etc. also cause noise pollution.

Effects of noise pollution

Major effects of noise pollution are as follows:

a) Hearing capacity becomes weak.

b) High blood pressure arises in human.

c) Maximum loud sound make ruptures in ear drum and leads to deafness.

d) Health problems appear such as insomnia, digestive disorder, etc.

e) Causes difficulty to concentrate in studying, writing or doing any activity.

Green house effect

The earth is surrounded by atmosphere. Different gases are found in atmosphere. Carbondioxide, carbonmonoxide, methane, ozone, nitrous oxide, sulphurdioxide as well as vapour cover the earth densely. These gases are called green house gases. When the sun light falls on earth's surface, it warms the atmosphere and the earth's surface. The earth reflects some amount of sun's heat back. Also, the heat and light of sun is allowed to enter the earth through green house but the reflected heat and light from the earth is not allowed to escape from atmosphere. As a result. If return to the earth. This leads to addition of sun's heat in atmosphere and hence hotness of earth increases. In this way, the process of storing heat by green house gas present in the atmosphere and increasing the temperature of earth is called green house effect.

If there are no green house gases in the atmosphere, there would not be storage of heat energy. Consequently, the temperature of earth would be very low (-18°C). The earth would be covered by ice. No possibility of existance of any organism. Therefore the natural green house effect of earth has made life possible. The balance of temperature of atmosphere do not change until certain amount of green house gases is present in the atmosphere. Due to the human activities when the amount of green house gas increases, the green house effect also increases. If the green house effect increases, temperature of earth also increases and causes climate change.

Reasons of increase in green house gases in atmosphere

a) Due to the forest fire, the carbon stored in plants realesed as carbondioxide in the atmosphere.

b) The stored carbon directly escapes to the atmosphere during deforestation.

c) The gases coming out from factory, industry, vehicles also increase the green house effects

d) When we throw wastes haphazardly, the methane gas comes out after they get decomposed and reach the atmosphere.

e) The gas released from aeroplane is also a green house gas.

f) The water on the surface of earth evaporates due to the heat of Sun. This also increases the green house effect.

Effect of green house effect

a) Increase in temperature of earth

b) Slow change in weather situation.

c) Affects water cycle.

d) The ice melts in the polar region and sea level increases.

e) The height of Himalaya decreases due to the excessive melting of snow.

Thoughtful question

Why is vegetable farm covered with plastic to create green house effect?

Climate change

Climate change is a natural event. The climate of earth is not stable. Different natural events occurring in the earth cause change in climate. Climate change means the long term change in climate due to the human activities as well as natural instability. The obstruction in the regular cyclic system of air and water is called climate change. Due to the interaction of the topography of any place, air, water, temperature and structure of physical objects, special type of weather is formed. The climate change can be identified by the study of characteristics/symptoms of fluctuation and difference in average climatic condition due course of many decades. Overall, climate change is the change in statistical data of weather in a long period of time.

Effects of climate change

a) Due to increasing temperature, the snow in the Himalayan region is melting which may lead to decrease in water source in near future.

b) The sea level is rising rapidly.

c) Over rainfall and drought have caused heavy rainfall in some places and no rainfall in some places.

d) Due to unseasonal rainfall, people do not get rainfall in required time.

e) Decrease in crop production.

f) Hot air, frost, epidemic, etc. lead to increase in adverse effects on human health.

g) Reduction in biological diversity.

Acid rain

The chemical and physical process by which the water vapour in atmosphere mixes to acidic substances and drops on the surface of the earth is called acid rain. Generally, acid rain means the rain fall when the water in the sky mixes with acidic substance. The water in the acid rain has generally more acidity than water of general rain.

Causes of acid rain

To fulfill the necessity of human, many developmental constructions have been carried out. Among this developmental works, industrial development is one. During production process in industry different types of toxic gases come out. From different types of industries gases like sulphurdioxide, carbondioxide, carbonmonooxide, nitrogendioxide, etc. come out. Such polluted gases coming out from industry reacts resulting polluted matter such as: combinations of sulphur dioxide and oxygen forms sulphur trioxide.

This reacts with water and convert into sulphuric acid. The sulphuric acid made in this way combines with rain water and forms acid rain.

Similarly, the carbondioxide coming out from factory/industry reacts chemically with water and forms carbonic acid.

Effects of acid rain.

a) Acid rain causes, various health problems in plants as well as animals.
b) Depletion of rocks
c) Depletion of statue, roof of house, metallic roof of temple (brass, copper).
d) Imbalance in terrestrial and aquatic ecosystem.
e) Increase in acidity of soil and decrease in crop production.
f) Reduction in the growth of plants.

Measures to control acid rain

a) Decreasing the source of pollution.
b) Searching and using alternative energy.
c) Re-using SO_2, CO_2 gases released from the factory.
d) Introducing techniques that do not release toxic gases and matters in the atmosphere.

Disaster and disaster management

You might have heard about the loss of people and property by flood, landslide, fire and earthquake etc. You might have seen this incident. These incidents are called disasters. These incidents lead to loss of human, animals, birds, vegetation, etc. The people affected by these incidents cannot face the situation only by themselves and have adverse effect on social phenomena. Therefore any incident occurring suddenly and causing huge loss of people and property leading to adverse effect on society is called disaster. Disaster is caused mainly by two reasons:

a) Natural disaster

The incident occurred due to natural cause leading to huge loss of life and property and resulting long term effect on society is called natural disaster. Natural disasters are earthquake, volcano, flood, landslide, hurricane, cyclone, storm, hailstorm, thunder, etc.

b) Man made disaster

The incident arose by different activities of people leading to loss and affecting life is called manmade disaster, for example, desertification, chemical accident, technical accident, road accident, etc.

Causes of disasters

The weak and steep geographical structure increase in river flow due to sudden heavy rainfall and deforestation cause disaster in Nepal. Similarly unscientific mining of ores, construction of water canals, construction of road, establishment of factories and industries and other developmental works cause disaster. Population growth, urbanization, chaotic living, unmanaged industrialization, improper management of transportation, inadequate management of waste, lack of public awareness inhibit disasters. Flood, landslide, fire, storm, hailstorm, thunder, avalanche, explosion of glacial lake, epidemic, earthquake are the common disasters in Nepal.

Measures for minimizing risk of disaster and managing them

Disasters are incident occurred due to different reasons. Therefore, management of disasters and reduction of their risk depends on causes of the disasters. Some ways of managing disasters and minimizing their risk are given below:

Measures of disaster management

a) Preparedness

b) Rescue of victim

c) Providing relief, rehabilitation and help to victim

d) Proper mobilization of aid

e) conducting public awareness programs.

1. Measures of managing earthquake and minimizing its risk

A sudden, violent shaking of earth is called earthquake. Earthquake occurs due to different reasons. The earthquake causes loss of life of human and animals, destroys the developmental infrastructure. Thus, different measures should be adopted to protect life and property from earthquake.

Measures that should be taken before earthquake comes

a) The cupboard, bookshelf, refrigerator, television, mirror, heavy photo frames etc should be kept inside the house firmly attached to wall.

b) Breakable materials like bottle, glass, mirror, etc. should be kept firmly

c) Torch light, radio, first aid box should be kept safely.

d) If the basement of house, ceiling, walls, electrical wire, etc. are damaged they should be repaired in time.

e) The safety place inside and outside of the house should be identified.

Measures that should be taken during earthquake

a) If the exit door is near, go to the safe place outside the house.

b) Remain in the safe place of the house if you are inside.

c) Move to the open area if you are outside.

d) Stop and stay in an open place if you are in a vehicle.

Measures that should be taken after earthquake

a) As soon as the earthquake stops, move to the safe place outside the house and do not enter the house immediately.

b) If you are injured, go for treatment.

c) If someone is trapped help them to come out and inform the rescue team.

d) Check the basement, wall, window, door, etc. before entering the house.

e) Hear the emergency news broadcasted through radio, television, etc. and follow it.

2. Management and risk minimization of flood and landslide

The increase in volume of water than normal situation in river is called flood. Heavy rain fall, melting of glaciers, explosion of glacial lake, overflow of blocked river by landslide cause flood. The falling a mass of land down

Fig. 23.2

the slope of a mountain or hill is called landslide. Flood and landslide cause loss of life and properties, Therefore, to protect from flood and landslide and to minimize and manage the risks, following measures should be taken:

a) Do not be panic, stay calmly in a safe place.

b) Do not cross flooded river.

c) If you see someone being trapped in a flood and landslide, inform elder person immediately.

d) If you see the river is blocked by landslide, inform all.

e) Support helpless to reach the safe place

f) Provide first aid to the injured personal and victim at first and then take them to the health post or hospital as per their condition.

g) After flood and landslide do the required help to the victim. Bury dead and decayed animals, birds and plants.

Management of flood and landslide

a) Embankment should be constructed at the side of river and human settlement on the side of river should be removed.

b) Plants such as bamboo that produce roots in greater amount should be planted at the side of river.

c) Terrace farming in a steep land should be carried out.

d) House and shed should not be constructed in steep place and place with a loose soil.

e) Manage water outlet around the house.

f) Identify the places where flood and landslide are prone to occur and stay on a alert.

g) Provide necessary support to the most vulnerable as far as possible.

3. Risk minimization and management of fires

Sometime fire destroys human houses, shed, factories, industries, etc. Fire destroys not only house, shed but also vegetation and forest. If a forest is on fire, plants, birds and animals living there get destroyed. Fire is the disaster caused by human activities. To protect from fire the following measures can be taken:

a) The objects like match, lighter should be kept away from children.

b) Do not smoke cigarette and extinguish cigarette before throwing.

c) Establish pond or water source near the village, house.

d) Keep fire engine and fire brigade in ready condition.

e) Keep a safe wiring in house and public building.

f) Conduct awareness program for the precaution of fire.

g) If fire is set, inform society and fire brigade as soon as possible.

h) Try to put out a fire.

i) Rescue the people who are trapped in a fire area.

j) Provide first aid to injured person.

k) Adopt measures to avoid the spread of fire.

l) Provide necessary support to the victim.

4. Management and risk minimization of epidemic of certain disease

A large number of cases of a particular disease happening at the same time in a particular community due to the rapid spread of the disease which affecting people health adversely is called epidemic. Since epidemic causes the loss of human resources, the following measures need to be taken to protect people from its effect:

a) Conduct awareness and educational programs.

b) Run programmes related to disease and hygiene.

c) Keep environment clean.

d) Pay attention in conservation and sanitation of water resource

e) In epidemic situation provide treatment for patient

f) Keep knowledge about cause, effect and preventive measures of disease and apply caution for that.

Protective measures of environment

Development and environment are inter related with each other. During developmental works environmental resources should be utilized properly. Their proper utilization leads to the long lasting and stable development. It supports in the protection of environment. Environment is the common property for all. Its preservation and protection is also our responsibility. Awareness, plantation, water and land conservation, pollution control, environmental sanitation, preservation of cultural heritage, etc. should be carried out to conserve environment. Some of the measures of conservation of environment are given below.

a) Increase public awareness

Governmental practices are not only sufficient to keep environment clean, green and attractive. Direct involvement of public ensure environment sanitation. Public involvement in development need to be kept in high priority from the perspective of financial and psychological aspect. Environment conservation is not possible without public participations. Public should be educated. Humans participation on environment conservation is possible only after awareness is increased. To increase public awareness, public notice, publicity, education, seminar, training, etc. should be conducted.

b) Plantation

Nowadays, deforestation has become the major problem. Bare hills, ground, etc. can be seen in different parts of our country. The area of forest should be increased by plantation in these bare ground, section and hills. It supports in environment conservation.

c) Conservation of water resource

River, snow, lake, pond, spring, well etc are our major sources of water. Conservation of these sources is called water resource conservation. For their conservation, plantation, protection from disasters like soil erosion, landslide, flood, etc. need to be carried out. Water of canal and brook should be managed. Pond, lake, marshy place should be protected from sedimentation. Industrial waste should not be mixed to water resources. Similarly use of pesticide, chemical fertilizer, etc. should be reduced. Washing clothes, bathing, washing dishes and defecation near the water source should be prohibited.

d) Soil conservation

The protection of land or soil is soil conservation. Land should be conserved to maintain its original qualities and its fertility. Soil conservation increases the yielding capacity of fertile land. Soil conservation helps to conserve environment. Plantation should be done on bare hills, open section, ground, steep land, etc. for the conservation of soil. Bamboo, large trees and grasses should be planted at the side of river, lake, pond, brook, stream, etc. Uncontrolled grazing inside the forest should be banned. Mobile grazing system should be implemented. Terrace farming should be done in steep area. Fence, embankment and dam should be constructed in water flow area. In this way, soil erosion can be prevented.

e) Pollution control

Nowadays pollution has become a complex problem. It forms complexity for the survival of organisms by hampering environmental condition. Thus, pollution should be controlled. The proper management of wastes coming out from house, office, factory, industry, etc. controls pollution. Sewerage should be managed properly. Regular repair and maintenance of old vehicles and machines of factories should be done so that less smoke would be emitted from them. Separation of decomposable and undecomposable waste and their proper disposal should be done. Decomposable waste should be used for making compost. Undecomposable waste should be reused or recycled. Haphazard use of insecticides should be discouraged. Wastes should not be thrown near the source of water. Undecomposable waste should not be thrown haphazardly to the fertile land and their proper management should be done.

f) Conservation of cultural heritage

Temple, Buddhist monastery, souvenir, inn, etc. are the cultural heritages. These should be repaired and conserved on time. Its original appearance should be preserved. Sanitation surrounding the cultural heritage sites need to be taken into consideration. The participants for its conservation can be motivated by explaining the importance and uses of old monuments sanitation, religious sites, etc.

g) Environmental cleaning

Our surrounding environment should be kept fresh and clean. Environment will be polluted if town village, community is dirty. It causes different diseases in human, animal and bird. Thus, we all collectively should keep our environment clean. Proper disposal of waste and sewerage should be managed for it. Similarly, conservation and cleaning of public place, temple,

inn, courtyard, keeping water sources clean, cleaning of house, shed, road, lane, etc. should be carried.

h) Public participation

Public involvement has an important place in conservation and enhancement of environment. All should work together to keep environment of village, house, area, city, clean and healthy. Mutual Cooperation and discussion supports the conservation and enhancement of environment.

Activity 1

Which measures have been implemented to manage and dispose wastes in your surrounding? Find out asking the people living there. Write in short about the types of wastes and the measures to manage those wastes.

National and international organizations involved in the conservation and enhancement of environment

National and international organizations have played a vital role in organizing environment conservation programmes. They have helped to formulate policy and to design programs for the conservation of environment in our country. Some of the organizations helping in conservation and enhancement of environment are as follows:

1. National Trust for Nature Conservation (NTNC)

The main objective of this organization is to contribute to stop environmental degradation/adverse environmental consequences by conserving and managing nature and natural heritages in national as well as international level. National Trust for Nature Conservation (NTNC) was established in 2039 B.S. This organization has been supporting the project related to nature conservation, research and environment education. Its major objective is to ensure balance between human needs and natural resource. In this way, it has played its active role in the conservation of environment. To fulfill its objectives, it has been conducting different programmes in association with the organizations like Bardiya Conservation Project, Bio-diversity Conservation Centre-Chitwan, Central Zoo, etc. Similarly this organization also conducts Manaslu Conservation Area Project and Annapurna Conservation Area Project.

(b) The World Conservation Union (IUCN)

It is an international non-governmental organization established in 1948 A.D. as International Union for Conservation of Nature and Natural resources (IUCN) . Recently, it has been named as IUCN- the world conservation union. Nepal has got a membership of IUCN in 1973A.D. This organization consists

of many higher level commissions such as education and communication, environmental economic and social policy, environmental laws, protected areas and species survival. These commissions formulate worldwide policies and programme. The main objectives of this organization are as follows,

i. To protect the natural solidarity of nature and its diversities.

ii. To follow environmental sustainability and equity while utlizing natural resources.

iii. To inspire, encourage and co ordinate the different countries, societies and organizations to achieve its objectives.

The main works of IUCN are to encourage, inspire and cooperate the international community for protection and conservation of bio-diversity for the sustainable utilization of natural resources. It has given emphasis on the study of the state of environment, policy formulation and sustainable development. It publishes the IUCN red list of endangered animals and provides information scientifically about the endangered animals due to the destruction of habits or other reasons. It helps to formulate and implement the environmental conservation policy and programme in national and international level. IUCN has been performing various functions in Nepal. These functions are: formation of curriculum and text book, teaching materials, formation of environmental policy, programme and planning, conservation of forest and wildlife, proper management of national park and wild life reserve etc.

c) World Wide Fund of Nature-(WWF)

It is an international non-governmental organization for the conservation of nature. It was established in 1961 A.D. It was called the World Wildlife Fund in its inception but since 1986, it has been called World-Wide Fund for nature. In Nepal, it's named as World Wildlife Fund. Its head quarter is in Switzerland. It has been working to conserve rare living creatures and natural resources on the earth. Its main objectives are given below:

a. To protect and conserve the gene pool, races of the organisms and the diversity of geo-spatial system.

b. To ensure sustainable utilization and development of renewable natural resources for present and future generation.

c. To organize various programmes to reduce consumption of natural resources and energy producing toxic waste products and polluting the environment.

This fund has helped to protect so many rare wildlife and vegetation of the

world from being extinct. This fund has been cooperating in conducting the programmes such as taking care of watershed area, protection of endangered plants and wild animals, checking of illegal trading of endangered animals, scientific study and research, environmental awareness programme, etc. It has conducted special programme to protect rare wildlife such as tiger, rhinoceros, and red panda.

d) United Nations Environment Programme (UNEP)

The United Nations had organized a conference on the human environment in Stockholm, Sweden in june, 1972. This conference strengthened the concept that man has the right of surviving in healthy environment and the environment should be preserved for the future generation. It declared to celebrate June 5th as "World Environment Day" every year. At the end of 1972, the general assembly of the UNO established the "United Nations Environment Programme". The governments of different countries, scientists, traders' group, non-governmental organizations, women and youth groups have been participating in its various programmes. It pays special attention to make the world's developmental activities healthy and long lasting from environmental point of view.

e) International Center for Integrated Mountain Development (ICIMOD)

International Center for Integrated Mountain Development was established in 1983 A.D. It is also called ICIMOD in short. There are eight member countries of organization, China, India, Pakistan, Bangladesh, Bhutan, Myanmar, Afghanistan and Nepal. Its central office is situated in Khumaltar, Lalitpur, Nepal. It is the first international organization for the development of hilly region. The main objective of this organization is to promote the economic status of people of Hindu-Kush region and to protect the ecosystem of hilly and mountain region. This organization conducts various programmes to conserve water, energy and biodiversity and to stop environmental degradation by increasing awareness in people. It has forwarded the development of hilly region and management of hilly environment in an integrated way. This organization has organized different awareness programs on local community participation and their roles and duties for sustainable development of hilly region. It has conducted various programs to save environmental, social and cultural diversity of hilly region. It has emphasized on the development of marginalized people of hilly areas. It lays emphasis on the protection of hilly ecosystem for future. The above various national and international organizations are conducting several programs in association with the various departments and offices of respective ministries.

Project work

Summary

1. The decrease in the natural quality of the environment is called environmental pollution. It can be divided into four types: air pollution, water pollution, land pollution and noise pollution.
2. The increase in temperature of earth due to the trapping of sunlight and heat by different gases in the atmosphere is called green house effect.
3. Climate change affects temperature of environment and causes atibristi (over rain), anabristi (no rain), unseasonal rains, snowfall, decline in agricultural production, etc.
4. The gases released from industry, react with water of rain fall to give acid rain.
5. Environment can be conserved with people awareness, plantation, land conservation, conservation of water resources, pollution control, conservation of cultural heritage and environmental cleanliness.
6. National Trust of Nature Conservation, IUCN, UNEP, ICIMOD, and WWF are conducting the activities for conservation of environment.

Exercise

1. Fill in the blanks with appropriate word.

a) Public awareness helps to the……. of environment.

b) The activity which reduces the quality of the environment is.....

c) Cabondioxide reacts with water to form……acid.

d) National trust of nature conservation conducts the activities to conserve .....

2. Write in short

a) World wide fund

b) IUCN

c) National trust for nature conservation

d) Climate change

e) Public awareness

3. Give reason

a) Public awareness helps in conservation and protection of environment.

b) Afforestation is an important way to conserve environment.

c) Environmental degradation reduces the production.

d) Human activities are the causes of the environment at degradation.

4. Write short answer

a) What is environmental pollution?

b) What are the causes of water pollution? Write in points.

c) What are the adverse effects of noise pollution in human body?

d) What are the green house gases? Explain.

e) What do you mean by climate change?

f) What are the effects of climate change?

g) Describe the ways of conservation of environment.

5. Make a list of national and international agencies that are contributing to the protection and conservation of environment in Nepal.

6. Observe any monument, temple or cultural places located near your school; describe it on the basis of the following points.

   i. Introduction of cultural place.

   ii. Religious importance

   iii. Present condition.

   iv. Efforts made for the protection and conservation.

7. What kinds of activities related to the environment are performed by the agencies in your locality? Describe.

8. What can you do to conserve the environment of your area/ locality?

9. As the humans are cause of environmental degradation, it is their responsibility to conserve it, justify.

Unit 24

Environment and Sustainable Development

Earth is the common habitat of all living beings. Living beings get air, water, food, etc. which are necessary for their survival from the earth. The aggregate form of all living and non-living beings is called environment.

Biodiversity

You might have seen various types of birds and animals in nature. There are human beings along with vegetation, birds, and animals, plants and micro-organisms on the surface of the earth. All the living beings have diversity in terms of various aspects, i.e. they differ in their shape, type, size, behavior and characteristics. Therefore they are found in different habitat. The aggregate form of the number of living organism, its type, gene and ecosystem is called bio- diversity. In short, the biodiversity is the total number of living organisms on the earth or their difference.

Types of biodiversity

Bio-diversity can be classified into three groups:

1. Ecosystem diversity

There is close relationship between living beings, non-living things and physical environment. Due to this relationship, certain type of ecosystem is formed in any place. There are mainly two types of ecosystem, terrestrial and aquatic ecosystem. There is also diversity in these ecosystems due to difference in land topography and climate. Ecosystem of sea, river, pond, lake, stream, wetland, etc. are different types of aquatic ecosystem. Likely, the ecosystem of hill, valley, terai, desert, etc. also differ. There is much diversity in terrestrial and aquatic ecosystems of Nepal due to its land topography and climate. There is much diversity in creatures and vegetation of our country due to the difference in these ecosystems.

2. Species diversity

The living organism of the earth are not similar. All living beings somewhat differ from each other. Member of one species of plants or animals differ from each other. The vegetation around us is distinguished on the basis of their names like tree, bush, algae, moss and vines. On diversity, the basis of their differences, their names and types also differ. Similarly, to differentiate animals in terms of their types and species, they are named as cow, buffalo, chicken, goat, grasshopper, etc. Though they seem similar to each other physically each species has distinct differences. For example, cow and buffalo are mammals but they are classified into different species due to

the differences of various characters. This type of differences or varieties between the species is called species diversity.

3. Genetic diversity

Parental features are genetically transmitted to their offsprings. The chemical unit which transmits the parental character from parents to their offspring is called gene. The differences in genetic groups and its type within the species are called genetic diversity. Genetic diversity also increases with increase in population. Genetic diversity clarifies the distinct variation within species, for example, Negros, Aryan and Mongol under human beings.

Activity: 1

Study the biodiversity around your residential area. Ask the local people about the plants and animals in that area .Write names of any five plants and animals each that you have seen in your area, their benefits and ways to protect them, write in table.

S.N.	Name of plant	Advantage	Way to protect
1			
2			

S.N.	Name of animals	Advantage	Way to protect
1			
2			

Principles of sustainable development

Development is the process of bringing improvement in any field or sector. Humans perform various reformative works for their prosperity. In this process, people interfere the natural environment to build artificial environment. As a result, the natural environment goes to deteriorate. If the natural environment is deteriorated, it also damages the man made environment. Therefore, developmental activities should be carried out protecting the natural environment. This kind of development is called sustainable development. It provides benefits to the present and future generations. Therefore, sustainable development is also called durable development. Sustainable development promotes the conservation and protection of human beings and the earth. Therefore, developmental activities must be favorable for the environment. The main principles of sustainable development are as follows.

a. Conservation of ecosystem

The main goal of sustainable development is to conserve and protect the earth for long time. Various ecosystems like land, water under the earth are to be conserved for its durability.

b. Conservation of biodiversity

All the creatures of the earth should be protected for sustainable development.

People should conserve the natural resources to protect the creatures. National and international programmes need to be launched for the conservation of the living beings.

c. Sustainable development of society

The social development work should be conducted for sustainable development. The living standard of human being should be improved for it. The sustainable development of the society can be done by providing different facilities like education, health, employment, security, etc.

d. Population control

Human beings live by utilizing the limited resources of the earth. Rapid population growth causes increase in the demand of people but resources of the earth cannot be increased according to the human needs. So, it is necessary to control population to keep a balance in environment.

e. Development of human resources

The man has profound role to play in utilizing and conservation of the environment. The knowledge and skill for protecting earth should be developed in people. The human resources can be developed by providing the facilities of education, health, etc.

f. Increase in people participation

The sustainable development cannot be ensured by only one person's efforts. It requires the participation of all people. The people's participation should be increased in each and every programme in order to ensure sustainable development.

g. Conservation of cultural heritage

Man made social norms and values, tradition, custom, religious places and culture are called cultural heritage. The sustainable development has given emphasis on the conservation of cultural heritages. It is our duty to conserve the religious, cultural tradition by avoiding superstition.

h. Included within carrying capacity of earth

The developmental work on the earth carried by the people should be within capacity of availed resources. The carrying and bearing capacity of the earth is limited .The resources available in the earth cannot fulfill the unlimited needs of the people. The excessive utilization of natural resources affects the environment negatively. So, we have to conduct development activities considering the carrying capacity of the earth.

Activity: 2

Observe the different activities performed by the people around in your residential area for one week. Write the things in your exercise book that you deserve. Among

them, which activities are carried out in line with the concept of sustainable development and which are not? Write with reasons

S.N.	Peoples activities	Concept related to sustainable development		
1		Match it	Do not match	Why
2	……	……	……..	……..
3.				

Efforts for sustainable development in context of world:

In 1983, the general assembly of the united nations formed the global commission of environment and development under the chairmanship of the then primenister Gro, Harlem Brunt land of Norway. In 1987 this commission brought a concept of sustainable development. This commission published the report "our common future" including the concepts of sustainable development. According to this commission "the need of the future generations should not be compromised while meeting the need of present generation" is called sustainable development.

Similarly, the conference on 'environment and development' was held in Rio di Jeneraio in 1992, it focused on the conservation of environment to obtain sustainable development. World food organization also focuses on the conservation and management of environment for the fulfillment of the need of future generation. In this way, the following points for sustainable development are taken into consideration.

(a) Care of nature and natural resource management
(b) Investment in environment
(c) Conservation of biodiversity
(d) Conservation of ecosystem
(e) Pollution control
(f) Population control and poverty alleviation
(g) Increase in public participation
(h) Nongovernmental organization and collective group formation
(i) Conservation for future generation

Importance of sustainable development:

Sustainable development is essential for the environmental conservation. The developmental works should not harm the environment. If these activities affects the environment, it makes the failure of developmental work. The importance of sustainable development are described as follows,

a) Appropriate use of resources

We should use technology in order to get maximum benefits using minimum resources. The use of minerals, water, insecticide, chemical fertilizer, etc should be

minimized. The sustainable development learns the concept of "waste not" while using these resources.

b) Sense of responsibility

The sustainable development is to bring changes in knowledge, skills and attitudes of an individual. The people take the sense of responsibility of utilizing and protecting of natural resources. It creates the feeling that these resources are common property It creats the feeling in us for the protection and conservation of common natural resources together.

c) Development of basic aspect

Sustainable development emphasizes on the development of health, education, agriculture, tourism and social reform, which are needed for the betterment of human welfare. The protection and conservation of environment is to be carried out in integrated form while developing this aspect.

(d) People participation based development

Sustainable development encourages people participation. It creates interest in local people for developmental works and environmental conservation. Along with, it also helps to conserve and protect the environment.

(e) Determination of the limit of development

People use unlimited resources for the fulfillment of their basic requirements. The non-renewable means and resources of the earth will be finished. Therefore the development should be done within the limit of the capacity of the earth. Sustainable development determines the how much development should be done.

(f) Long term vision

Sustainable development preserves the present developmental achievements for future and it conserves the available resources. It concerns with the right of future generation. Hence it develops the sense of sustainability in human beings. This positive attitude helps to preserve the earth and its resources.

Project work

Observe the ongoing developmental activities in your surroundings. What are the impacts of these developmental activities on environment ? Whether these activities are in favour of sustainable development or not, write a report with reasons.

Exercise

1. Fill in the blanks with appropriate word.

a) The aggregate form of number, types, gene, ecosystem of living beings is called …… .

b) Biodiversity is generally classified into …….types.

c) Sustainable development is also called ……development.

d) The developmental works and activities of human beings should

be ……..to the earth and its resources.

e) Sustainable development focuses on the ……of cultural heritages.

2. Choose the correct answer from the given answers.

a) Which factor carries the parental character from parents to offspring?
i) cell ii) heredity iii) blood iv) tissue

b) What does it mean by one species is different from another species?
i) ecosystem diversity ii) genetic diversity
iii) species diversity iv) habitat diversity

c) Which of the followings is focused to conserve and promote by sustainable development?
i) animals ii) plants iii) human beings iv) all of the above

d) What does increase in participation mean?
i) increase in human concern ii) increase in human presence
iii) increase in positive attitude of human iv) all of the above

e) What does long term vision mean ?
i) development and construction ii) conservation for future
iii) development based on own aspiration iv) use immediately

3. Write short answer.

a) What is biodiversity?
b) What does ecosystem diversity mean?
c) How can biodiversity be conserved?
d) What are the importances of sustainable development? Write any two.

4. Write the principles of sustainable development in points.

5. Write the world wide efforts for sustainable development.

6. Write short notes on.

i. species diversity ii. conservation of cultural heritages
iii. population control iv. appropriate use of resources

7. What does determination of limit of development mean?

8. Write differences

a) developmental activities and environment conservation
b) development and sustainable development