

BASIC SCIENCE

PART - 1

STANDARD VIII



**Government of Kerala
Department of General Education**

Prepared by

State Council of Educational Research and Training (SCERT), Kerala

2025

THE NATIONAL ANTHEM

Jana-gana-mana adhinayaka, jaya he
Bharatha-bhagya-vidhata.
Punjab-Sindh-Gujarat-Maratha
Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
Uchchala-Jaladhi-taranga
Tava subha name jage,
Tava subha asisa mage,
Gahe tava jaya gatha.
Jana-gana-mangala-dayaka jaya he
Bharatha-bhagya-vidhata
Jaya he, jaya he, jaya he,
Jaya jaya jaya jaya he!

PLEDGE

India is my country. All Indians are my brothers and sisters.

I love my country, and I am proud of its rich and varied heritage.

I shall always strive to be worthy of it.

I shall give my parents, teachers and all elders, respect and treat everyone with courtesy.

I pledge my devotion to my country and my people. In their well-being and prosperity alone lies my happiness.

BASIC SCIENCE

VIII

Prepared by

State Council of Educational Research and Training (SCERT)

Poojappura, Thiruvananthapuram 695012, Kerala

Website : www.scertkerala.gov.in, e-mail : scertkerala@gmail.com

Typeset and design by : SCERT

Printed at : KBPS, Kakkanad, Kochi

© Department of General Education, Government of Kerala

Friends,

This textbook contains fundamental information and a variety of activities for observing deeply and studying the environment in which we live. When you observe in this way, you can understand the features of creatures and things, and the connections among them. The book also provides the opportunity to understand the basic factors that influence human life as a social animal. This book includes many activities that you can do along with your friends. The Basic Science textbook offers occasions for creating knowledge through fun activities including observation, queries, discussions, debates, simple experiments, and projects. We hope that the information given in the textbook will prompt you to seek out further knowledge.

Learn and enjoy..

Wishes,

Dr. Jayaprakash R. K.

Director
SCERT, Kerala

TEXTBOOK DEVELOPMENT COMMITTEE

Advisor

Dr. Salahudheen Kunju A.
Principal (Retd.), University College,
Thiruvananthapuram

Chairman

Dr. K.J. Abraham
Associate Professor (Retd.),
Maharajas College, Ernakulam

Experts

Dr. Sangeetha C.
Asst. Professor,
SNGS College, Pattambi

Dr. Vaisakhan Thampi
Asst. Professor,
M.G. College, Thiruvananthapuram

Sanu V.K.
Senior Lecturer (Retd)
DIET, Idukki

Participants

Premachandran K.V.
HM, GVHSS Ndakkavu, Kozhikode
Anie Varughese
HST (Retd), GHSS Kudamalur, Kottayam
Geetha P.O.
HST, GVHSS, Chirakkara, Thalassery
Surendran K.
HM (Retd.) GHS Azhiyur, Kozhikode
Sajeev Thomas
DPC, SSK, Kollam
Prakash Narayanan P.
AEO (Retd), Cherpulassery, Palakkad
Rameshan P.
HST (Retd.), NAMHS Peringathur, Kozhikode

Sreeraj S.
HST, KMG VHSS Tavanoor,
Malappuram
Ranjith E.
HST, KVR HS, Shornur, Palakkad
Unnikrishnan I.
HST, GHSS Perinthalmanna, Malappuram
Aneesh S.
HST, MESHSS Irumbiliyam, Malappuram
Simla P.C.
HST, PBMGHSS Kodungallur, Thrissur.
Deepthi E.P.
BPC, BRC Panthalayani, Kozhikode

Artists

Rajeev N.T., Gireesh Peruvaka, Aruna Narayanan
Alanchery, Abhilash Theruvoth

Cover design

Sreeja Pallam

English Version

Dr.E.K.Simil Rahman
HST, KMHSS Kuttoor North, Malappuram
Geetha Nair S
HSST Jr, GVHSS for Girls, Nadakkavu,
Kozhikode
Anie Varughese
HST (Retd), GHSS Kudamalur, Kottayam

Geetha P.O.
HST, GVHSS, Chirakkara, Thalassery
Aneesh S.
HST, MESHSS Irumbiliyam, Malappuram
M.A. Poulouse
HM (Retd), GUPS Kallinkara, Wayanad

Academic Co-ordinator

Dr. Vineesh T.V.
Research Officer, SCERT Kerala



State Council of Educational Research and Training (SCERT) Kerala

Vidyabhavan, Poojappura, Thiruvananthapuram - 695 012

Contents

1	Measurement and Units	07
2	Motion and Force	23
3	Pressure	37
4	Chemistry of Changes	51
5	Elements and Compounds	67
6	Metals and Non-Metals	85
7	Let's Cultivate and Reap Goodness	102
8	Origin of Life, Origin of Living Things	122
9	Cells and Cell Clusters	134

Certain icons are used in this textbook for convenience



For further reading
(Evaluation not required)



Let's assess



Extended activities

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a **¹[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the **²[unity and integrity of the Nation]**;

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

MEASUREMENT AND UNITS

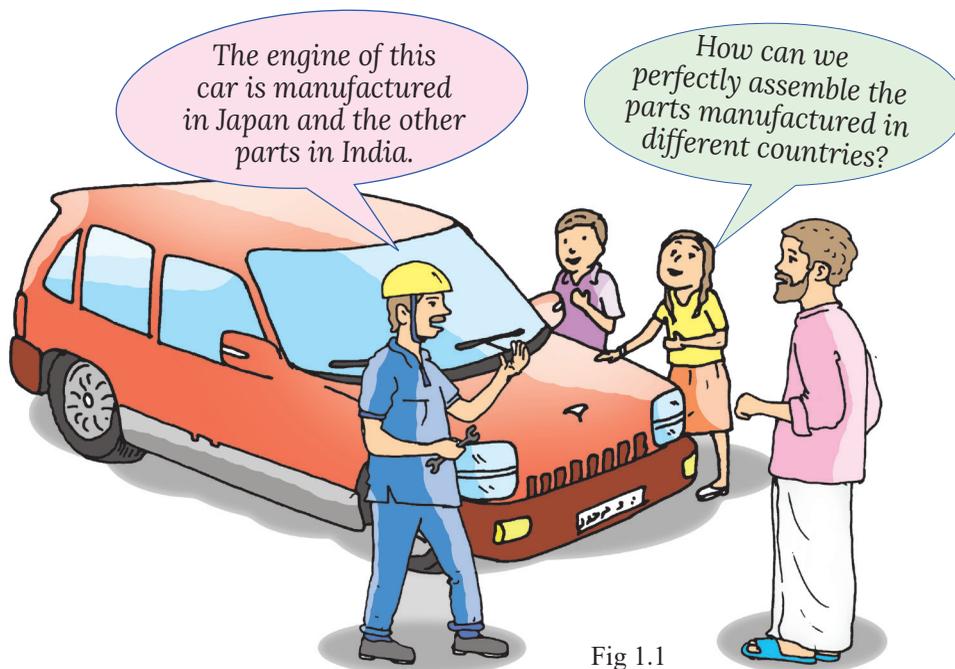


Fig 1.1

Have you noticed the child's question? What is your opinion?

Write it.

To solve such problems in our daily life, it is necessary to measure and state the characteristic properties of objects and phenomena. Such measurable quantities are physical quantities.

Observe the following situations in our life. Find the physical quantities in each of them.

Record the quantities you identified, in the table.



Fig. 1.2

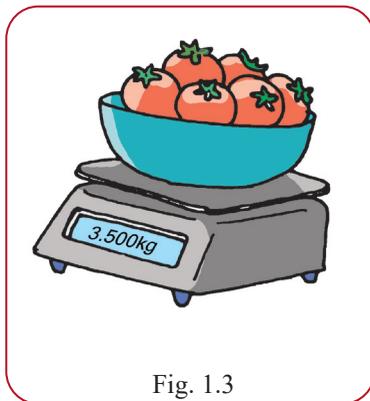


Fig. 1.3

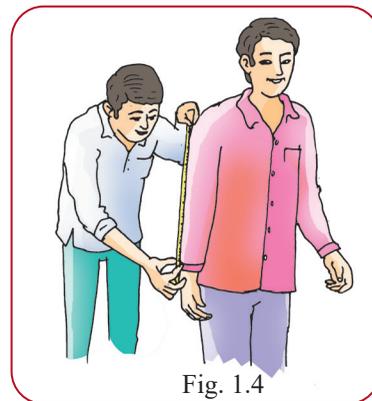
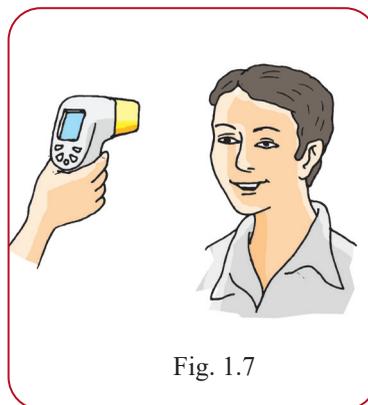
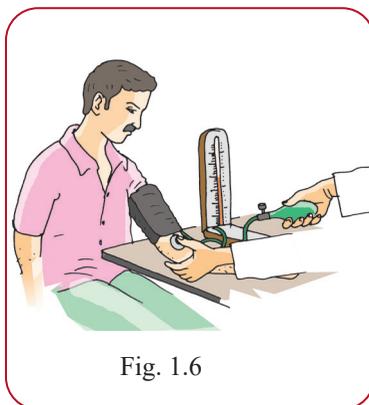
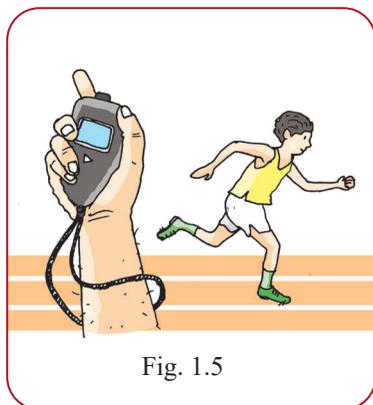


Fig. 1.4



	Situation	Physical Quantity
1	Measuring the depth of a pit	Length
2	Measuring the weight of vegetables	Mass
3	Taking measurements by a tailor	
4	Using a stopwatch in a race	
5	Measuring blood pressure	
6	Measuring body heat	

Table 1.1

In all the above situations, physical quantities help solve the practical problems suitably.

Find and write more physical quantities that you are familiar with.

-
-

Can all the physical quantities be measured directly? In situations where direct measurement is not possible, can you write them with reference to other physical quantities?

Fundamental Quantities and Derived Quantities

There are many physical quantities. Among them length, mass, time, electric current, temperature, amount of substance and

luminous intensity are called fundamental quantities. All other quantities can be expressed in terms of these fundamental quantities. If so, what is a fundamental quantity?

Fundamental quantities are quantities that exist independently and cannot be expressed in terms of other quantities.

Find out the physical quantities mentioned in the table 1.1 and list them below.

- Length
-
-
-

In our daily life, do we use fundamental quantities only?

Look at the pictures. What are the physical quantities in these situations?

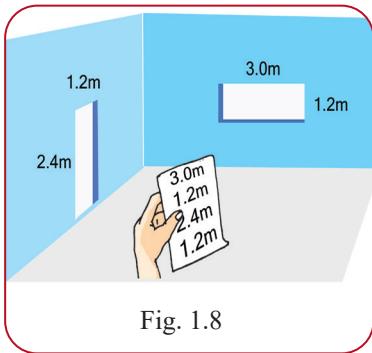


Fig. 1.8

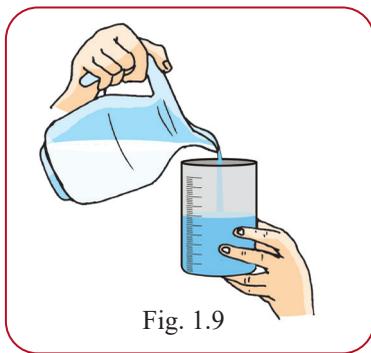


Fig. 1.9

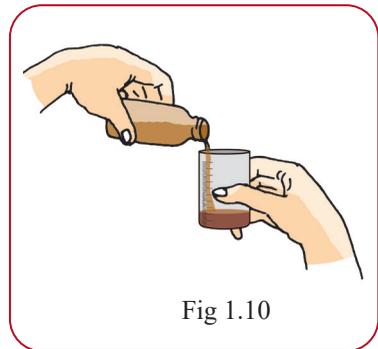


Fig. 1.10

- Area
-

Record how each of them is found out and complete the table appropriately.

Situation	Physical Quantity	Method of Finding
For painting the wall	Area	Area = x Width
Measurement of medicine/liquid	Volume	Volume = Area x

Table 1.2

- Which are the quantities used here to find area and volume?
- All of them are distances between two positions, aren't they?

The distance between two positions represents a physical quantity called length. We have used the fundamental quantity of length to find the quantities of area and volume. Such quantities that can be found out using fundamental quantities are called derived quantities. Now, write a definition for derived quantities.

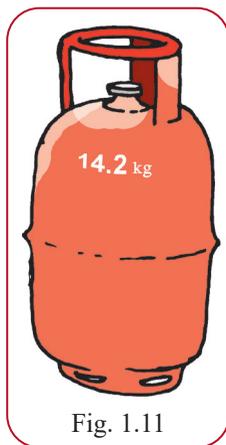


Fig. 1.11

Quantities that can be expressed in terms of fundamental quantities are derived quantities.

See, how the mass is marked on a gas cylinder.

Mass marked on the cylinder = _____ kilogram

Here, the physical quantity of mass is indicated using a numerical value i.e., 14.2 (magnitude) and a unit i.e., kilogram.

Similarly, complete the table with the physical quantities shown in the pictures below, along with their numerical values and units.

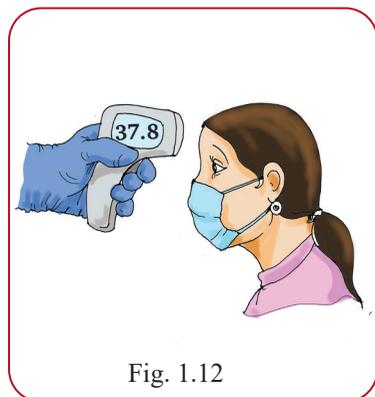


Fig. 1.12

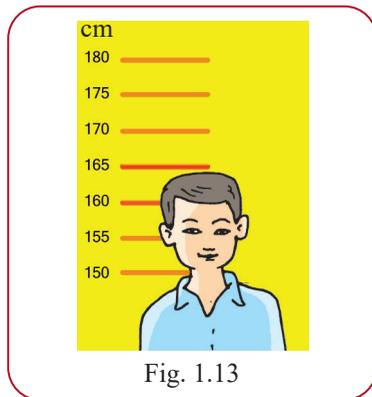


Fig. 1.13

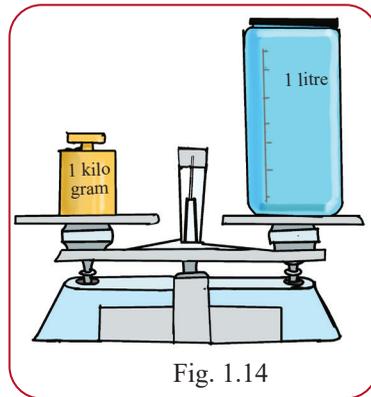


Fig. 1.14

Situation	Physical Quantity	Numerical Value	Unit	Mode of marking measurements
Fig. 1.12	Temperature	37.8	Celsius	37.8° C
Fig. 1.13				
Fig. 1.14				

Table 1.3

What can be understood from the table above?

A physical quantity is expressed by a number indicating its value followed by its unit.

Units of Physical Quantities

Mark the height of a child in your class on the wall using a pencil as shown in the figure. Each one in the class may measure the height using two sticks of different lengths. Record the measurements in your Science Diary.

Fill a bucket with water. Measure the water in it with two glasses of different sizes (Figure 1.16). Write down the measurements in the Science Diary.

Tabulate the measurements from both the activities written in the science diary.



Fig.1.15

Activity	Physical quantity	Reference object used for Measurement	Recorded Quantity
Measuring the height of the child	Length	Longer stick	----- stick
		Shorter stick	----- stick
Measuring the quantity of water	Volume	Larger glass	----- glass
		Smaller glass	----- glass

Table 1.4



Fig.1.16

Analyze the table. Two different reference objects were used in each case to determine a physical quantity.

- In both cases, are the measurements obtained the same?
- Why are the measurements not equal?
- When everyone uses the same reference object, isn't measurement the same?

When a physical quantity is measured anywhere in the world, the measurement should be the same, right? For this, everyone should adopt a fixed reference. This is called the unit of a physical quantity.

A unit is a standardized reference accepted generally to measure a physical quantity.

In the past, different units were used for measurement and recording in each region. For example, units like the foot, cubit and hand span were used locally to measure length.

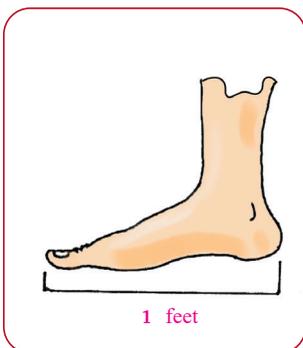


Fig. 1.17

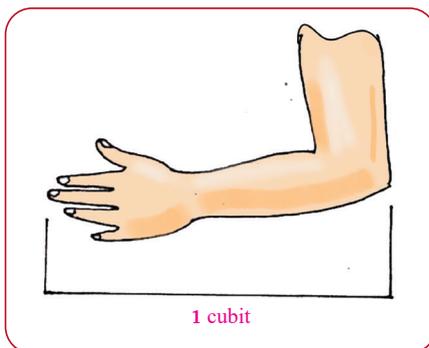


Fig 1.18

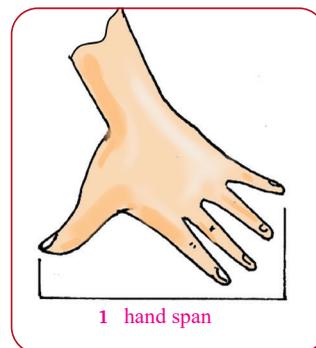


Fig 1.19

Different units were also used in other countries. What would be the practical problems of using these units?

- Low accuracy
- Difficulty for the people in other regions to analyse measurements
-

But today, the unit 'metre' is used everywhere in the world to measure length. Similarly, there are internationally accepted units for all other physical quantities. This is called the International System of Units, abbreviated as 'SI' units. Measurement using the SI units always has a universal result.

Now you might have understood how parts of vehicles and equipment we use, even if manufactured in different countries, can be perfectly assembled in any factory in the world.

Different units are required for the same physical quantity in various contexts. Larger units are used for larger quantities and smaller units for smaller quantities.

Different Units of Length

The SI unit of length is metre.
Its symbol is 'm'

Centimetre, millimetre, kilometre, etc. are the other units of length. Let's get familiar with them.

The picture shows part of a metre scale.



Fig.1.20

Take a metre scale from the science lab and examine it. You can see small and large lines on the metre scale. The distance between two consecutive large lines is one centimetre and the distance between small lines is one millimetre.

Now complete the following relationship given below.

1 metre = centimetre
1 centimetre = millimetre
1 metre = millimetre

Are there situations where we have to use smaller measurements?

Pay attention to the notice of a municipality.

Prohibited

The sale of plastic bags below 30 micron is prohibited in shops within the limit of the municipality with effect from 30.10.2022.



Fig. 1.21

What is the measurement mentioned in the notice? Micron is the abbreviation of micrometre. How many micrometres would make one metre?

1 metre = 1000000 micrometre



The term "light speed" is used to refer to a very high speed. What is the speed of light?

The light travels at a speed of 299,792,458 metre per second in vacuum. The distance that light travels in $\frac{1}{299,792,458}$ of a second is accepted as the SI unit of length.

The distance travelled by light in one second = 299,792,458 metres.

Distance travelled by light in $\frac{1}{299,792,458}$ second = 1 metre.



Fig. 1.22

There are also situations where we need units larger than metre.

The abbreviation "km" on the traffic sign stands for kilometre.

1 kilometre = metre

Are there situations where we need even larger units? Read the following excerpt from a science article.

Scale of the Solar System

Astronomical Unit (AU) is the average distance from the Earth to the Sun. It is approximately 150 million kilometre. A light year is the distance light travels in a year in vacuum. Light travels at a speed of approximately 300,000 km/s.

Discuss the situations where the units mentioned in the article are used.

Different units of mass

Look at the picture of weighing apples in a shop. The weight is measured by placing weight blocks on one side of the scale.

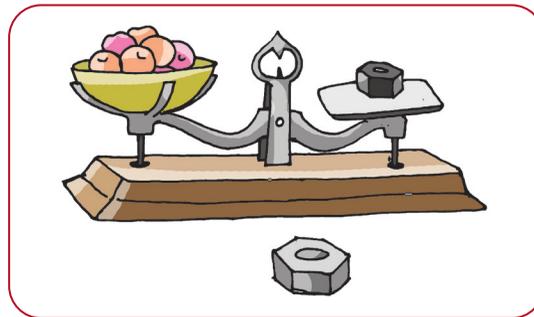


Fig. 1.23

- Here, why are weight blocks placed on one side?

This is done to ensure that the apples taken have the same mass as weight of blocks.

The amount of matter contained in a substance is its mass.

Examine the picture of the weight blocks shown in figure 1.24.

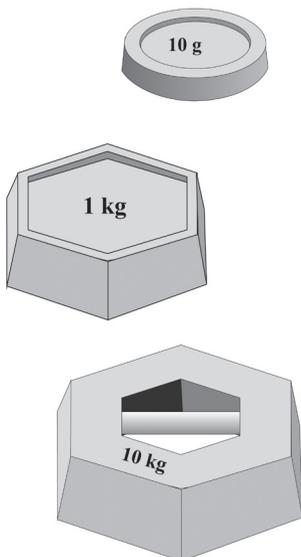


Fig. 1.24

What is written on them?

The unit of mass is the kilogram. Its symbol is 'kg'.

Do we need units other than kilogram for mass? You might have noticed the quantity of toothpaste and tablet printed on their packages. What does it mean?



Fig.1.25

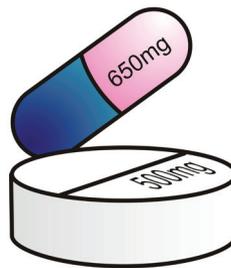


Fig.1.26

**Milligram and gram are the smaller units of mass.
1 gram = 1000 milligrams**

Have you heard of any larger units of mass? You might have seen trucks carrying load. Which are the larger units commonly used in such situations?

Quintal and tonne are the larger units of mass.

Identify the relationship between the units of mass and kilogram from the table given below.

Unit	Relation to kilograms
Milligram	1 kilogram = 1000000 milligram
Gram	1 kilogram = 1000 gram
Quintal	1 quintal = 100 kilogram
Tonne	1 tonne = 1000 kilogram

Table 1.5

Different Units of Time

The SI unit of time is the second. Its symbol is 's'.

Minute and hour are the other units used to denote time. Identify the relationship between these units and 'second'.

Unit	Relationship with second
Minute	1 minute = second
Hour	1 hour = second

Table 1.6

Volume

The volume of an object is the amount of space it occupies. Do you remember measuring the volume of water in a bucket? What is the unit of volume?

*The SI unit of volume is cubic metre.
It's symbol is m^3 .*

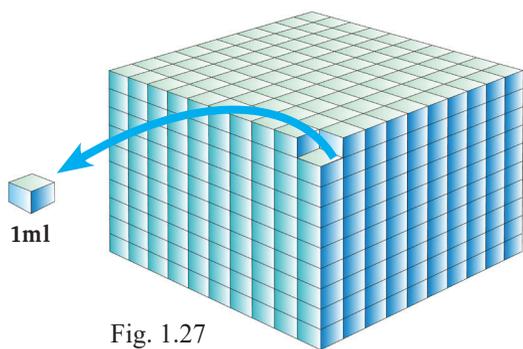


Fig. 1.27

The figure shows thousand cubes each with sides of 1 cm arranged to form a large cube. If volume of the large cube is 1 litre, can you complete writing the relationship between various units based on the figure?

1 litre = 1000 cm^3

1 litre = millilitre

Density

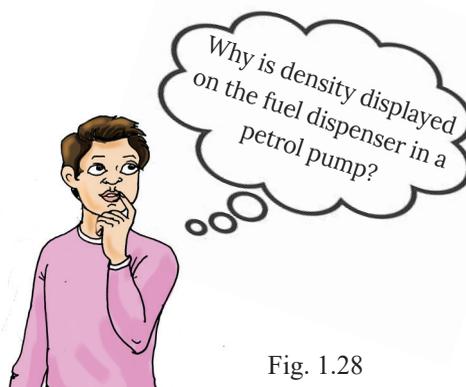


Fig. 1.28

Take a cardboard box and calculate its volume. Fill it with sawdust and measure its mass. Then replace it with sand and find its mass. Tabulate the findings.

Substance	Mass	Volume	$\frac{\text{Mass}}{\text{Volume}}$
Sawdust			
Sand			

Table 1.7

$\frac{\text{Mass}}{\text{Volume}}$ represents the mass of a substance per unit volume.

The mass of a substance per unit volume is called its density.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

In the table given, even though the volume of sawdust and sand is the same, see how the mass per unit volume is calculated.

If volume is the same, objects with higher mass will have higher density. In the case of a particular substance, density is a fixed number.

Now you can understand why density is displayed on the fuel dispenser in a petrol pump.

Fundamental Units

In 1960, an international conference held in Paris approved the International System of Units or SI units as the universal system of units for measurements. Under this system, units were assigned to all the fundamental quantities.

Fundamental units are the units of fundamental quantities.

Note the fundamental units and their symbols given below.

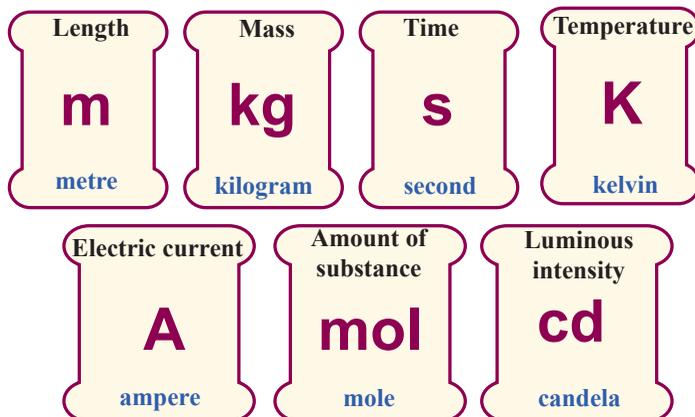


Fig. 1.29

What are the characteristics of SI units?

- They are standardised units.
- They are internationally accepted.
- Units of all other quantities can be expressed in terms of these units.

Derived Units

We have learned about derived quantities. Such as volume and density, whose units are obtained from fundamental units.

We can write the derived units by relating fundamental units one another. Derived units are formed using fundamental units. See how derived units are formulated in the table given.

Derived Quantities	Equation	Unit
Area	Area = length x breadth	m x m = m ²
volume	Volume = length x breadth x height	
Density	Density =	

Table 1.8

Now try a definition for derived units.

Derived units are units that can be stated using fundamental units or that depend on fundamental units.

Rules for writing the units

What are the rules to be followed internationally when writing units and their symbols?

Observe the correct notation of units for two physical quantities.

Quantity	Unit
Mass of 1.5 litre of water	1.5 kg
Density of water	1000 kg/m ³ 1000 kilogram per cubic metre

Table 1.9



Fig. 1.30

The table below shows common errors that may occur when writing units. Compare each of these with the correct version and suggest a general rule for each.

Unit written incorrectly	General rules
1000 KG/M ³ 1.5 KG	Use lower case of the English alphabet
1000 kgs/m ³ 1.5 kgs	.....
1000kg/m ³ 1.5kg	.....
1000 kg/m/m/m	.....
1000 kg/cubic metre 1000 kilogram per m ³	Do not mix a symbol of a unit with the name of the unit.
1 kg 500g	.....
273 Kelvin 250 Metre	Use only lowercase letters when writing the name of a unit instead of its symbol

Table 1.10

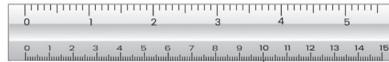
Now let us get familiar with some other rules.

Physical Quantity	Correct method	Incorrect method	Rule
Force	N	n	The symbols of the units formed from the names of individuals should be written using uppercase of the English alphabet.
Length	60 cm is the length of the desk.	60 cm. is the length of the desk.	No full stop or comma should be used after the symbol. They can be used at the end of the sentence.
	The length of the desk is 60cm.	The length of the desk is 60cm	
Energy	N.m N m	Nm	A full stop/space should be used between the units formed as multiples of units.

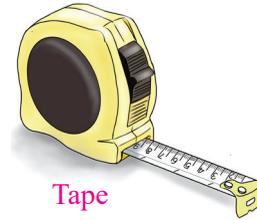
Table 1.11

Measuring Instruments

What are the instruments used to measure length? Look at the picture given.



Scale



Tape

Table 1.31

Measure the length of a pen using a scale and write it down. Also, use a measuring tape to determine your height.

What is the unit on the scale/tape used?

- Length of the pen =
- Your height =
- What is the smallest measurement possible using the scale/measuring tape?

The smallest value that can be measured using an instrument is called its least count.

The least count of a commonly used scale is 0.1 cm. Are there instruments with a least count smaller than this? Find out and write.

Can you find the thickness of a paper using a scale?

Measuring the thickness of papers using a scale

The figure shows some papers stacked together. Measure the thickness of the paper stack and write it down.

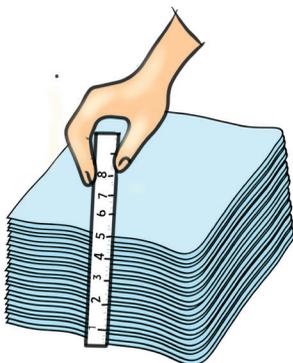


Fig. 1.32

Number of papers in the paper stack =

Thickness of the paper stack =

Thickness of one paper = $\frac{\text{Thickness of the paper stack}}{\text{Number of papers}}$

=

Measuring the volume using a measuring jar

Let's try to the volume of a stone. Pour some water into a measuring jar and mark its level. Tie the stone with a thread and dip into the water. Observe the rise in the water level. From this, we can calculate the volume of the stone which is equal to the volume of water displaced.

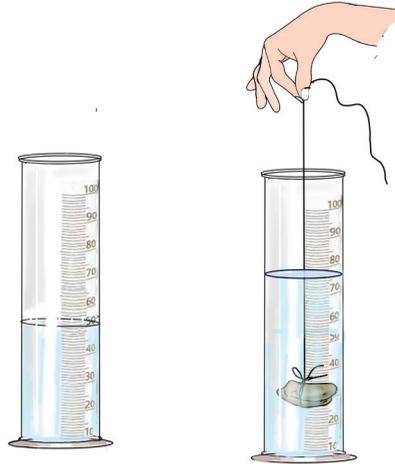


Fig. 1.33

- What unit is used in the measuring jar?
- What is the least count of the measuring jar?

Initial water level before dipping the stone =

Water level after dipping the stone =

Volume of the stone =

Measuring time using a stopwatch

A stopwatch is used to measure a time intervals. As shown in the figure, tie a metal ball using a thread and hang it. Pull the ball slightly and release it to oscillate. Observe the motion. Measure the time taken for 10 oscillations using a stopwatch. Record the measurement.

Time required for 10 oscillations =

A good understanding of physical quantities will help you in further studies and on the proper use of measurement and units in daily life.

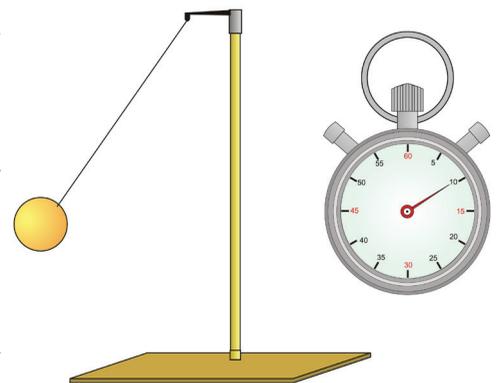


Fig.1.34



Let's assess

1. Identify the odd one out in each group and explain common features of the others.

- I a) Kilogram b) Kilometre c) Second d) Mole
- II a) Time b) Area c) Mass d) Electric current
- III a) Metre b) Kilogram c) Second d) Degree Celsius

2. Different units of length are given below. Fill in the table below.

Unit	Relationship with metre
Kilometre	1 km = metre
Millimetre	1 m = millimetre
Centimetre	..... cm = 1 m

3. Convert the following measurements to SI units without changing their values.

- a) 2000 g b) 1 h c) 1.5 km d) 200 cm

4. Different units of mass are given below. Arrange them in the ascending order of their values.

- a) Kilogram b) Milligram c) Quintal d) Gram



Extended Activities

- Identify the different units used in our locality for measuring length and mass in the past.
- Prepare a seminar paper on the rules to be followed when writing 'units'.

2

MOTION AND FORCE



Fig. 2.1

Teacher : Children, are you still sitting in the same place where you were when the class started?

Student : Teacher, we haven't moved from our place.

Teacher : No, your position has been changed

Why does the teacher say that the children's position has been changed?

In our daily life we always engage in some activities. We move in various situations like running, playing and walking. A bird flying, a car running, leaves swaying in the wind - all these are different forms of motion.

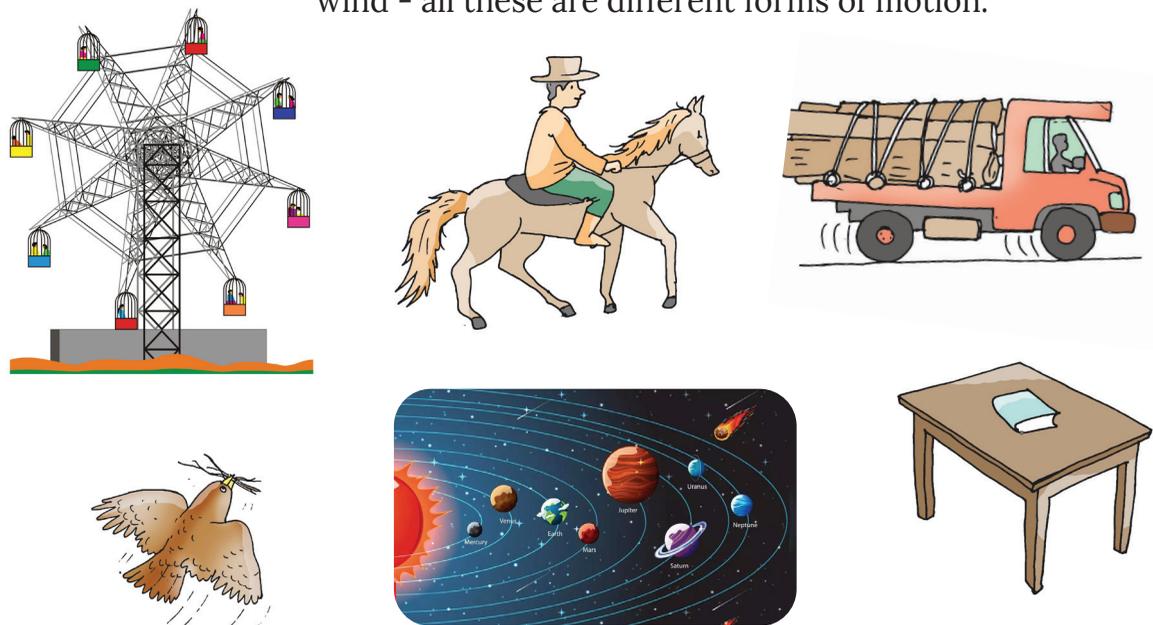


Fig. 2.2

How can we understand whether an object is moving? Let's analyze the picture given above. What are the situations shown in the figure 2.2?

- Child sitting on a moving giant wheel •
- •
- •

Tabulate the situations that the objects change their position relative to the surroundings and those do not.

Objects changing position relative to surroundings	Objects not changing position relative to surroundings
•	•
•	•

Table 2.1

Objects that change the position with respect to their surroundings are considered to be in motion, while those that do not change position are considered to be stationary.

Is a child sitting on a moving giant wheel in motion relative to the child sitting near by? What does a person standing on ground see?

The above situations are given in the table below. Complete the table suitably by putting ✓ marks.

Context	The reference object	State of motion	State of rest
Child on a moving giant wheel	child sitting near by		
	A Person standing on the ground		
Person riding a horse	The Horse		
	The Ground		
Twig in the beak of a flying bird	The Bird		
	A Person standing on the ground		
Earth in the solar system	The Sun		
	The Moon		
Log of wood in a moving lorry	The Lorry		
	The trees on either side		
A book on a table	The Table		
	The Sun		

Table 2.2

What can we infer from the table? To determine whether an object is moving, we need to refer to another object. The object that is used as a reference is called the reference object.

The object taken to determine the state of motion or the state of rest of a body is called the reference object.

If an object changes its position relative to the reference object, it is said to be in motion, and if it does not change position, it is said to be stationary. Moving objects undergo

a change in position. Let's try measuring the change in position.

Distance

The picture of a 400 m track is given below.

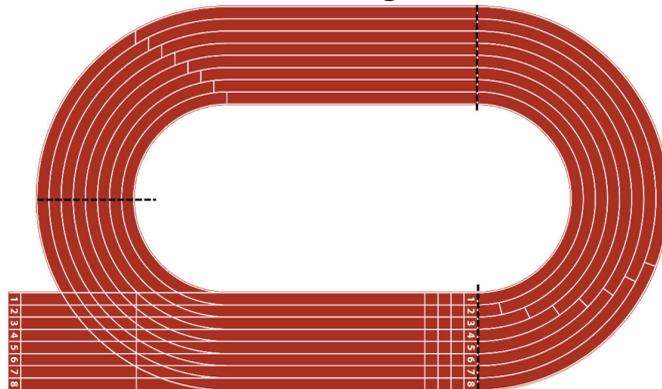


Table 2.3

What will be the length of the path travelled by an athlete completing two rounds on this track?

Odometre



Fig. 2.4

*Distance is the length of path travelled by an object.
The SI unit of distance is metre.*

Have you ever seen the device that shows the distance travelled by vehicles? It is called an odometre. An odometre records distance in kilometre.

Since 1 km = 1000 m, calculate how far a vehicle has travelled so far, according to its odometre.

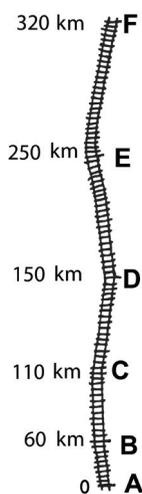


Fig. 2.5

Figure 2.5 shows a railway track from A to F. Note down the distance traveled by the train upon reaching each place.

Place	Distance traveled
At A	
While reaching B	
While reaching C	
While reaching D	
While reaching E	
While reaching F	

Table 2.3

Speed

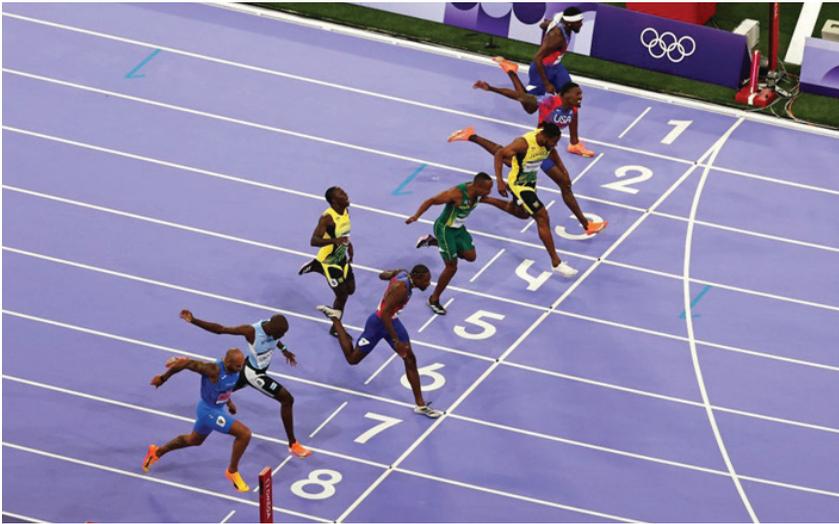


Fig. 2.6

A photo finish picture of the 100 m race in the Olympics is given above. How would the winner be decided? The athlete who completed 100 m in the least time would be the winner.

Let's do an experiment.

Take a tall glass jar. Mark the top and bottom as A and B, respectively. Fill the glass jar with glycerin and drop a stone from the top. Start the stopwatch when the stone reaches A. Stop the watch when the stone reaches B.

- Time taken for the stone to reach B =
- Distance travelled =
- Distance travelled by the stone in one second =

The unit of speed is m/s.

Speed is the distance travelled by an object in unit time. The SI unit of speed is m/s.

Although the SI unit of speed is m/s, the speed of vehicles is usually expressed in km/h.

Observe the relation between km/h and m/s.

$$1 \text{ km/h} = \frac{5}{18} \text{ m/s}$$

Can you explain how this was calculated?

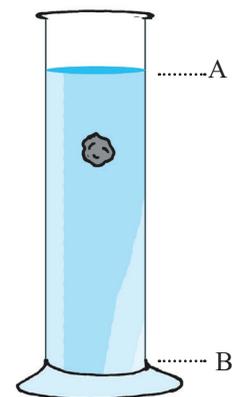


Fig. 2.7



Fig. 2.8

- Bus A traveled 75 m in 5 seconds. Bus B travelled 112 m in 7 seconds. Which bus was faster?

Speedometre is the device that shows the speed of a vehicle (Fig 2.8).

The details of 3 children who participated in a 400 m running race in school sports meet are given in the table below. Can we find the fastest athlete among them?

Child	Distance	Time	Speed
A	400 m	180 s	
B	400 m	120 s	
C	400 m	400 s	

Table 2.4

Here, speed is the distance traveled in one second. Will the distance traveled in one second always be the same? Let's check.

Uniform Speed, Non-uniform Speed

Look at the clock dial shown. Complete the table based on the movement of the tip of the second hand (P in the figure). You can measure the distance between different points using a thread, right?

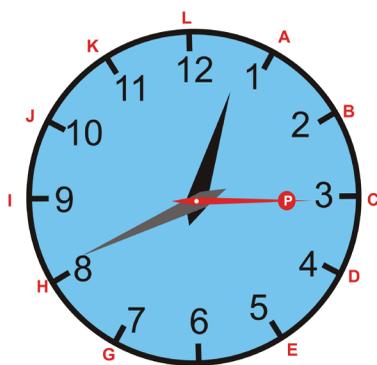


Fig. 2.9

Change in position	Distance (cm)	Time (s)
From A to C		10
From C to E		10
From E to G		10

Change in position	Distance (cm)	Time (s)
From A to D		15
From D to G		15
From G to J		15

Table 2.5

- What is the distance travelled in every 10 seconds?
- What is the distance travelled in every 15 seconds?

If an object covers equal distances in equal time intervals, it is said to have uniform speed. Let's write the definition of uniform speed.

If an object travels equal distance in equal intervals of time, it is in uniform speed.

In our daily life, are all movements like this?

Birds flying, humans walking, a ball rolling, etc., do not move with uniform speed. They move with non-uniform speed. Now, write a definition of non-uniform speed.

We see vehicles ranging from slow-moving bicycles to high-speed cars on the roads. Road accidents due to excessive speed and carelessness are daily news, aren't they? What can we do to avoid such road accidents? Discuss.

Now you have learnt about motion. Have you ever thought about the cause of motion?

Force

What do you see in the figure 2.10?

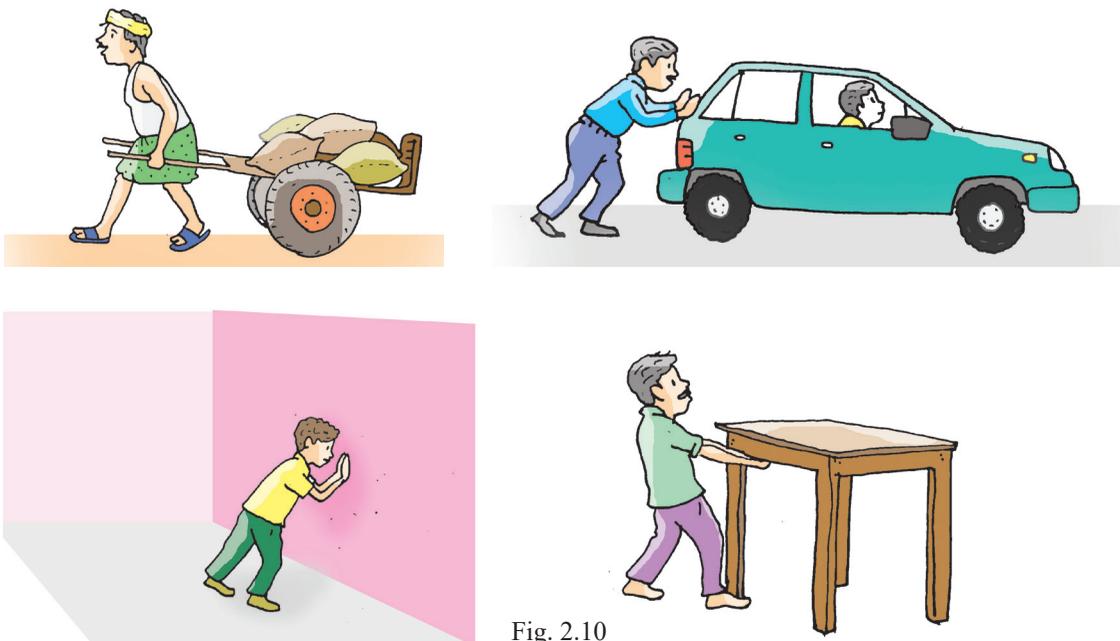


Fig. 2.10

Don't we see a push or pull in all the situations shown above? This is force. But, is force applied only during pushing and pulling?



Fig. 2.11

In figure 2.11, we can see that force is applied to change the shape and direction of the object and to stop a moving object.

Now, write the definition of force.

In all the situations shown above, force is applied through direct contact with the object. Is it necessary to have a direct contact in all the cases?

Contact Force, Non-contact Force

Examine the figures.

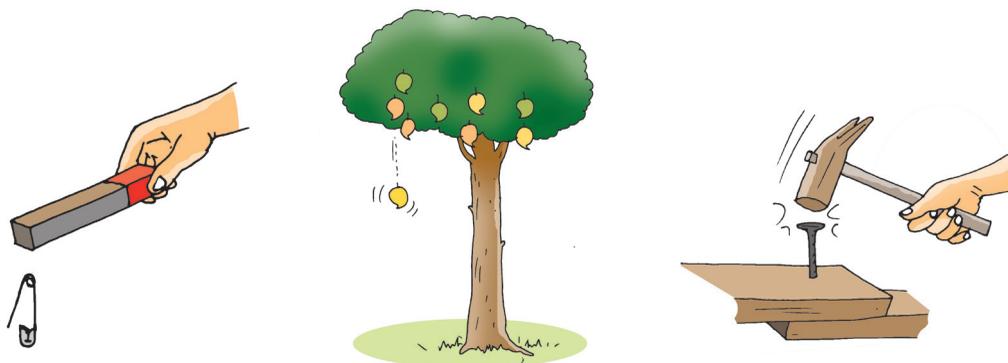




Fig. 2.12

Identify whether the force applied in each case is a contact or a non-contact force.

Situation	Force	Through Contact / Non-Contact
Mango falling downward	Earth's Gravitational Force	
Leaves swaying in the wind		

Table 2.6

The force experienced when objects come into contact with each other is called contact force. The force effected when there is no contact with the object is called non-contact force.

The standard unit of force is called the newton. It can be represented by the letter N. The capital letter is used because it is the first letter of the scientist's name.

Frictional Force

You must have noticed that a ball rolling freely on the floor gradually comes to rest. What is the force responsible for this?

Let's try an activity.

Take a wooden block and make one side smooth leaving the other rough. Slide its smooth surface down the inclined plane. Then try to slide its rough side down the inclined plane.



Sir Isaac Newton

Fig. 2.13



Fig. 2.14

What difference do you feel?

More force is effected against the movement on a rough surface. This is frictional force. You can see that the speed decreases with the increase in friction.

When a surface moves or tries to move over another surface, a parallel force is produced between them against their relative motion. This is frictional force.



Fig 2.15

Observe this activity (Fig 2.15).

Slide a heavy box on a rough surface. Then move the same box on a trolley with tyres. What difference do you see? Doesn't the box move faster? In this case, does friction increase or decrease?

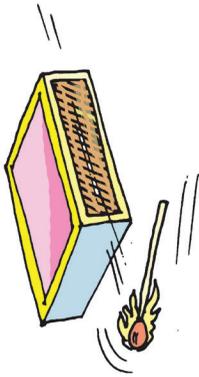
More friction occurs when sliding. This is called sliding friction. When using a trolley, the tyre rolls. This is rolling friction. Sliding friction is greater than rolling friction.

Where do we make use of friction in our life?

Friction in Daily Life

Rub your palms together. Do you feel the warmth?

The same thing happens when striking a matchstick and lighting a lighter.



Write down the advantages of friction.

- Helps to hold objects firmly.
- Helps us in walking.
- Helps vehicles to move without slipping.
-
-



Fig. 2.16

You have understood the benefits of friction.

Is friction always beneficial? Analyze the given situations below.



Tire wear



Knee wear

Fig.2.17

Does friction have any disadvantages?

- Surfaces in contact wears out.
- Obstructs smooth movement of machine parts.
-

Ways to reduce friction

To understand the ways to reduce friction, don't we need to know the factors that influence it?

Do this activity.

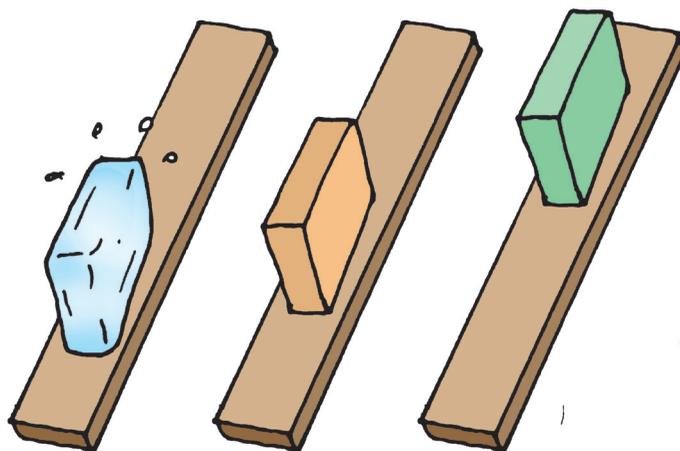


Fig 2.18

Take a wooden block, an ice block, and a rubber piece of the same mass. Allow them to slide down an inclined plane. The area in contact with the inclined surface should be equal in all cases. Record the observations in the Science Diary.

Doesn't the nature of the surfaces in contact influence the frictional force?

Let's try the experiment given below.

Take some water in a glass jar and drop a round stone and a sharp-edged stone of equal mass into the water.

Which one falls down faster?

From this, we can understand that the shape of the object affects friction. Write down the factors that affect friction.

-
-

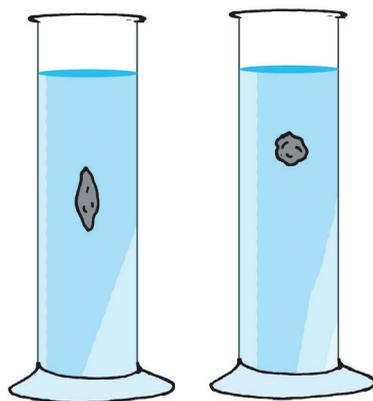


Fig. 2.19

We have seen that friction occurs when our palms are rubbed together. If oil is applied on the hands and rubbed together, they slip quickly. From this, it can be assumed that friction is reduced when oil is applied.

Substances that help to reduce friction between contacting surfaces are lubricants.

List some examples of lubricants.

-
-

Graphite is a solid lubricant. It is commonly used as a lubricant between machine parts at high temperature.

Have you noticed ball bearings like the one shown in the figure in connection with tyres in vehicles? These are used to reduce friction with the axle.



Fig. 2.20

Why are airplanes and boats made in a special shape? Can you explain it based on the experiment shown in Figure 2.19?



Fig. 2.21

This method of reducing friction by changing the shape is called streamlining.

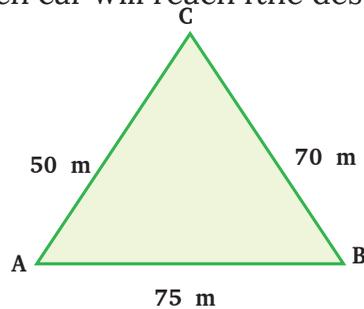
Let's write let us the various ways to reduce friction.

-
-



Let's assess

1. A car starts from A and reaches B, which is 75 m away. The uniform speed of the car is 25 m/s. Another car with a uniform speed of 30 m/s starts from A and reaches B through C. Which car will reach the destination first?



2. A bus starts from C and reaches D in 17 s. If the uniform speed of the bus is 5 m/s, find the distance from C to D.
3. How long will it take to hear thunder from 12000 m away? (The speed of sound is 340 m/s).
4. Complete the puzzle given below.

Brings a moving object to rest..

FORCE



Extended activities

1. Prepare and present a seminar paper on the ways to reduce road accidents.
2. Prepare a science article on friction in daily life.

3

PRESSURE



Fig. 3.1

Why did the driver comment like this?

We have learnt about different types of forces. The earth exerts an attractive force on all objects. That is the weight of the object. Let's now have a look at the figure given below, in which the same weight is applied in two different ways.

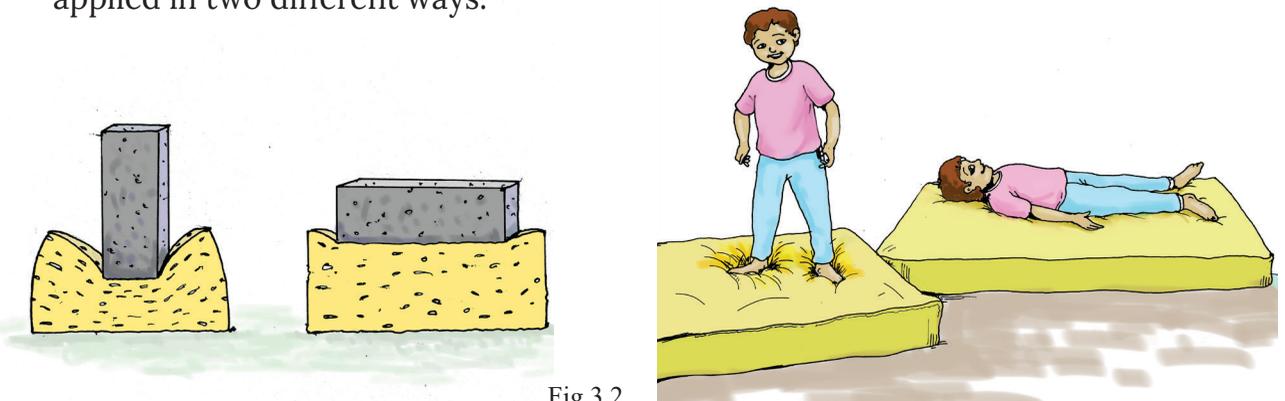


Fig 3.2

A brick is placed vertically and then horizontally on a sponge. In both cases, does the weight of the brick remain the same? Are the compressions on the sponge equal?

The weight of the child remains the same whether they stand or lie on the mattress. Yet, the mattress is compressed more while standing. What could be the reason for this? Let's do an activity

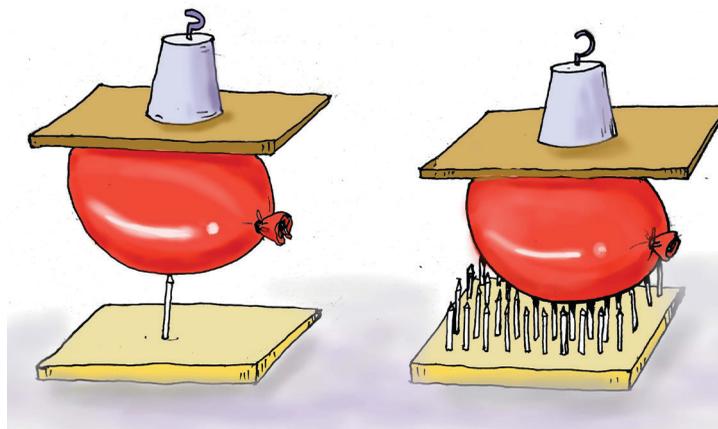


Fig. 3.3

Fix a single nail on the cardboard as shown in the figure and place a balloon on top of it. Place a small weight on the balloon. Does the balloon burst? Now, nail multiple pins very close to each other as shown in the second figure. Place the same weight on top of the balloon. Observe the result. Record the observations in the table below.

Situation		Area of Surface in Contact Less / More	Observation
Brick on a sponge	When placed vertically		
	When placed horizontally		
Child on the mattress	While standing		
	While lying down		
Balloon on the pin(s)	When used a single pin		
	When used multiple pins		

Table3.1

Analyze the table. Even when the same force is applied in each case, the results vary depending on the change in surface area in contact. This variation is due to the difference in pressure. What is pressure?

Pressure is the force acting normally per unit area.

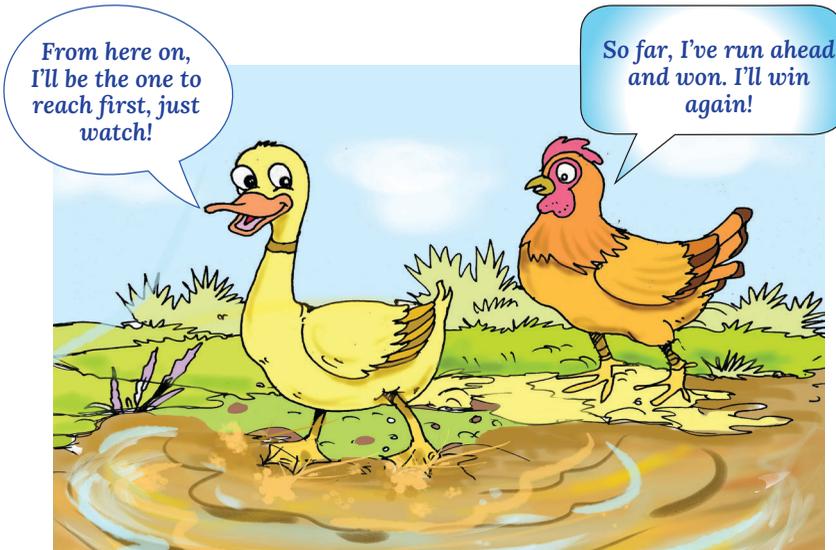


Fig. 3.4

Who will win the race? Write your opinion.

What could be the reason?

Measurement of Pressure

See the figure (3.5) of two concrete slabs placed in sand. Each of them is made of cubes weighing 18 N fixed together. The area of one side of the cube is 0.36 m^2 (See fig 3.6).

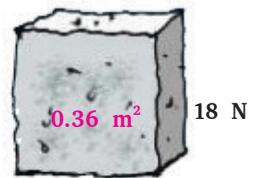


Fig. 3.6

Referring to the figures, complete the following table.

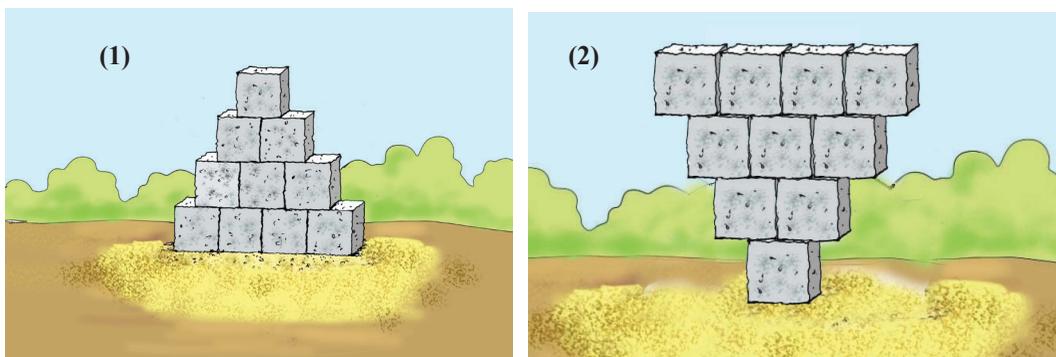


Fig. 3.5

Measurements	Slab 1	Slab 2
Force experienced on the sand		
Surface area of contact		
Force experienced per unit area		

Fig. 3.2

The weight of the slab acts normally on the sand. This is called thrust.

The force acting normally on a surface is called thrust.

We have found the force acting normally per unit area. This is pressure. Let's now write an equation for pressure.

If pressure is denoted by P, thrust by F and area by A, then,

$$\text{Pressure} = \frac{\text{Thrust}}{\text{Area}} \quad P = \frac{F}{A}$$

What would be the unit of Pressure?

$$\text{Unit of Pressure} = \frac{\text{Unit of thrust}}{\text{Unit of area}}$$

The SI unit of pressure is pascal

$$1 \text{ pascal} = 1 \text{ N/m}^2$$

Now, find out the pressure exerted by the above slabs, on the sand.

- Pressure exerted by slab 1 =
- Pressure exerted by slab 2 =

Let us analyse a different situation.

A concrete block weighing 100 N is placed on sand in three different ways as shown in the figure (3.7).

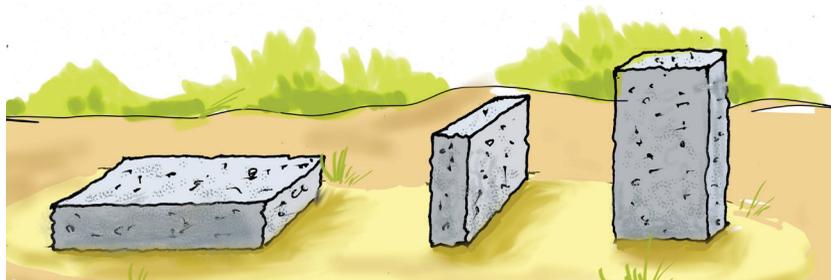


Fig. 3.7

- In which position will the highest pressure be exerted on the sand?
- Which position will cause the concrete block to sink deeper into the sand? Why?

When thrust remains constant, the pressure is inversely proportional to the surface area. This means, when the surface area increases, the pressure decreases and vice versa.

Now you can explain the reason why the driver commented as the lorry would not get stuck in the mud if a wooden plank is put.

Try to lift your school bag by tying it with a thin twine. How do you feel? What if you lift it using a wide strap as shown in the figure? Can you explain the difference by relating its area to pressure?



Fig. 3.8

Similarly, explain the following situations in the figure. Suggest more such situations.

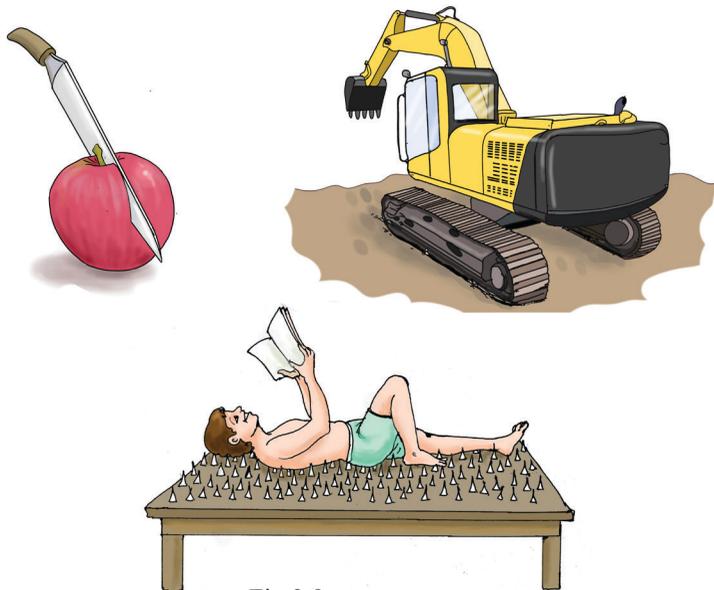


Fig.3.9

- The edge of a knife is made thinner.
- The wheels of bulldozers are connected by wide chains.
-
-

Liquid Pressure

Do only solids exert pressure? Can't liquids and gases exert pressure?

Let us try the activity given below.



Fig 3.10

Tie a polythene cover tightly around your hand as shown in the figure. Dip your hand into a bucket of water. Does the cover stick to your hand? This happens due to the pressure exerted by the water on the polythene cover, right?

Thus we can understand that, just like solids, liquids can also exert pressure. Liquids exert pressure on all sides of the container.

What are the factors liquid pressure depends on?

Let us do the following activity

The normal force exerted by a liquid is called thrust. The thrust that a liquid exerts per unit area is called liquid pressure.

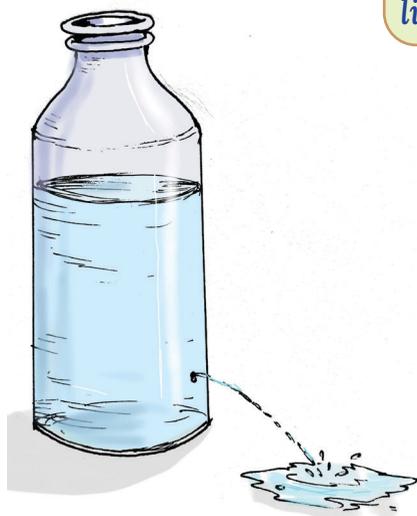


Fig. 3.11

Make a hole at the bottom of a plastic bottle. Close the hole and fill the bottle with water. Open the hole and observe the water jetting out.

Repeat the experiment using bottles of different shapes and sizes.

- If the force of water jetting out is greater, wouldn't the pressure also be greater?
- What happens to the water stream when the water level decreases? What can be inferred from this?

Pressure increases as the depth in a liquid increases.

What are the other factors that liquid pressure depends on?

Attach a syringe on a board as shown in the figure 3.12. Attach one end of the I.V. set tube to the hub of the syringe. Attach the piston of the syringe to the bottom end of a pen barrel. Arrange it so that the pen barrel deflects when the piston moves. Now fix a thin stick to the top end of pen barrel as a pointer. Attach the other end of the I.V. set to the plastic bottle. Fill the plastic bottle with water and place it at a higher level than the syringe.

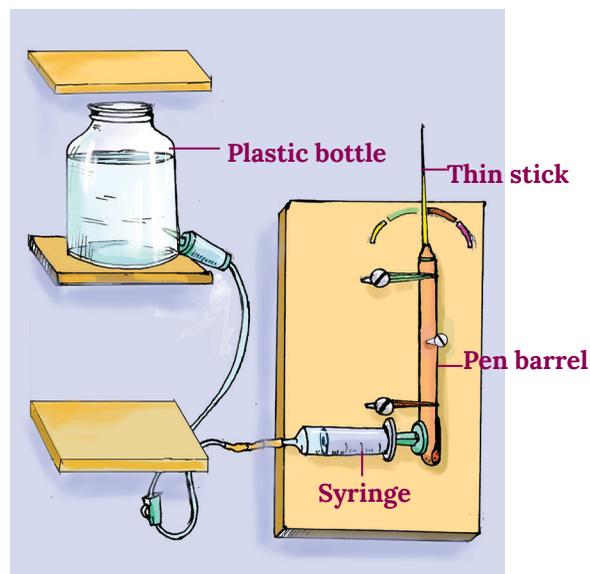


Fig. 3.12

Raise the bottle. The force applied by the piston will change according to the pressure of the water. Now you can see the thin stick deflecting according to the force exerted in the piston, right?

- Raise the bottle further. What do you observe? What is the reason?
- Repeat the experiment using salt solution instead of water.

Why does the thin stick deflect more?

Water and saline water have different densities. Density of saline water is higher than that of water. That is why the piston moves more causing greater deflection of the thin stick.

The density of a liquid influences its pressure. If the density of a liquid increases, the pressure also increases.

Let's list the factors affecting liquid pressure based on the experiments we have done.

- Height of the liquid column (h)
- Density of the liquid (d)

The instrument used to measure liquid pressure is called a manometer. Shall we make a manometer?

Manometer

Fix a plastic tube on a board in a U shape. Fill it with water. Connect a funnel to one end of the tube as shown in the figure. Make a diaphragm with a balloon on the mouth of the funnel. Attach a scale to the board. Now the manometer is ready.

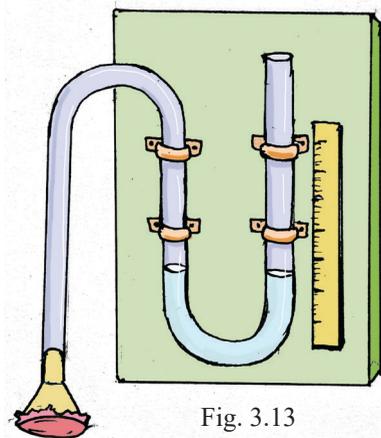


Fig. 3.13

Apply slight pressure with your finger on the balloon.

Do you see any difference in the level of water in the tube?

Apply more pressure. You can see a difference in water levels also.

Now take different solutions in the beaker and measure the pressure at different levels. Write your observations in the table below.

Position of the funnel	Difference in the water levels of U -tube/pressure		
	In Water	In Saline water	In Kerosene
On the surface			
Midway in the beaker			
At the bottom of the beaker			

Table 3.3

Analyse the table.

- In which position is the pressure highest?
- Which liquid exerts the highest pressure?

Let us try another activity. Fill a deep vessel with water. Dip a straw into the water and blow gently. Do bubbles come up?

- What happens to their size when they reach the surface?
- Explain their change in size.

Explain why dams are built with a wider base. Can you think of more situations in daily life where liquid pressure is experienced?

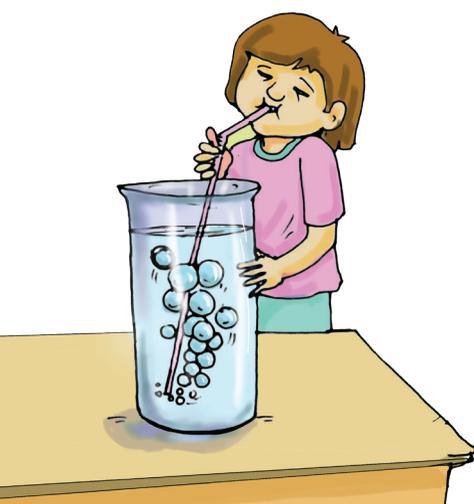


Fig. 3.14

Gas Pressure

Just like solids and liquids, gases also have the ability to exert pressure.

As we know, pressure is measured when air is filled into vehicle tyres.

Pressure is the force exerted by the particles of a gas on unit area of a surface. This is due to the collision of gas particles.

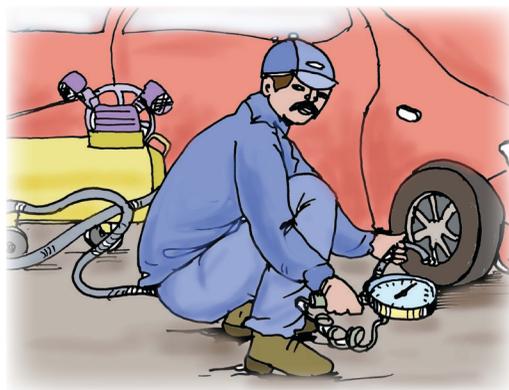


Fig. 3.15

The force exerted by a gas normally on a unit area is gas pressure.

What are the factors influencing gas pressure?

Inflate a balloon at its maximum. What happens when the balloon is inflated further? Will it eventually burst? The balloon bursts as it fails to withstand the pressure inside. Find the change in the number of gas particles, in figure 3.16, when more air is filled. What can be inferred from this?

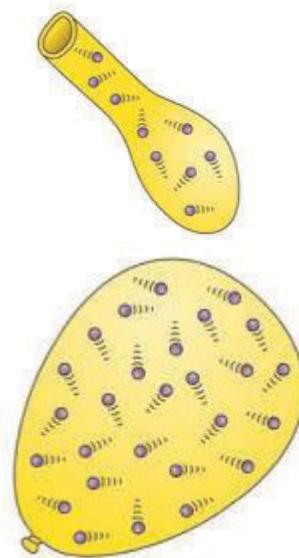


Fig. 3.16

Gas pressure depends on the number of particles. As the number of particles increases, gas pressure also increases.

Fill the same quantity of air into two balloons of different sizes. Now the number of gas particles in both balloons is equal, right? Which of the balloons has more pressure inside? What can be inferred from this?

Gas pressure depends on its volume.

Leave an inflated balloon in the sunlight. What do you observe? What is the change in the pressure when the air inside gets heated up?

Gas pressure depends on its temperature.

When we cook food in a pressure cooker, the pressure inside increases as the temperature increases.

Now list, the factors influencing gas pressure are

- Number of particles

-
-

Atmospheric Pressure

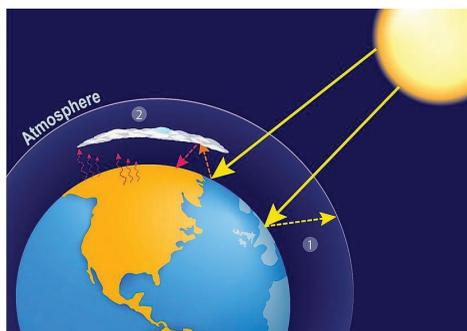


Fig. 3.17

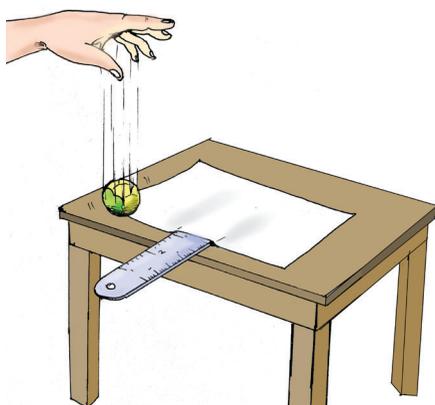


Fig. 3.18

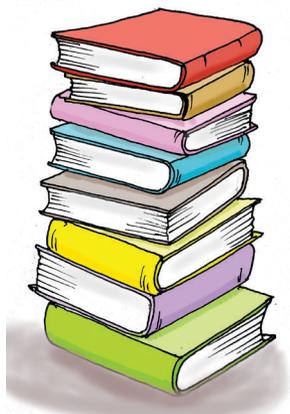


Fig.3.19

The atmosphere is a blanket of air surrounding the Earth. The density of air decreases as we go higher. Can atmosphere exert pressure?

Do the following activity

Place a scale on the table as shown in the figure. Drop an ice cream ball on the scale from a small height. Doesn't the scale fall? Place an A4 size paper on the scale. Drop the ball again from the same height. Now, the scale does not fall down. Why? It is because of the weight of the air above the paper. The atmospheric pressure counteracts the force exerted by the ball.

Atmospheric air exerts pressure on objects.

From the above activity, we understood the influence of atmospheric pressure. What is atmospheric pressure?

The weight of air column per unit area on the earth's surface is atmospheric pressure. The unit of atmospheric pressure is 'bar.'

Is atmospheric pressure the same everywhere on the Earth? Observe the figure. Which book will experience the highest pressure? Why?

Similarly, we know that atmospheric pressure is the weight of air column experienced per unit area. So, what is the change that occurs in atmospheric pressure as altitude increases? Note your inferences.

Atmospheric pressure decreases as height from the Earth's surface increases.

Atmospheric pressure at sea level is known as standard atmospheric pressure. It is defined as the weight of a mercury column that is 0.76 m high, with a unit cross sectional area, exerting a pressure of 1 atm. The instrument used to measure atmospheric pressure is a barometer.

Do you know how strong atmospheric pressure is?

Take an aluminum can and fill it with hot water. Pour out the hot water and immediately seal the can. Immerse the can in cold water. What do you observe? (See figure). When the can cools down, the pressure inside the can decreases. The external atmospheric pressure is strong enough to crush the can.

- Calculate the force exerted by atmospheric pressure on a table surface of area 1 m^2 . Atmospheric pressure is 101325 Pascal.

$$\begin{aligned} \text{Force} &= \text{Pressure} \times \text{Area} \\ &= 1 \text{ Pa} \times 1 \text{ m}^2 \\ &= 101325 \text{ N} \end{aligned}$$

This is equivalent to the weight of an object with a mass of 10339 kg. If such a large force is exerted on the table, why doesn't it collapse?



Great Strength

In 1654, Otto von Guericke joined two copper hemispheres (Magdeburg hemispheres) together to form a hollow sphere with a diameter of 35.5 centimeters (14 inches). The air was pumped out of the sphere. Two teams of horses tried to pull them apart but failed to separate the hemispheres. Thus, the incredible force of atmospheric pressure was first demonstrated.

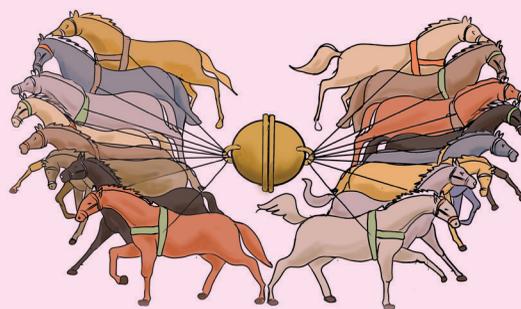


Fig. 3.22

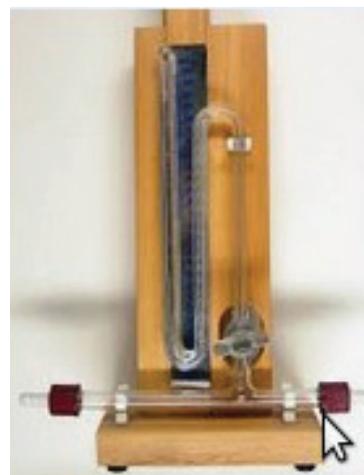


Fig. 3.20



Fig.3.21

Gas pressure is exerted in all directions, similar to that of liquids.



Fig. 3.23

Let's do another experiment. Fill a glass with water and cover it with a cardboard. Hold the cardboard with your hand and turn the glass upside down. Remove your hands slowly. Does the water fall? The force due to atmospheric pressure can hold the entire weight of the water in the glass.

The equilibrium of pressure between gases and liquids is a common phenomenon occurring in nature.

Pressure Balance

Let's do an activity. Pour water in a flat container. Place a lit candle in it. Cover the candle with a glass. Cover the candle with a glass.

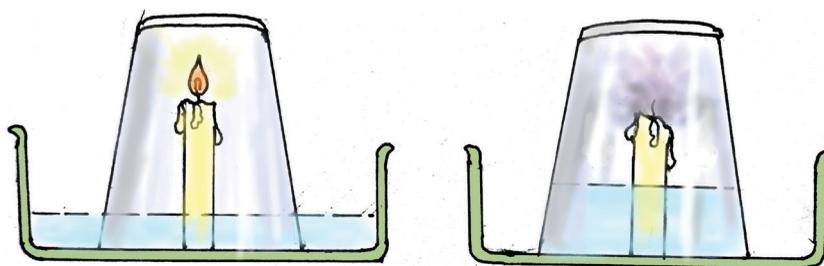


Fig.3.24

- What happens to the candle flame?
- What happens to the air pressure inside the glass?
- What is the change in the water level?

The water level remains stable when the pressure inside the glass and the atmospheric pressure outside the glass are in equilibrium.

Gently pull back the piston of a syringe and seal the opening with your hand. Then pull the piston all the way back and release. What do you see? Why does the piston go back? Discuss the reason.



Fig. 3.25

Read the following situations and explain them based on atmospheric pressure.

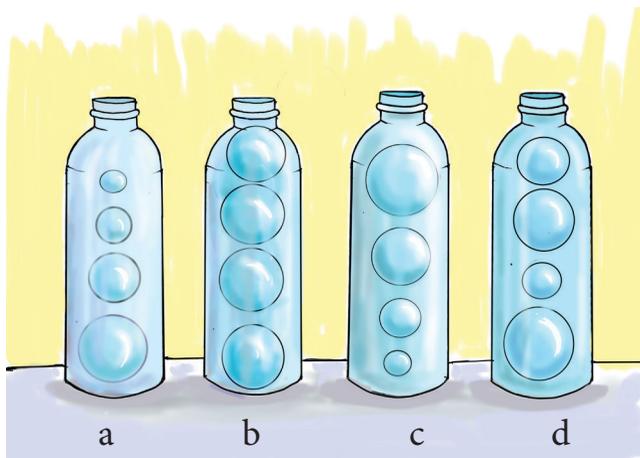
- Rubber suckers stick to smooth surfaces.
- Mountain climbers often experience nosebleeds at high altitudes.
- Holes are made on the injection bottle with a needle during a drip injection.
- Passengers travelling uphill in vehicles on a ghat road experience ear pain.



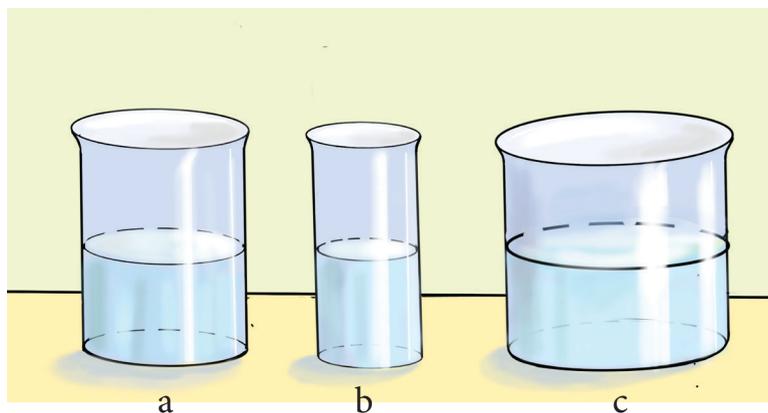
1. Give reasons.

- Heavy vehicles have more tyres.
- Some passengers experience nosebleeds when airplanes fly at high altitudes.
- The size of the bubbles rising from the bottom of an aquarium increases gradually.
- The foundation of buildings is made wider.

2. Which of the bottles below shows the shape of rising bubbles correctly? Explain why.



3. Observe the picture below. Which of the following jars containing the same liquid, will experience the highest pressure at the bottom? Explain why.



4. Cooking is faster in a pressure cooker than in an open vessel. Explain why.



Extended Activities

1. Conduct a study on the topic 'Rain and Pressure' and prepare a project report.
2. Attach a pipe to each end of a plastic bottle, ensuring it airtight. One pipe should be longer and the other shorter. Place one end of the pipe in a bucket filled with water and placed at a highest level. Place the shorter pipe in another vessel. Squeeze and release the plastic bottle two or three times. Does the water from the bucket flow into the lower vessel? State the reason for this.

CHEMISTRY OF CHANGES



Fig. 4.1

Look at the picture.

What do you see in the picture?

- A candle burning
- Food is cooked
-
-

Substances undergo different types of changes here. Don't they?

The stone is shaped into a sculpture and banana gets ripened. Are these changes of the same kind? One is man made and the other is natural, isn't it? If you look around you can observe so many changes.

These changes may lead to the production of new substances.

We can see so many substances around us, which undergo various changes. You know that these substances are different forms of matter.

All substances in the universe are made of matter.

Let us discuss the chemistry of changes of matter after understanding their general characteristics.

What are the characteristics of matter?

Let us examine them one by one.

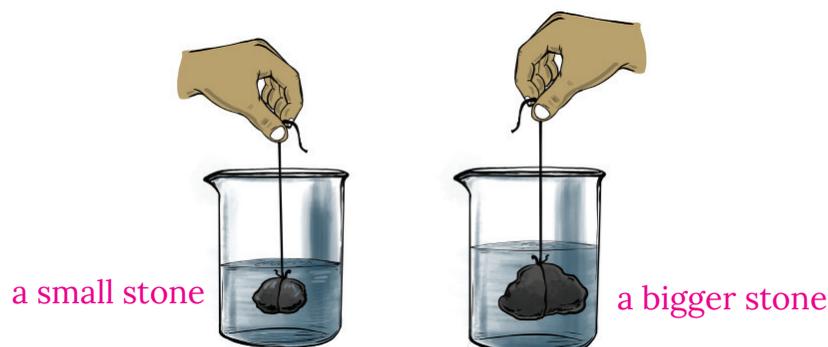


Fig. 4.2

Dip a stone hung on a thread into a beaker with marked water level. What happens to the water level?

Why does the water level rise?

What difference do you observe if a bigger stone is used?

One of the properties of matter is that it occupies space. The space occupied by matter is its volume.

Weigh both the stones using a balance.

What difference do you observe?

Matter has mass. This is another property of matter.

Mass of a substance is the measure of the quantity of matter contained in it.

Is air a form of matter?

Does air need space to occupy?



Fig. 4.3

Fix a towel inside a glass and immerse it upside down into the water taken in a beaker, as shown in the figure 4.3.

Does the towel get wet?

Why doesn't water enter the glass?

What happens to the water level in the beaker?

The difference in water level indicates the volume of air, right?

How can we find out whether air has mass?

Will the mass of a football without air be the same as the mass of an inflated football? Check it out using a digital balance.

Now it is clear that air has mass.

Anything that occupies space and has mass is called matter.

From this we can understand that air is a form of matter.

Matter exists mainly in three states.

Complete the given table with respect to the three states of matter. Put ✓ mark appropriately.

Property	Solid	Liquid	Gas
Has definite mass			
Has definite volume			
Has definite shape			

Table 4.1

Different types of changes

Heat some wax in a steel vessel. What happens?

What happens when the liquid wax is cooled?



Matter exists mainly in three states viz: solid, liquid and gas. But, these three are not the only states of matter. The fourth state of matter is Plasma. The most abundant state of matter in the universe is plasma. The stars and nebulae are in the form of plasma. Plasma is formed at very high temperatures and contains free ionised particles. Scientists have discovered that matter exists in various other states at high and low temperatures. Bose-Einstein condensate, Fermionic condensate, etc. are examples for these.

We have seen that wax can be converted from solid to liquid and vice versa.

But if a piece of paper is burnt to ash, can it be changed to paper again?

Do all the changes occur at the same speed?

What is the approximate time taken for the germination of a pea seed?

Doesn't it take a long time for the plant to grow and blossom?

But, lighting of a gas stove and bursting of crackers happen very quickly.

Find more examples for slow and fast changes.

Slow changes	Fast changes
•	•
•	•
•	•
•	•
•	•

Table 4.2

Physical Change and Chemical Change

What is the difference between the burning of a piece of paper and the melting of wax? Do the chemical properties of wax change when it melts? What happens when a piece of paper burns? Burning of paper is a chemical change and melting of wax is a physical change.

No new substances are formed during a physical change. Only the molecular arrangement changes. But in chemical change, a substance is converted into another one. That means, new molecules are formed.

Classify the following changes into physical change and chemical change.

i) curdling of milk	ii) melting of wax
iii) burning of a candle	iv) formation of ice
v) melting of ice	vi) dissolution of salt in water
vii) rusting of iron	viii) burning of firewood

Take some ice in a bowl and heat it. What happens?

What happens if heating is continued? Water boils and water vapour is formed.

You have learnt about the arrangement of particles in different states of matter; i.e., solid, liquid and gas in lower classes. Can you write about the distance and force of attraction between the particles, speed of movement and the energy of the particles in each state in the following table?

	Solid	Liquid	Gas
Distance between the particles	very less		
Attraction between the particles		less than solid	very less
Speed of movement of the particles	very less		
Energy of the particles		higher than solid	very high

Table 4.3

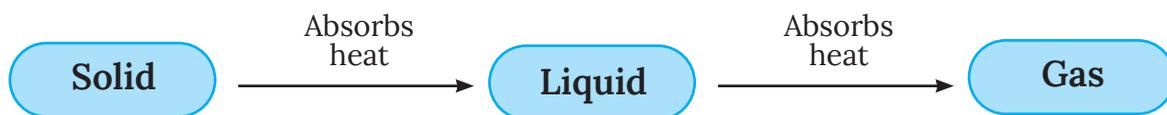
We have seen that particles are very close to each other in solid state.

What happens to the distance between particles and energy of particles when solids are heated?

Distance between the particles: _____

Energy of the particles : _____

When a solid is heated, the distance between its particles and their energy increases and gradually it attains the particle arrangement of a liquid.



When liquids are heated gradually, they become gases.

What happens when a gas is cooled ?



The distance between particles and the energy of particles decreases. Gradually gas becomes liquid.



If we further cool a liquid, it becomes solid.

Solid substances like Camphor and Naphthalene when heated, directly change to gases. This is known as Sublimation.

How does the water kept in a freezer change to ice? Discuss.

The change of substance from one physical state into another is known as **change of state**.

Is change of state a physical change or a chemical change?

Which form of energy is absorbed or liberated during the change of state?

What happens to the energy of particles when heat is absorbed or liberated?

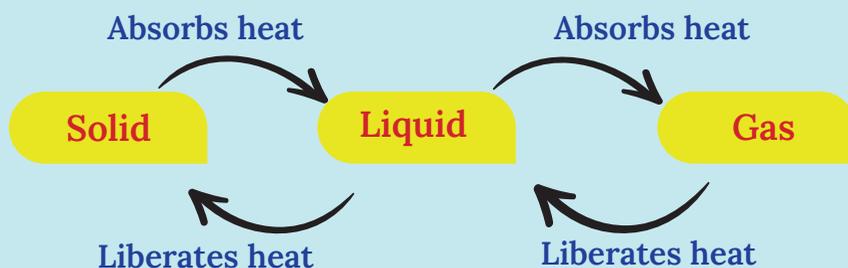


Illustration 4.1

Chemical Changes and Energy Change

Place some potassium permanganate crystals on a tile and pour glycerine in the middle. Record your observation.

Is the colour of potassium permanganate same before and after the reaction?

Let us see.

Take water in two beakers and add two or three crystals of fresh potassium permanganate into one of them. Add two or three crystals of the product obtained in the second beaker. Record the difference.

What is the change in colour you have observed?

Is it clear that new substances are formed as a result of this reaction?

Is this a chemical change or a physical change?

The substances which take part in a chemical reaction are known as reactants and the substances formed are known as products.

Thermochemical Reactions

Take a piece of magnesium in a test tube and add dilute hydrochloric acid into it.

What do you observe?

How will you identify the gas formed here?

If a burning match stick is brought near the mouth of the test tube, the gas burns with a pop sound.

Which is this gas?

When magnesium reacts with dilute hydrochloric acid, hydrogen gas is formed.

Touch the bottom of the test tube. What do you feel?

As a result of chemical reaction, heat is also produced along with hydrogen, right?

What are the reactants of this reaction?

What are the products?

Let us do another activity.

Take quicklime in a steel cup. Add some water into it. Touch the cup after sometime. What do you feel ?

What is the reason?

Quicklime + water \longrightarrow slaked lime +

If heat is liberated as a result of a chemical reaction, such reactions are known as exothermic reactions.

Let us do another activity.

Take some potassium permanganate in a test tube and heat it.

Hold a burning incense stick near the mouth of this test tube. What do you observe?

Which gas helps flaring the incense stick?

Can you guess?

Potassium permanganate decomposes and produces oxygen gas.

Which form of energy is used to decompose potassium permanganate?

You have seen that one of the products is oxygen.

Let us do another activity.

Take some ammonium chloride in a watch glass, add some barium hydroxide into it and mix well with a glass rod. Touch the bottom of the watch glass.

What do you feel? Is heat energy absorbed or liberated here?

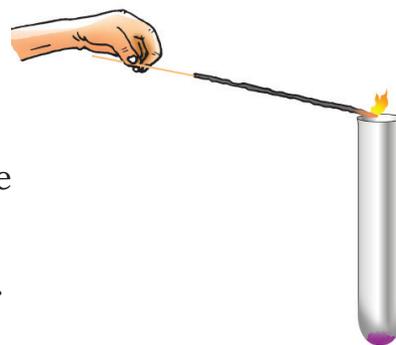


Fig 4.4

If heat energy is absorbed during a chemical reaction, it is known as an endothermic reaction.

Find more examples for such reactions.

Exothermic Reactions	Endothermic Reactions
<ul style="list-style-type: none"> • Reaction between potassium permanganate and glycerine • Reaction between magnesium and hydrochloric acid • 	<ul style="list-style-type: none"> • Decomposition of potassium permanganate • Reaction between ammonium chloride and barium hydroxide •

Table 4.4

The reactions in which heat energy is liberated or absorbed are known as thermochemical reactions.

Photochemical Reactions

Take some silver nitrate solution in a watch glass and add sodium chloride solution into it. Dip two pieces of cotton in the product formed. Cover one of them with black paper and keep the other one open. Keep them aside for some time. Record your observations.



Fig. 4.5

Which form of energy is responsible for the colour change?

The reactants, silver nitrate and sodium chloride react to form silver chloride. This silver chloride decomposes by absorbing light to form silver. This is the reason for blackening of the cotton which is kept open.



Photosynthesis

Which reaction is represented by the illustration 4.2 ?

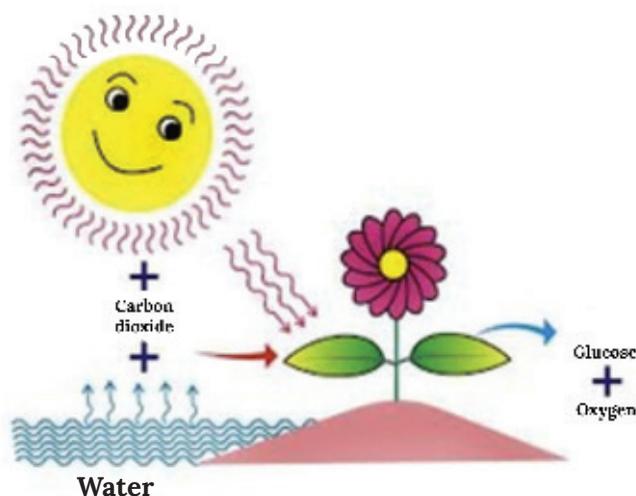


Illustration 4.2

What are the reactants here? What are the products?

The glucose produced here is converted to starch and stored in different parts of the plant. Photosynthesis is the process responsible for the existence of life on earth.

Which form of energy is absorbed in photosynthesis?

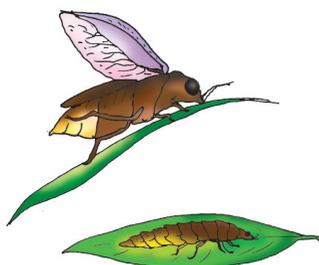


Fig. 4.6

In photosynthesis light energy is converted into chemical energy.

In both the reactions we discussed above, light energy is absorbed.

Do you know any reactions which liberate light energy?

You might have seen the light of fireflies.

How do fireflies produce light?

The chemical luciferin reacts with oxygen with the help of the enzyme luciferase present in the body of fireflies and emits visible light. This phenomenon is known as bioluminescence. Firefly can control the amount of oxygen entering its body and there by regulate the intensity of light produced. Some species of marine organisms and worms exhibit bioluminescence.

In these reactions light energy is liberated.

The reactions in which light energy is absorbed or liberated are known as photochemical reactions.

- Some medicines are kept in brown coloured bottles. What could be the reason?
- Silver nitrate is not stored in transparent bottles. Why?

Electrochemical reactions

Look at the figures given.

Are you familiar with these objects?

They are known as dry cells.

What is their use?

What are the parts of a dry cell?

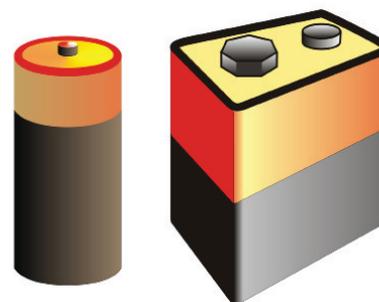


Fig. 4.7

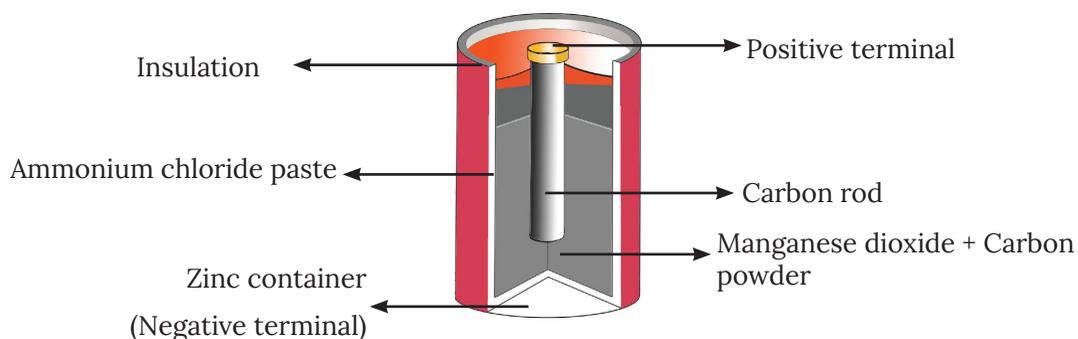


Fig. 4.8

Electricity is produced as a result of chemical reaction taking place in a dry cell.

In a dry cell chemical energy is converted into electrical energy.

Let us do an activity.

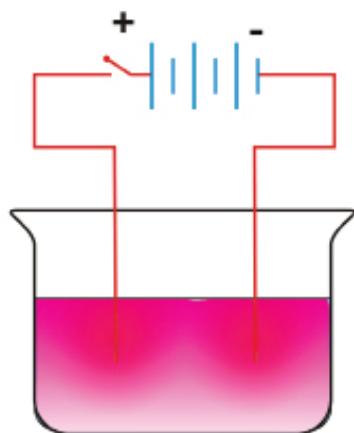


Fig. 4.9

Take some concentrated salt solution (sodium chloride) in a beaker. Add three or four drops of phenolphthalein into it. Dip the ends of copper wires connected to both the terminals of a battery into the solution (figure 4.9)

What is your observation?

Which compound's presence is indicated by pink colour?

When sodium chloride undergo dissociation, sodium hydroxide is formed as one of the products. This turns the solution pink.

Which form of energy is responsible for this reaction?

Here electrical energy is absorbed for the chemical reaction.

The process of dissociation of a substance by absorbing electrical energy is known as electrolysis.

If electricity is passed through water containing a small amount of acid, it dissociates into hydrogen and oxygen.

Water \longrightarrow Hydrogen + Oxygen

Water dissociates by absorbing electrical energy.

Hence this process is electrolysis.

Many such reactions take place by absorbing electricity.

Haven't you seen gold coated ornaments, spoons and silver coated decorative materials?

How are they produced?

Let us coat copper on an iron bangle.

Check the diagram (figure 4.10)

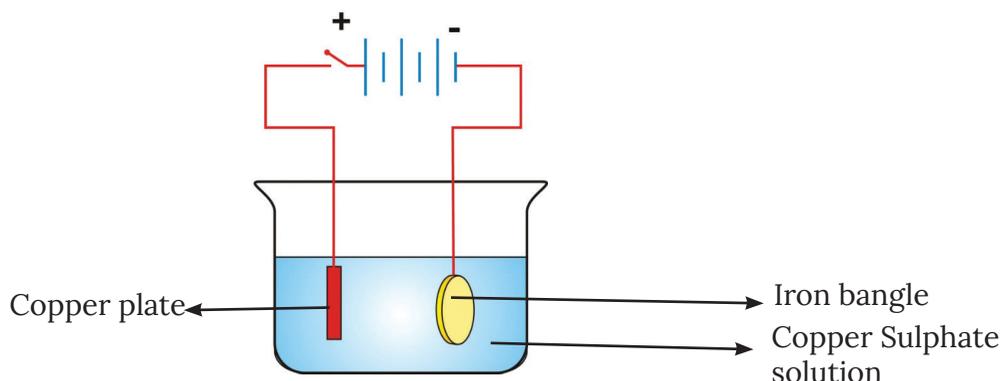


Fig. 4.10

Which solution is taken in the beaker?

To which terminal of the battery is the copper plate connected?

What about the bangle?

When the circuit is switched on, do you notice the red colour of copper on the iron bangle?

Which metal plate should be connected to the positive terminal of the battery if silver is to be coated instead of copper?

The metal to be coated must be connected to the positive terminal of the battery.

The solution of the salt of the same metal dissolved in water should also be used.

If silver is to be coated on iron bangle silver plate is to be connected to the positive terminal of the battery and a mixture of silver cyanide and sodium cyanide solutions also is to be used.

- If gold is to be coated, gold plate is to be connected to the positive terminal of the battery and a mixture of gold cyanide and sodium cyanide solution also is to be used.

Coating a metal with another metal using electricity is known as electroplating.

Battery Made of Lemons

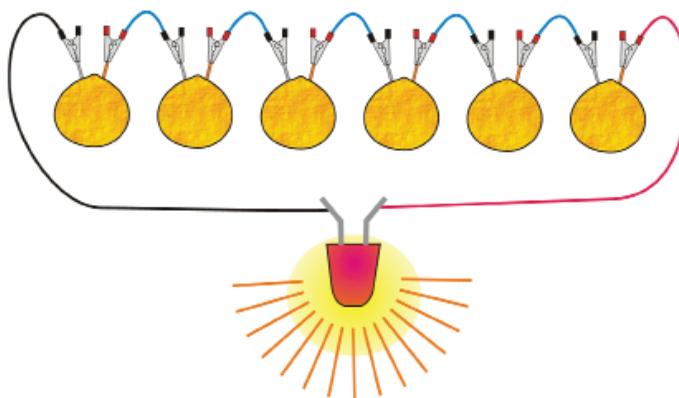


Fig. 4.11

Arrange zinc and copper nails on lemons as shown in the figure. Connect them with copper wire. Then connect this arrangement to an LED.

Which energy has caused the LED glow?

Which is the source of this electrical energy?

Here the acid in the lemons reacts with metals to produce electricity.

If electrical energy is absorbed or produced during a chemical reaction, it is known as an electrochemical reaction.

Different forms of energy are absorbed or liberated in every chemical reaction. Reactions are known by the major form of energy involved in that reaction.

Chemical reaction	Major energy change
Burning of substances	Liberates heat
Decomposition of substances on heating	Absorbs heat
Bioluminescence	Liberates light
Cell made up of lemon	Liberates electrical energy
Electrolysis of sodium chloride solution	Absorbs electrical energy

Table 4.5

You have learned about the different states of matter and the changes they undergo. Some of these changes help to improve human life and some others do not. Discuss in your class and write a note on the changes of matter and how they affect human life.



Let us assess

- What changes in the arrangement of particles occur during the following situations?
 - Solid changes to liquid
 - Liquid changes to gas
 - Gas changes to liquid
- Which is the main form of energy liberated/ absorbed during the given reactions? Write the type of each of these chemical reactions.
 - Ammonium chloride and barium hydroxide react.
 - Coating an iron bangle with copper.
 - Glowing of Firefly.
 - Decomposition of potassium permanganate.
 - Lighting an LED using lemons.

3. Heat some crystals of potassium permanganate in a dry test tube. Bring a burning incense stick near the mouth of the test tube.
 - a) What do you observe?
 - b) Which is the gaseous product formed?
 - c) Which type of reaction is this?
4. A white cloth dipped in silver nitrate darkens when it is kept in sunlight.
 - a) Which form of energy is responsible for this chemical change?
 - b) What is the general name for this type of reaction?
5. Sodium metal reacts with water to give new substances.
 - a) Which are the reactants in this reaction?
 - b) Which are the products formed?



Extended Activities

1. Collect a little aluminium powder and iodine powder from the science lab. Mix them well. Add two or three drops of water to this mixture. Write the observations.
2. Make a heap of ammonium dichromate powder on a tile. Make a small pit in it and insert the chemicals collected from matchsticks and ignite it. Record the changes you see.

ELEMENTS AND COMPOUNDS



Fig. 5.1

We know that all objects around us are made up of different molecules. Let us examine how each of these molecules differ with respect to their structural characteristics.

What do you know about molecules? Try to write it.

Can you formulate a definition for molecules?

Molecules are the smallest, independent and stable particles that have all the fundamental properties of a pure substance.

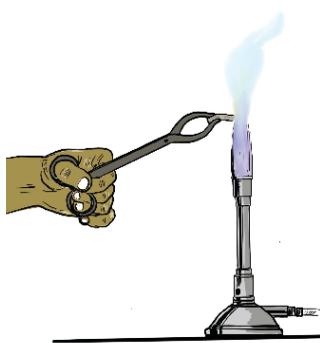


Fig. 5.2

Do you know that new molecules are formed through chemical reactions?

Let's do an experiment.

Burn a magnesium ribbon which is scrubbed clean. Record your observations.

What is the white powder obtained as a result of the reaction?

It is magnesium oxide produced when magnesium reacted with oxygen.

This is an example for the formation of new molecules when different types of molecules undergo chemical reactions.

Similarly, let us see if we can dissociate molecules to make new molecules.

Take some sugar in a dry boiling tube. Cover the mouth of the boiling tube with a piece of cotton. Heat the boiling tube strongly for a few minutes. Write your observations.

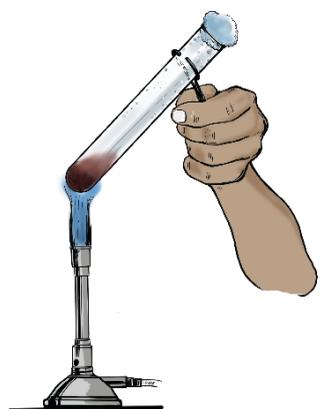


Fig. 5.3

What is the black substance left in the boiling tube?

What is the substance seen on the sides of the boiling tube?

Did you observe that when sugar is heated, carbon and water are formed?

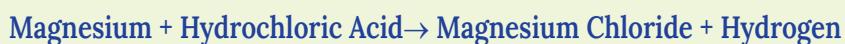
Through this experiment, we can understand that sugar molecules can be broken down through chemical reactions.

Let's do another experiment.

Take some dilute hydrochloric acid in a test tube and add a small piece of magnesium to it. Introduce a burning incense stick to the mouth of the test tube. Record your observations.

What is the gas produced as a result of the reaction?

How can we represent this reaction?



Collect the hydrogen gas obtained in this experiment into another moisture-free test tube and introduce a burning incense stick to it. Record your observations.

What do you understand from the presence of water droplets on the sides of the test tube?

In this experiment, hydrogen collected in the dry test tube reacts with oxygen to form water.



Henry Cavendish proved that water is a substance made up of more than one element. His experiment of burning hydrogen gas in the presence of oxygen helped to know about the components of water.



Henry Cavendish

Fig. 5.4

In 1806, Sir Humphry Davy discovered that water could be split into hydrogen and oxygen by passing electricity through it.



Sir Humphry Davy

Fig. 5.5

Which are the substances obtained when water is dissociated?

Can hydrogen, and oxygen be further split in to components?

Atom

We have learned that molecules are the smallest particles obtained by dissociating various substances having their fundamental properties.

What if molecules are split again?

Atoms are obtained when molecules are split.

The molecules of every substance are made up of minute atoms. All substances in the universe are made up of atoms. The word atom comes from the Greek word atomos, which means indivisible.

Democritus proposed that all matter is made up of indivisible particles called atoms.

In 1807, John Dalton proposed the atomic theory to explain the nature of atom. Dalton's Atomic Theory is one of the important theories in modern chemistry. The ideas put forward by Dalton are given below.



John Dalton

- All matter is made up of minute particles called atoms.
- An atom is the smallest particle that can participate in a chemical reaction.
- An atom cannot be divided during a chemical reaction.
- An atom cannot be created or destroyed.
- All atoms of an element are of the same size, property and mass.
- Atoms of different elements differ in their size, property and mass.

Fig. 5.6

You know that a water molecule is made up of two atoms of hydrogen and one atom of oxygen.

Look at the table below.

Molecules	Atoms in a molecule
Ammonia	One atom of nitrogen Three atoms of hydrogen
Oxygen	Two atoms of oxygen
Chlorine	Two atoms of chlorine
Methane	One atom of carbon Four atoms of hydrogen
Hydrogen	Two atoms of hydrogen
Carbon dioxide	One atom of carbon Two atoms of oxygen

Table 5.1

Which molecules in the table consist of the same type of atoms?

Which of these molecules consist of different types of atoms?

- Elements are pure substances made up of the same type of atoms. They cannot be further divided into components through chemical reactions.
- Compounds are pure substances formed by the combination of atoms of two or more elements in a fixed ratio. These can be dissociated into constituent elements through chemical reactions.

Categorise the following into elements and compounds.

Oxygen, water, salt, sugar, carbon, nitrogen, carbon dioxide, ammonia, magnesium oxide

Elements	Compounds

Table 5.2

Symbols



Fig. 5.7

We use many signs like the above ones in our day to day communication. Do you know what these signs represent ?

Why are they used?

Symbols are used to represent concepts in a clear and simple manner. Symbols make communication and interpretation easier.

Similarly, signs are used to represent elements. These are known as chemical symbols. A symbol represents an atom of an element.

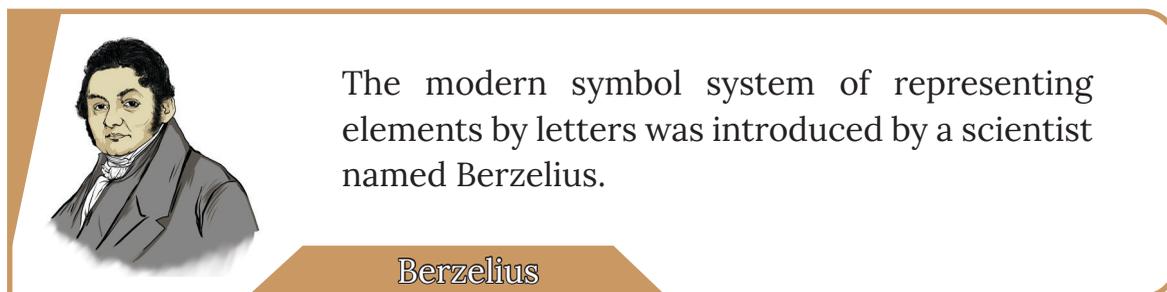


Fig. 5.8

Origin of Symbols

- The element hydrogen is represented by the letter 'H'. That is, the first letter of name of the element is used here as the symbol.

Note the list of other elements represented by the first letter of their name. Expand the list by adding more elements.

Element	Symbol
Carbon	C
Nitrogen	N
Sulphur	S
Oxygen	O

Table 5.3

- The element Helium is represented by the symbol 'He'. The first and second letters of the English name are used here. What could be the reason?

Some elements are represented by another letter along with the first letter of the English name in upper case. See more examples of using two letters as symbols.

Element	Symbol
Aluminium	Al
Chlorine	Cl
Curium	Cm
Calcium	Ca

Table 5.4

The first letter of the English name is used upper case along with the second letter or any other prominent letter in lower case. Find more examples and expand the list.

Some elements have symbols based on their Latin names.

Element	Latin name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Iron	Ferrum	Fe
Gold	Aurum	Au
Copper	Cuprum	Cu

Table 5.5

Find more examples and expand the list.

How Elements Got their Names

When you hear the names of the elements Francium and Einsteinium, don't you recall the country France and the scientist Einstein? Elements are named not only on the

basis of country and scientists, but also on the basis of colour, name of planets, satellites, continents, etc.

Find out how the elements given below got their names.

- Chromium
- Iridium
- Neptunium

Classification of elements

Observe the picture. Have you ever seen books arranged in a library?



Fig. 5.9

What are the advantages of arranging the books by categorising them into essays, poems, stories, novels, etc.?

Elements are also classified in this manner. So far, 118 elements have been discovered which include natural and synthetic elements. It is very difficult to study all these elements and their compounds separately. It would be easier if elements with similar properties are classified into groups, right?

The Periodic Table is a table in which all the elements are categorised and arranged based on their properties.

- Analyse the Periodic Table and write down the name and symbol of any 5 elements.

Periodic Table

¹ H Hydrogen 1	² He Helium 2																
³ Li Lithium 2,1	⁴ Be Beryllium 2,2											⁵ B Boron 2,3	⁶ C Carbon 2,4	⁷ N Nitrogen 2,5	⁸ O Oxygen 2,6	⁹ F Fluorine 2,7	¹⁰ Ne Neon 2,8
¹¹ Na Sodium (Natrium) 2,8,1	¹² Mg Magnesium 2,8,2											¹³ Al Aluminium 2,8,3	¹⁴ Si Silicon 2,8,4	¹⁵ P Phosphorus 2,8,5	¹⁶ S Sulphur 2,8,6	¹⁷ Cl Chlorine 2,8,7	¹⁸ Ar Argon 2,8,8
¹⁹ K Potassium (Kalium) 2,8,8,1	²⁰ Ca Calcium 2,8,8,2	²¹ Sc Scandium 2,8,9,2	²² Ti Titanium 2,8,10,2	²³ V Vanadium 2,8,11,2	²⁴ Cr Chromium 2,8,13,1	²⁵ Mn Manganese 2,8,13,2	²⁶ Fe Iron (Ferrum) 2,8,14,2	²⁷ Co Cobalt 2,8,15,2	²⁸ Ni Nickel 2,8,16,2	²⁹ Cu Copper (Cuprum) 2,8,18,1	³⁰ Zn Zinc 2,8,18,2	³¹ Ga Gallium 2,8,18,3	³² Ge Germanium 2,8,18,4	³³ As Arsenic 2,8,18,5	³⁴ Se Selenium 2,8,18,6	³⁵ Br Bromine 2,8,18,7	³⁶ Kr Krypton 2,8,18,8
³⁷ Rb Rubidium 2,8,18,8,1	³⁸ Sr Strontium 2,8,18,8,2	³⁹ Y Yttrium 2,8,18,9,2	⁴⁰ Zr Zirconium 2,8,18,10,2	⁴¹ Nb Niobium 2,8,18,12,1	⁴² Mo Molybdenum 2,8,18,13,1	⁴³ Tc Technetium 2,8,18,14,1	⁴⁴ Ru Ruthenium 2,8,18,15,1	⁴⁵ Rh Rhodium 2,8,18,16,1	⁴⁶ Pd Palladium 2,8,18,18	⁴⁷ Ag Silver (Argentum) 2,8,18,18,1	⁴⁸ Cd Cadmium 2,8,18,18,2	⁴⁹ In Indium (Stannum) 2,8,18,18,4	⁵⁰ Sn Tin 2,8,18,18,4	⁵¹ Sb Antimony (Stibium) 2,8,18,18,5	⁵² Te Tellurium 2,8,18,18,6	⁵³ I Iodine 2,8,18,18,7	⁵⁴ Xe Xenon 2,8,18,18,8
⁵⁵ Cs Caesium 2,8,18,18,8,1	⁵⁶ Ba Barium 2,8,18,18,8,2	⁵⁷⁻⁷¹ La-Lu Lanthanum 2,8,18,32,18,8,1	⁷² Hf Hafnium 2,8,18,32,10,2	⁷³ Ta Tantalum 2,8,18,32,11,2	⁷⁴ W Tungsten (Wolfram) 2,8,18,32,12,2	⁷⁵ Re Rhenium 2,8,18,32,13,2	⁷⁶ Os Osmium 2,8,18,32,14,2	⁷⁷ Ir Iridium 2,8,18,32,15,2	⁷⁸ Pt Platinum 2,8,18,32,17,1	⁷⁹ Au Gold (Aurum) 2,8,18,32,18,1	⁸⁰ Hg Mercury (Hydrargyrum) 2,8,18,32,18,2	⁸¹ Tl Thallium 2,8,18,32,18,3	⁸² Pb Lead (Plumbum) 2,8,18,32,18,4	⁸³ Bi Bismuth 2,8,18,32,18,5	⁸⁴ Po Polonium 2,8,18,32,18,6	⁸⁵ At Astatine 2,8,18,32,18,7	⁸⁶ Rn Radon 2,8,18,32,18,8
⁸⁷ Fr Francium 2,8,18,32,18,8,1	⁸⁸ Ra Radium 2,8,18,32,18,8,2	⁸⁹⁻¹⁰³ Ac-Lr Actinium 2,8,18,32,18,8,1	¹⁰⁴ Rf Rutherfordium 2,8,18,32,32,10,2	¹⁰⁵ Db Dubnium 2,8,18,32,32,11,2	¹⁰⁶ Sg Seaborgium 2,8,18,32,32,12,2	¹⁰⁷ Bh Bohrium 2,8,18,32,32,13,2	¹⁰⁸ Hs Hassium 2,8,18,32,32,14,2	¹⁰⁹ Mt Meitnerium 2,8,18,32,32,15,2	¹¹⁰ Ds Darmstadtium 2,8,18,32,32,16,1	¹¹¹ Rg Roentgenium 2,8,18,32,32,18,1	¹¹² Cn Copernicium 2,8,18,32,32,18,2	¹¹³ Nh Nihonium 2,8,18,32,32,18,3	¹¹⁴ Fl Flerovium 2,8,18,32,32,18,4	¹¹⁵ Mc Moscovium 2,8,18,32,32,18,5	¹¹⁶ Lv Livermorium 2,8,18,32,32,18,6	¹¹⁷ Ts Tennessine 2,8,18,32,32,18,7	¹¹⁸ Og Oganesson 2,8,18,32,32,18,8

Atomic number
Symbol
Name
Electron configuration

Hints
Gases
Liquids
Synthetic Elements

⁵⁷ La Lanthanum 2,8,18,18,9,2	⁵⁸ Ce Cerium 2,8,18,19,9,2	⁵⁹ Pr Praseodymium 2,8,18,21,8,2	⁶⁰ Nd Neodymium 2,8,18,22,8,2	⁶¹ Pm Promethium 2,8,18,23,8,2	⁶² Sm Samarium 2,8,18,24,8,2	⁶³ Eu Europium 2,8,18,25,8,2	⁶⁴ Gd Gadolinium 2,8,18,25,9,2	⁶⁵ Tb Terbium 2,8,18,27,8,2	⁶⁶ Dy Dysprosium 2,8,18,28,8,2	⁶⁷ Ho Holmium 2,8,18,29,8,2	⁶⁸ Er Erbium 2,8,18,30,8,2	⁶⁹ Tm Thulium 2,8,18,31,8,2	⁷⁰ Yb Ytterbium 2,8,18,32,8,2	⁷¹ Lu Lutetium 2,8,18,32,9,2
⁸⁹ Ac Actinium 2,8,18,32,18,9,2	⁹⁰ Th Thorium 2,8,18,32,18,10,2	⁹¹ Pa Protactinium 2,8,18,32,20,9,2	⁹² U Uranium 2,8,18,32,21,9,2	⁹³ Np Neptunium 2,8,18,32,22,9,2	⁹⁴ Pu Plutonium 2,8,18,32,24,8,2	⁹⁵ Am Americium 2,8,18,32,25,8,2	⁹⁶ Cm Curium 2,8,18,32,25,9,2	⁹⁷ Bk Berkelium 2,8,18,32,27,8,2	⁹⁸ Cf Californium 2,8,18,32,28,8,2	⁹⁹ Es Einsteinium 2,8,18,32,29,8,2	¹⁰⁰ Fm Fermium 2,8,18,32,30,8,2	¹⁰¹ Md Mendelevium 2,8,18,32,31,8,2	¹⁰² No Nobelium 2,8,18,32,32,8,2	¹⁰³ Lr Lawrencium 2,8,18,32,32,9,2

Fig. 5.10

- Which elements were added recently in the Periodic Table? Find out.
- Elements exist in different states.

List the elements existing in solid, liquid and gaseous states with the help of the Periodic Table.

Solid	Liquid	Gas

Table 5.6

- Find the synthetic elements with the help of the Periodic Table.

Earlier attempts for the classification of elements

The modern Periodic Table that we use today is the result of the efforts of many scientists. Have a look at the contributions of various scientists to the earlier classification of elements.



Antoine Lavoisier Fig. 5.11

Lavoisier made the earliest attempts to classify elements. He classified the then-known elements into metals and non-metals.

Dobereiner classified the elements of similar properties into groups of three. These groups were called triads. He stated that the atomic mass of the element in the middle of the triads was approximately the average of the atomic masses of the other two elements. Only a few elements could be classified in this way.



Dobereiner Fig. 5.12

Element	Atomic mass	Element	Atomic mass	Element	Atomic mass
Li	7	Ca	40	Cl	35.5
Na	23	Sr	87.6	Br	80
K	39	Ba	137.3	I	127

Table 5.7

Newlands found that when elements were arranged in ascending order of atomic mass, each eighth element was a repetition of the first in its properties. He compared this to the seven notes in music.

This classification was known as the Law of Octaves. As more elements were discovered, it became clear that all elements could not be arranged in this way.



Newlands
Fig. 5.13

Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl

Table 5.8

A scientist named Mendeleev arranged the 63 elements known till that day in ascending order of their atomic masses and prepared a table. It was found that elements with common properties were repeated at regular intervals.



Mendeleev
Fig. 5.14



Mass number, atomic number

Atoms were initially thought to be the smallest indivisible particles, but later it was discovered that atoms are made up of tiny particles called electrons, protons, and neutrons. Atoms have a center called the nucleus. Protons and neutrons are found in this very small nucleus. Electrons exist around the nucleus. Protons have a positive charge and electrons have a negative charge. Neutrons are chargeless particles. The number of protons in an atom is considered as its atomic number. The mass number is the total number of protons and neutrons. The number of protons in an atom is equal to the total number of electrons in it.

Mendeleev's Periodic Law

The physical and chemical properties of elements are the periodic functions of their atomic mass.

Mendeleev's Periodic Table is shown in the figure. The horizontal rows in the table are called periods and the vertical columns are called groups. Elements in a group show similar chemical properties.

Group	I	II	III	IV	V	VI	VII	VIII			
Oxide Hydride	R ₂ O RH	RO RH ₂	R ₂ O ₃ RH ₃	RO ₂ RH ₄	R ₂ O ₅ RH ₃	RO ₃ RH ₂	R ₂ O ₇ RH	RO ₄			
Periods	A B	A B	A B	A B	A B	A B	A B	Transition series			
1	H 1.008										
2	Li 6.939	Be 9.012	B 10.81	C 12.011	N 14.007	O 15.999	F 18.998				
3	Na 22.99	Mg 24.31	Al 29.98	Si 28.09	P 30.974	S 32.06	Cl 35.453				
4 First series Second series	K 39.102 Cu 63.54	Ca 40.08 Zn 65.37	..... .....	Ti 47.90	V 50.94 As 74.92	Cr 50.20 Se 78.96	Mn 54.94 Br 79.909	Fe 55.85	Co 58.93	Ni 58.71
5 First series Second series	Rb 85.47 Ag 107.87	Sr 87.62 Cd 112.04 In 114.82	Y 88.91 Sn 118.69	Zr 91.22 Sb 121.75	Nb 92.91 Te 127.60	Mo 95.94 I 126.90	Tc 99	Ru 101.07	Rh 102.91	Pd 106.4
6 First series Second series	Cs 132.90 Au 196.97	Ba 137.34 Hg 200.59	La 138.91 Ti 204.37	Hf 178.49 Pb 207.19	Ta 180.95 Bi 208.98	W 183.85		Os 190.2	Ir 192.2	Pt 195.09	

Fig. 5.15

Characteristics

- Elements were arranged in the ascending order of atomic mass. Blank spaces were left for elements to be discovered and their properties were predicted.
- Elements with similar properties were grouped together to simplify the study of elements and their compounds.
- However, the order of atomic mass was not strictly followed in the case of all elements. Hydrogen could not be given an exact position.

- Elements with very different properties had to be placed in the same group.

When Mendeleev's Periodic Table was formed in 1869, there was limited knowledge about the structure of the atom and its elementary particles. Henry Moseley later discovered that the properties of elements depend on their atomic number. The periodic table developed by him is the modern periodic table used today.

Chemical Formula of Molecules

We use symbols to identify elements easily.

If we write N, it refers to nitrogen and one atom of nitrogen.

Is there any difference between 2N and N₂?

- 2N - refers to two free nitrogen atoms.
- N₂ - refers to a nitrogen molecule formed by two atoms.
- 2N₂ - refers to two nitrogen molecules.

What is the total number of atoms in 2N₂?

Check the abbreviation of the molecules of some elements.

Molecule	Number of atoms	Category
He	1	Monoatomic elements.
O ₂	Diatomic elements.
S ₈	Polyatomic elementss.
H ₂
P ₄
Ne
Cl ₂
Ar
O ₃

Table 5.9

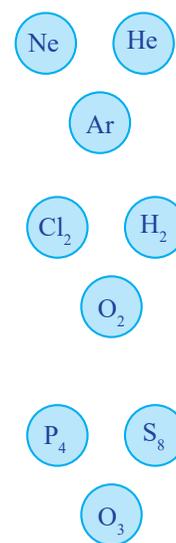


Fig. 5.16

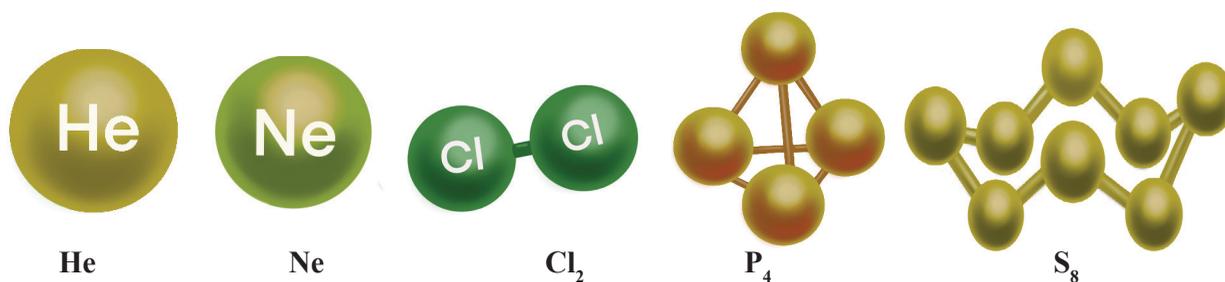


Fig. 5.17

Is it clear that, monoatomic elements are elements that have only one atom in a molecule? Write the difference between diatomic elements and polyatomic elements.

Chemical formula of the molecule represent one molecule of a substance.

Chemical formula of elements

In monoatomic elements, the symbol itself is considered as the chemical formula.

In monoatomic molecules, the number written on the left of the symbol indicates the number of molecules. This is also the number of atoms.

$2\text{He} \rightarrow 2$ Helium atoms / 2 Helium molecules

$3\text{Ne} \rightarrow 3$ Neon atoms / 3 Neon molecules

Atomicity is the number of atoms in a molecule. In diatomic and polyatomic elements, the atomicity is written as a subscript on the right of the symbol to obtain their chemical formula. The total number of molecules is written on the left side of the chemical formula.

We can find the number of molecules and the number of atoms from the chemical formula of the elements.

$3\text{O}_2 \rightarrow 3$ oxygen molecules

Total number of atoms = $3 \times 2 = 6$ oxygen atoms

$5\text{Cl}_2 \rightarrow 5$ chlorine molecules

Total number of atoms = $5 \times 2 = 10$ chlorine atoms

Find the number of molecules and the total number of atoms in the following.

Substance	No. of molecules	No. of atoms
H ₂	1 × 2 = 2
5O ₂
6N ₂
4Cl ₂
S ₈

Table 5.10

Chemical Formula of Compounds

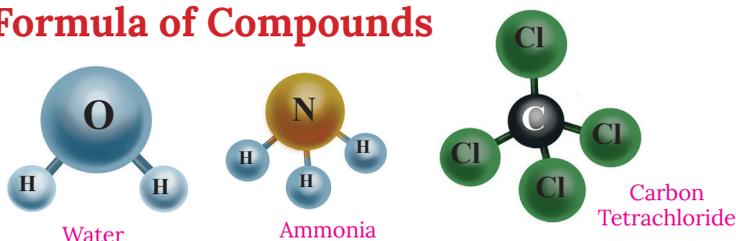


Fig. 5.18

Hydrogen chloride is a compound familiar to you. Hydrogen and Chlorine are the constituent elements in hydrogen chloride.

Write the symbols for hydrogen and chlorine. A molecule of hydrogen chloride contains one hydrogen atom and one chlorine atom.

How can we represent a molecule of hydrogen chloride?

Hydrogen chloride - HCl

How can we represent a molecule of water in the same way? Complete the table.

Compound	Elements	Symbol	Atoms in a molecule	Chemical Formula
Nitric Oxide	Nitrogen	N	1	NO
	Oxygen	O	1	
Ammonia	Nitrogen	N	1	.....
	Hydrogen	H	3	
Carbon dioxide	.....	.....	.....	CO ₂
	
Sulphuric Acid	Hydrogen	.....	2	.....
	Sulphur	S	1	
	Oxygen	.....	4	
Carbon tetrachloride	Carbon	.....	.....	CCl ₄
	Chlorine	.....	.....

Table 5.11

A compound has a certain ratio between the number of atoms of its constituent elements.

Find the number of molecules and the total number of atoms present in 3CO_2 .

$$\text{Number of molecules} = 3$$

$$\text{Atoms C} = 3 \times 1 = 3$$

$$\text{O} = 3 \times 2 = 6$$

$$\text{Total number of atoms} = 9$$

Like this, you can find the total number of atoms in the molecules of any compound.

Complete the table given below.

Compound	No. of molecules	No. of atoms
2HCl	2	H - $2 \times 1 = 2$ Cl - $2 \times 1 = 2$ 4
4SO_2	4	.....
$3\text{C}_2\text{H}_5\text{OH}$	.....	.....
$2\text{C}_6\text{H}_{12}\text{O}_6$	.....	.....

Table 5.12

Chemical Equations

Carbon reacts with oxygen to form carbon dioxide.

What are the reactants in this reaction?

What are the products?

How do you write the reactants using chemical formula?

How about products?

This chemical reaction can be represented as $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$.

A chemical equation is the representation of a chemical reaction which helps to understand it at a glance. It uses symbols/chemical formulae to represent the reactants and products.

Calcium carbonate (CaCO_3) decomposes to form calcium oxide (CaO) and carbon dioxide (CO_2). How can this chemical reaction be represented?

Write the chemical equations of some chemical reactions that you are familiar with.

-
-
-



Let's asses

1. Match the following.

A Element	B Symbol	C Base
Francium	Rb	continent
Curium	Eu	satellite
Rubidium	Ti	colour
Neptunium	Cm	country
Europium	Fr	planet
Titanium	Np	scientist

2. Cl is the symbol of the element chlorine. How can we represent two chlorine atoms and one chlorine molecule using this symbol?
3. Find the number of atoms in each of the following and write which of them contains the most number of atoms.



4. Complete the table.

Element	Basis of nomenclature	Symbol
Indium	Indigo - colour	In
.....	Rutherford - Scientist	Rf
Germanium	.....	.....
Silver	Argentum - Latin name	.....

5. The names of some scientists are given.

(Dobereiner, Lavoisier, Newlands, Mendeleev)

Match the statements given below with the names given in brackets.

- The chemical and physical properties of the elements are functions of their atomic masses.
- Elements were divided into groups containing three elements (triads) with similar properties.
- The elements were classified into metals and non-metals.
- When the elements were arranged in ascending order of atomic masses, it was found that every eighth element was a repetition of the first, in terms of its properties.



Extended activities

- Make models of the molecules using materials available in your surroundings.
 - Carbon tetrachloride (CCl_4)
 - Ammonia (NH_3)
 - Water (H_2O)
- Prepare a slide presentation/chart on the history of development of Periodic Table and exhibit it in the classroom.

METALS AND NON-METALS



Fig. 6.1

You must be familiar with different kitchen utensils. What are the common materials used to make utensils for cooking?

Let us do an activity. Take some water in a flat bowl. Place a wooden ladle and a steel ladle in it and let it boil. Touch the ladles and find out which one is hotter. Why is it so?

Why are you warned against handling iron like objects during thunder and lightning?

Find out the characteristics of metals as indicated in the above situations.

Device/Article	The characteristic property of the metal

	Thermal conductivity

	Shining


Table 6.1

What are the other characteristics of metals familiar to you?

Metals like iron, copper, gold, silver and aluminium are familiar to us because they are widely used in everyday life. What are the other metals familiar to you?

Write a short note highlighting the characteristic properties of different metals.

Define metals on the basis of the characteristics mentioned above.

Malleability

Have a look at the picture.

What is the blacksmith doing? What changes occur when a piece of metal is hammer blown?



Fig. 6.2

Strike an aluminium wire with a hammer in the same manner.

Haven't you seen aluminium foil which is used to wrap tablets and food materials? Which characteristic property of metals is used in this case?

Generally metals can be hammered and flattened into thin sheets. This characteristic property of metals is known as malleability.



Fig. 6.3

However, it is not possible to hammer all metals into thin sheets in the same manner.

All metals are not malleable to the same extent.

Gold is the most malleable metal.

Write examples for utilising the malleability of metals.

- Metal sheets are used to make roofing of buildings.

-

-

Ductility

Filament of the bulb given in the figure is made of very thin wires of tungsten.

Metals can be drawn into thin wires.

This property of metals is known as Ductility.

Metals like gold and copper can be drawn into very fine wires. Gold and Platinum are the most ductile metals.

There are a lot of situations where ductility of metals is utilised. List a few of them.

- Electric wires

-

-



Fig. 6.4

Electrical Conductivity

Complete the circuit as shown in the figure.

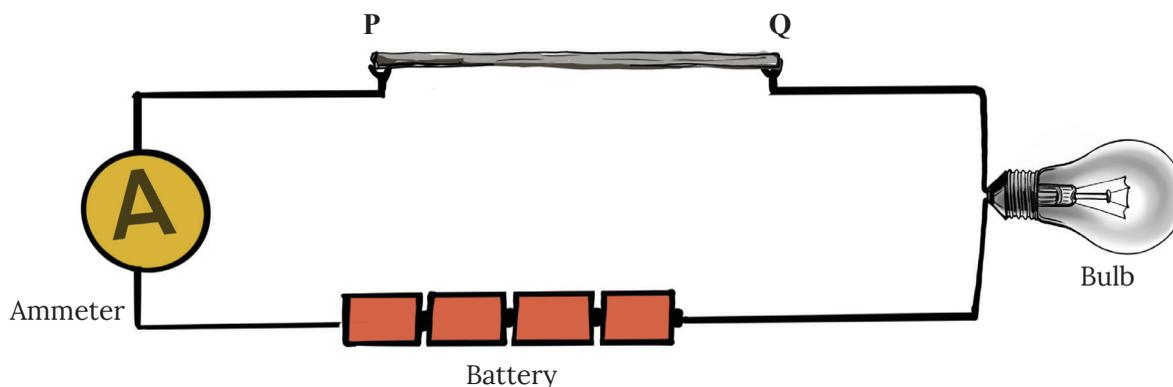


Fig. 6.5

A few materials are given in the table. Put them one by one in the place marked as P, Q. Repeat the experiment using more objects. Record the observation and inference.

Object	Bulb glows/ does not glow	Conductor of electricity/ not a conductor of electricity
A folded piece of paper		
A piece of plastic scale/ ruler		
A piece of razor blade		
A fine iron wire		
Aluminium wire		

Table 6.2

Which among these objects made the bulb glow?

Are they metals or non -metals?

What can be inferred from this experiment?

All metals conduct electricity. But all the metals do not conduct electricity to the same extent.

The ability of a material to conduct electricity through it is known as electrical conductivity. All metals are electrical conductors.

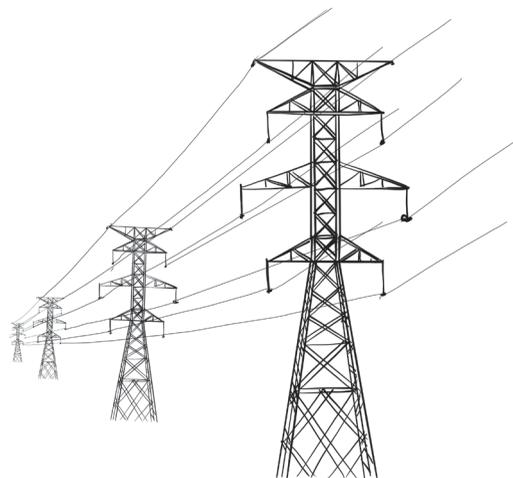


Fig. 6.6

Silver is the best electrical conductor among the metals. The electrical conductivity of the metals such as silver, copper, gold, and aluminium decreases in the following order.

Silver > Copper > Gold > Aluminium

Which metal is used in household electrical wiring?

Which metal is used to make electric lines for the public distribution of electricity?

Why is silver not used for this purpose?

Thermal Conductivity

Utensils for cooking are usually made of metals. Which characteristic properties of metals are utilised in this case?

The ability of metals to conduct heat is primarily utilised here, right?

The ability of metals to conduct heat viz., thermal conductivity is one of the fundamental characteristics of metals.

Silver is the best conductor of heat among metals. Metals such as aluminium and copper have relatively high thermal conductivities. Aluminium is extensively used for making cooking utensils. Find the reasons.



The non metal carbon exists in two main allotropic forms, diamond and graphite. The distinct characteristics of diamond and graphite make them suitable for various applications.

Diamond is one of the materials having highest thermal conductivity. Since graphite has high electrical conductivity, it is used as electrodes.

Diamond is used to cut glass due to its high hardness. The strikingly different properties of diamond and graphite are due to the differences in the carbon-carbon bonding in them.



Fig. 6.7

Sonority

You can hear the school bell ringing even from a distance.

Isn't it pleasant to listen to the jingling of anklets or cymbals?

All these items are made of metals.

Imagine a situation where we use a piece of wood as the school bell.

Will it jingle like the metal piece?

The ability of metals to produce characteristic sound when struck with a hard material is known as sonority.

Metallic Lustre

Rub an iron nail with a sand paper.

What change do you observe?

The metals such as gold and silver have a natural shine.

You may observe cutting a piece of sodium metal with a knife.

Don't you see that the newly formed surface has a shiny appearance?

The shiny appearance of the surface of metals is known as metallic lustre.

Certain metals show metallic lustre when they are cut into pieces or polished.

Examine whether all metals have similar metallic lustre?

Identify the situations in which metallic lustre is made use of ?

- for making ornaments

-

Hardness

You know that it is easy to cut sodium metal with a knife.

Is it possible to cut metals such as copper, aluminium and gold in the same manner?

Lithium, sodium and potassium are soft metals. But other metals are harder.

Generally metals are hard.

Metals generally exist in the solid state.

Are there metals which exist in liquid state?

Metals generally have high melting point.

However, gallium and caesium are metals having low melting point. They start melting when placed on our palm. In other words, they exist in the liquid state on warmer days.

Metals generally have high boiling points.

Take some articles made up of different metals (iron nail, aluminium wire), a small piece of wood, charcoal, thermocol and cork. Put each of them one by one in water taken in a beaker.

Which among these articles sink into the water? Which of these float over water?

Metals generally have high density.

Lithium, sodium and potassium are the metals having low density.

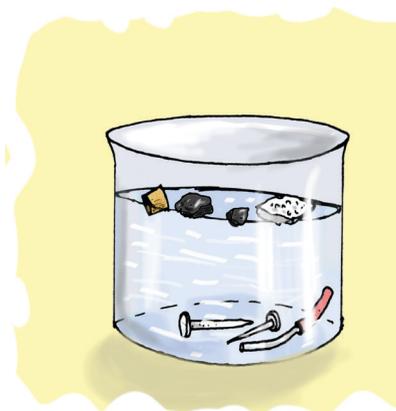


Fig. 6.8

Metals are substances that generally exist in solid state, show high conductivity of heat and electricity, metallic lustre and hardness.

Non-Metals

What are the characteristics of non-metals in comparison with metals?

- Generally, non-metals are less hard.
- They do not show sonority.
- They generally do not conduct heat.
-
-
-

List some non metals in your Science Diary. Classify them into solid, liquid and gas.

You have already learnt about the characteristics of metals and non-metals. These are their physical properties. Both metals and non-metals differ in their chemical properties too. Based on this, they undergo various types of chemical reactions.

Reactions of metals with atmospheric air

Observe the newly formed surface of sodium when it is cut with a knife. You can see the metallic lustre. Observe the surface after keeping it exposed to air for sometime. What change do you observe? Why did it lose its metallic lustre? It is because sodium reacts with the components of air.

Haven't you noticed the dull appearance of the surface of old objects made of aluminium? Take an aluminium wire and scrub it with sandpaper. What change do you observe?

Most of the metals such as copper and magnesium react with air in the same manner.

Burn a piece of magnesium in air. What is left behind?

Magnesium reacts with oxygen in the air to form the compound magnesium oxide.

Magnesium + Oxygen \rightarrow Magnesium oxide



Dissolve the magnesium oxide formed, in water taken in a beaker. What is the colour change when a red litmus paper is dipped in it?

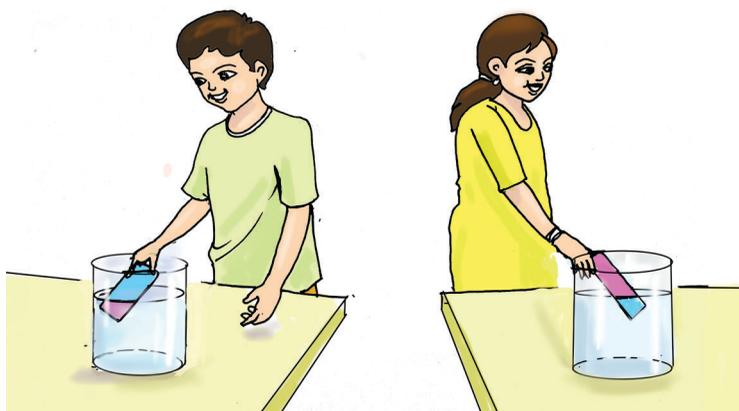


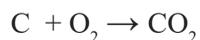
Fig. 6.9

What is the reason?

Magnesium oxide dissolves in water to form magnesium hydroxide which is a base. Most of the metals (except silver, gold and platinum) react with oxygen in air to form the corresponding oxide. Almost all the metal oxides show basic nature in the presence of water. Some metals react with the components of air like moisture and carbon dioxide in addition to oxygen. Oxides of metals are generally basic in nature.

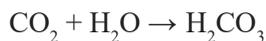
Oxides of Non-metals

Carbon combines with oxygen to form carbon dioxide.



Do you know how soda water is prepared?

Soda water is prepared by dissolving carbon dioxide in water at high pressure.



Dip a blue litmus paper in soda water. Notice the change in colour.

It is clear that soda water is acidic in nature. Carbonic acid is present in soda water.

Oxides of non metals are generally acidic in nature.

Corrosion of Metals

Haven't you noticed that iron knives used in the kitchen rust unless wiped and dried properly?

You might have seen the tarnishing of copper. It is because metals react with air.

The surface of aluminium loses its lustre and becomes dull because of the same reason.

Metals react with different components of air and form various compounds. This is known as corrosion of metals.

There are a number of factors which influence the rusting of iron. Let us understand what they are.

Let us do an experiment

Materials required

Clean and dry test tubes-4, cork-4, rust free and shiny iron nails -4, anhydrous calcium chloride, table salt, ordinary water, distilled water, boiled distilled water and oil.

Procedure

Take four test tubes. Put a rust free and shiny iron nail in each of them. Add distilled water in the first test tube, salt solution in the second test tube and distilled water soon after boiling in the third test tube. Iron nails should be fully immersed in these three test tubes. Add oil in the third test tube in such a way that the surface of the water is completely covered by oil. Take anhydrous calcium chloride or quicklime in the fourth test tube. All the four test tubes should be closed immediately with cork after putting the materials.

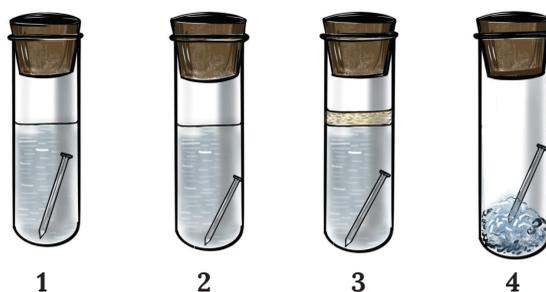


Fig. 6.10

Keep the test tubes at rest for a few days and watch the iron nails afterwards. Indicate the test tubes in which the iron nails got rusted.

Air and moisture are present in the first test tube.

How does the salt solution in the second test tube influence the rusting of iron?

The iron nails in the third and fourth test tubes haven't undergone any change. What is the reason?

Why was boiled distilled water used in this experiment?

Since the third test tube contains distilled water soon after boiling and oil floating on the surface of water, the iron nail cannot come in contact with air. Anhydrous calcium chloride or quicklime absorbs the moisture present in the fourth test tube.

Anhydrous calcium chloride absorbs moisture from atmosphere very quickly. Silica gel and quick lime are also used for this purpose.

The factors influencing the rusting of iron can be found out from this experiment. Record them in your Science Diary.

Iron rusts when it undergoes chemical reaction with oxygen, moisture, etc., present in the atmosphere. The presence of salts like common salt accelerates the rusting process of iron.

Do you know why iron window bars in houses close to sea shore corrode faster?

It is clear that the presence of salts in the atmospheric air causes faster rusting of iron.

Besides iron, which are the other metals used in our daily life that undergo corrosion in the presence of atmospheric air?

- Copper

-

Very reactive metals like sodium and potassium are stored in kerosene. Can you find the reason for it?

After cutting lemon, if the iron knife is left without wiping, it starts rusting faster. You are familiar with the acid present in lemon, aren't you?



Fig. 6.11

Iron rusts faster in the presence of acids.

Aluminium and iron react with acids. That is why food items having sour taste such as pickles and curd are not stored in vessels made of aluminium and iron.

Do all metals undergo corrosion in the similar manner?

Have you noticed any changes to gold ornaments when exposed to air?

What can be inferred from this?

The metals which react with the components of air undergo corrosion.

What are the disadvantages of the corrosion of metals?

- Objects made of metals break due to the deterioration of their strength.
- Electric circuits stop working.
- Results in economic loss.

20% of the world's production of iron is lost by corrosion every year. Hence it is important to prevent rusting of iron.

Haven't you noticed that window bars made of iron are painted and iron knives are coated with oil?

This is done to prevent corrosion of iron.



Fig. 6.12

Now a days utensils made up of stainless steel are widely used instead of those made of aluminium and iron. Why?

Stainless steel is an alloy of iron.

Metals are combined with other metals or non metals to make alloys. It is done to obtain materials with desirable properties and to resist corrosion. A very small amount of non metals like carbon, phosphorus, etc. are also added to such alloys.

For e.g:- stainless steel, brass, bronze



Aranmula Kannadi



Fig. 6.13

The world- renowned 'Aranmula Kannadi' is not made of glass as its name indicates. It is traditionally crafted using a secret alloy of copper and tin, known only to traditional artisans. What makes Aranmula Kannadi unique is that it is handmade without the aid of any machine. It reflects light because it is finely polished like a mirror.

Can you suggest any other methods to prevent corrosion ?



As iron objects undergo corrosion, the rust formed on the surface flakes off as layers, leading gradually to their complete deterioration. Although aluminium and copper react with air, they do not get deteriorated completely as in the case of iron. Aluminium oxide and basic copper carbonate formed respectively on the surface of aluminium and copper act as a coating on it. Hence, these metals are protected from further corrosion. Though rust acts as a covering on the surface of iron articles, it is porous and as a result the metal again comes in contact with air.

Metals in Human Body

Presence of certain metals is essential for the normal functioning of human body. They are not present as free metals. Sodium, potassium, calcium, iron, cobalt and zinc are examples of such metals. These elements must be present in the appropriate amounts in our body. You have already learnt that iron is present in haemoglobin which brings oxygen from lungs to cells, and carries carbon dioxide back.

Calcium is the most abundant metal in our body. It gives strength to bones and teeth. Moreover, it helps to regulate blood pressure. As human body cannot synthesise those metals, they should be made available through food in sufficient quantities.



Let us assess

1. Match the following.

A Name of metal	B Characteristic property	C Symbol
Silver	high ductility	Au
Platinum	the highest malleability	Ag
Gold	high electrical conductivity	Pt

2. The names of certain metals are given in the box.

Calcium, Mercury, Gallium, Copper, Silver

Choose the appropriate metal for the following situations.

- Reacts with the components of air and forms tarnish on the surface.
 - It is the best conductor of heat.
 - The metal that melts when placed on the palm.
 - It exists in the liquid state in normal temperature.
 - This metal is present in bones and teeth.
3. Certain metals are given in the following table. Find any two uses of each and the characteristic property responsible for it.

Metal	Use	Characteristic property
Copper		
Gold		
Aluminium		
Iron		
Silver		

4. Oxides of elements A and B are dissolved in water in two separate beakers.
- How can you identify the acidic solution and the basic solution?
 - Which of these elements is more likely to be a metal? Why?



Extended Activities

- Alloys have a variety of uses. Duralumin, which is used to make the parts of aircrafts and Alnico, which is used to make magnets are examples. Collect information about the alloys and their uses. Present it in your class as slides or charts.
- Metals are present not only in the human body, but in plants as well. Collect information regarding the important metals present in plants and their functions. Prepare a science article based on this.

LET'S CULTIVATE AND REAP GOODNESS



Fig.7.1

Have you noticed the diligent student who is receiving the 'Karshaka Pratibha Award' for being the best student farmer of the state government, for producing high-quality vegetables at a low cost?

- What do the government aim in giving away such awards to children?
- Do you know anyone who has achieved similar success in agriculture? What activity in the agricultural sector made them notable?

.....

Let us take a look at a portion of the report submitted by this student farmer to the award selection committee. Read the given excerpt of the report.

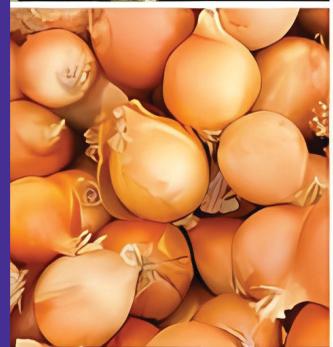


I am a student of Class VIII. My family consists of my father, mother and a sister. We have our own house and fifteen-cents of land. My father is a small scale businessman.

I became more interested in farming when I visited a farm as part of my school activities. Then I gathered more information by contacting experts in the field of agriculture. Considering the space constraint, I made precise plans and started farming. I mainly cultivate beans, bitter gourd, brinjal, lady finger, ivy gourd, mint, spinach, green chilli and tomato.

After meeting our household needs, we can also sell the vegetables, and through this, we can earn about Rs. 2,000 per week.

I have been receiving unwavering support and cooperation from the Agriculture Office, Gram Panchayat Administration, and the Agricultural Cooperative Society. Recently, I have also been utilising some online services.



Aren't you happy on hearing about our friend's success story?

There are many individuals in our state who have achieved success in the field of agriculture. Prepare a note by examining the news paper reports based on the indicators.

School student seeks patent for tapioca harvester

A school student has garnered media attention for developing a simple machine for harvesting tapioca. This little scientist has applied for a patent for his invention.

Success in banana leaf

Edappal: Instead of banana bunches, a young postgraduate farmer from Edappal has scripted a new success story through the marketing of banana leaves. The idea struck when banana bunches were selling at a low price, prompting him to think: 'What if I sell banana leaves instead?'

Student's leafy greens shop

A college student's startup, aimed at utilising the market value of nutrient rich leafy greens achieved record sales within a year of its inception.

Entrepreneur through turmeric cultivation

Wayanad: A young man who started turmeric cultivation on two acres of land faced difficulties during harvest time due to low market prices. When he realised that numerous value-added products could be made from turmeric, he became a new entrepreneur.

New brand for Gandhakshala

Gandhakshala, the valuable variety of rice was cultivated in a unique way and it was launched in the market under a special brand, received a good response in the market. Inspired by this, more young entrepreneurs are planning to start cultivation at more places.

Indicators

- What are the ideas you have learned from the news reports?
- What are the circumstances that have prompted farmers to choose new ways?
- What are the other possibilities to make farming profitable?

Innovative agricultural initiatives can strengthen rural economies, enhance food security, and inspire future generations to engage in farming.

What types of support are available for those starting a new venture? Complete the given illustration 7.1.

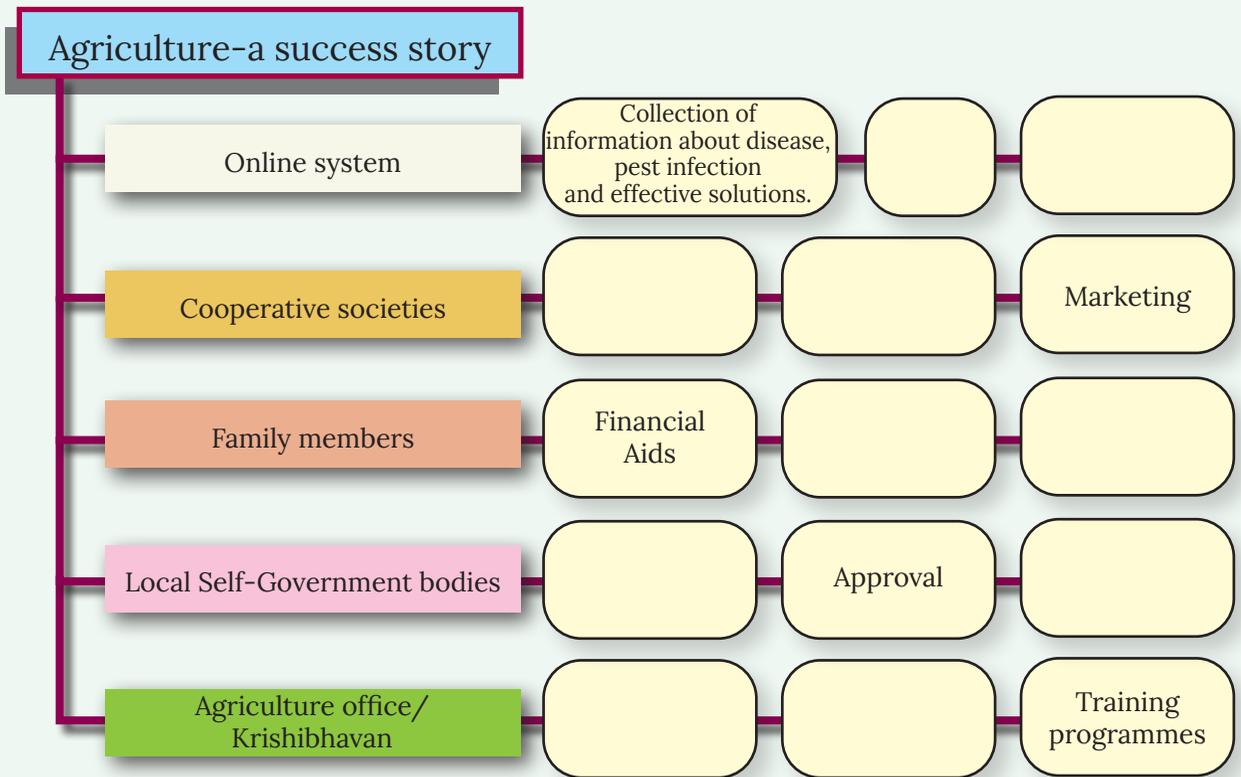


Illustration 7.1

Will you try to elaborate the illustration?

Maximising Land Utilisation

Our young farmer presents a model as a guiding example for those who regret the lack of space for farming.

Collect information on government initiated programmes to support new entrepreneurs and present it in your class.

Figure 7.2 provides insights into how he has effectively utilised his 15-cent plot of land to the fullest.

Discuss the possibilities and limitations of each method shown.



Sack farming



Aquaponics



Pet bottle farming



Vertical farming



Pot cultivation



Terrace farming

Fig. 7.2

Vertical farming is an innovative method to overcome space constraints. What are its possibilities?

Observe **figure 7.3** and prepare a note based on the indicators through discussion.



Fig. 7.3

Indicators

- How does it help to overcome space constraints?
- How does it ensure availability of light?
- How does it help to reduce the use of water?
- Construction cost

Implement a vertical farming system at school or home at a low cost.

Present a picture of your vertical farming setup along with a brief description of its construction in the class.



Vertical Farming

Vertical farming is an innovative agricultural method where crops are grown in vertically stacked layers. A key feature of vertical farming is that it utilizes the possibilities of hydroponics and aeroponics. It can be implemented even in urban areas with limited space by incorporating artificial lighting and protective structures to shield crops from rain and sunlight. Farming can be carried out independent of climatic conditions, making it a significant advantage of this method.

Application of Fertiliser

Fertilisers are commonly used in farming, aren't they?

What is the necessity of applying fertilisers?

Examine the given description and note down your conclusions.



Fig. 7.4

Plant nutrients

The elements required by plants are obtained from the soil. Of these, nitrogen, potassium, phosphorus, calcium, magnesium and sulphur are the elements required in large quantities. These are called macronutrients. However, elements such as barium, boron, zinc, copper, manganese, iron, molybdenum, chlorine and nickel are required only in very small quantities. These are known as micronutrients. Fertilisers are applied to ensure that crops receive all the essential nutrients for their growth.

Indicators

- Macronutrients and Micronutrients
- Need for the application of fertilisers

Some fertilisers are sprinkled on the field before or after planting. Liquid fertilisers are sprayed on the leaves while others are mixed with water and sprayed. Using different methods depending on the type of crop and soil ensures better yields.

You learned how to produce organic manure at a low cost using bio bins in the previous classes. Will you take the initiative to set up a similar system at home?

As you know different types of fertilisers are used in agriculture.

Complete the **illustration 7.2** below.

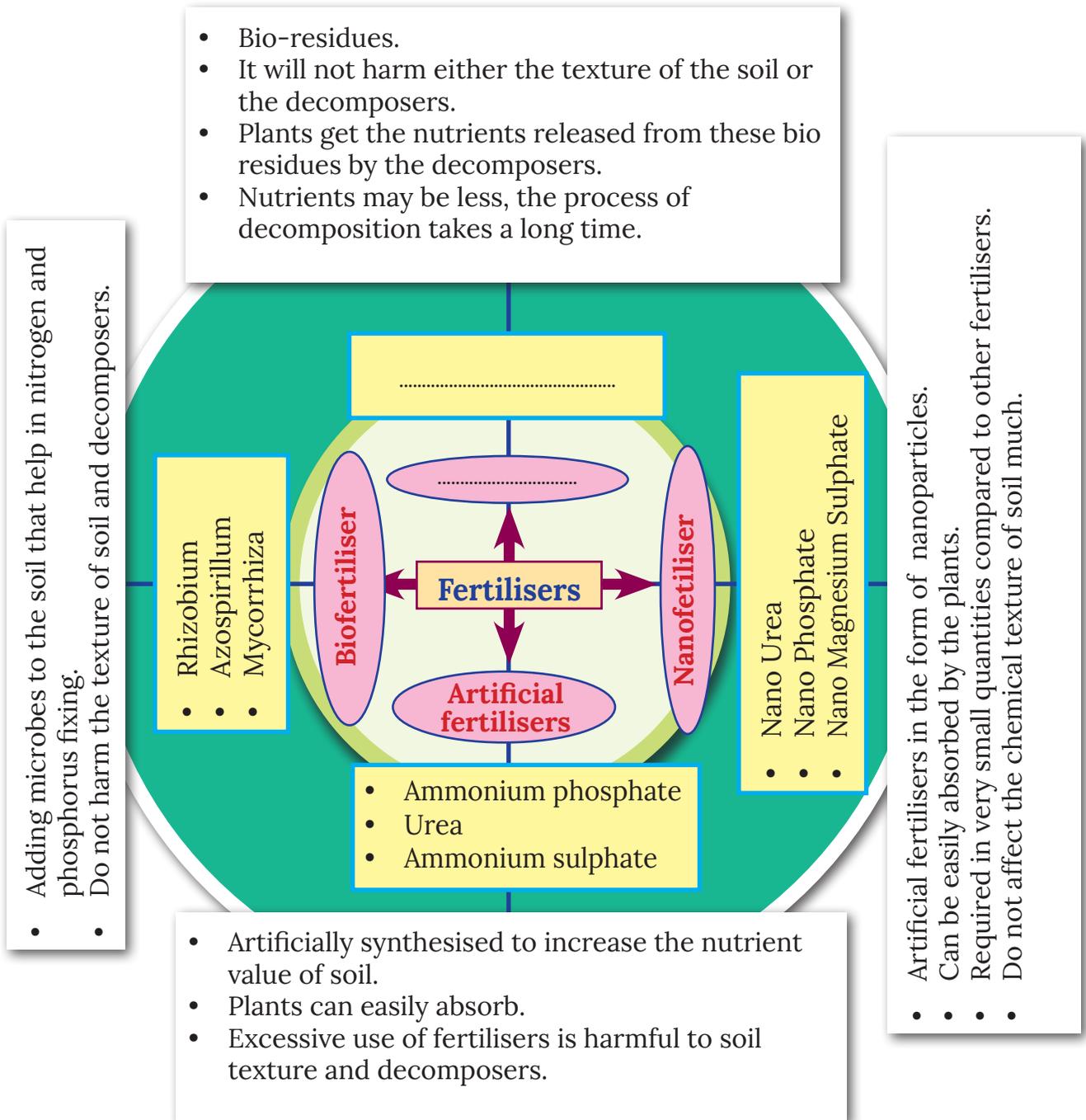


Illustration 7.2

Gather more information related to this and present a seminar paper in the class on the topic '**Different types of fertilisers - advantages and limitations**'.

While preparing the seminar paper consider the following facts also.

- The advantages and limitations of each type of fertiliser.
- Soil testing and application of fertilisers.
- Fertigation and irrigation



Fig. 7.5

Leaf colour chart

This is an easy way to find out the availability of nitrogen in crop plants. It helps to find out how much nitrogen fertilisers need to be added by comparing the colour of leaves of plants with a standard picture. Light green colour indicates the deficiency of nitrogen. Dark green colour indicates that nitrogen is present in adequate quantities.

The more you give, the more you receive.

All the nutrients absorbed by plants eventually reach us through the food we consume, don't they?

The quantities of various nutrients present in 100 grams of edible vegetables from a study are given in **Table 7.1**.

By examining the table, collect more information about the necessity of including local vegetables in the diet.

Vegetable	Protein (gram)	Fibre (gram)	Carbo-hydrate (gram)	Calcium (milligram)	Iron (milligram)	Carotene (milligram)	Vitamin C (milligram)
Colocasia leaf	3.9	2.9	6.8	227	10	10278	12
Curry leaf	6.1	6.4	18.7	830	0.93	7560	4
Drumstick leaves	6.7	0.9	12.5	440	0.85	6780	220
Sweet amaranth	6.8	1.4	11.6	570	28.0	5706	247
Cabbage	1.8	1.0	4.6	39	0.8	120	124
Beetroot	1.7	0.9	18.3	18.3	1.19	0	3
Cauliflower	2.6	1.2	4.0	33	1.23	30	56



Table 7.1

Fig. 7.6

Local varieties are naturally well-suited to the local environment. Since they have inherent resistance to pests and diseases, the use of pesticides can be minimised. By supporting local pollinators and beneficial insects, they help maintaining ecological balance. As these crops require minimal fertilisers and pesticides, cultivation costs can also be reduced.

Isn't it possible to grow such local vegetables in home gardens? They can enrich your kitchen garden to a nutrition garden.

Set up a nutrition garden in the school premises and document your experiences.

For better yield, high quality planting materials

We get high yield when we use high quality planting materials. Observe the **illustration 7.3** showing the methods of production of high yield planting materials. Prepare notes on it.

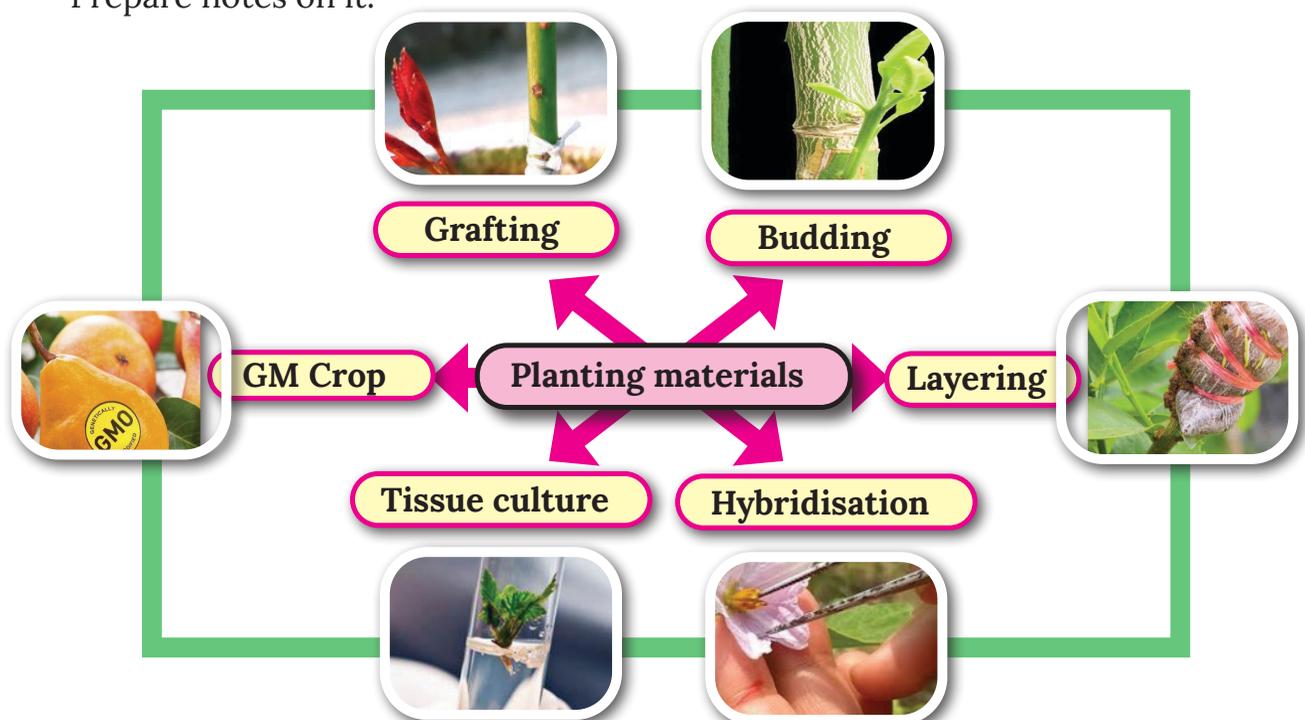


Illustration 7.3

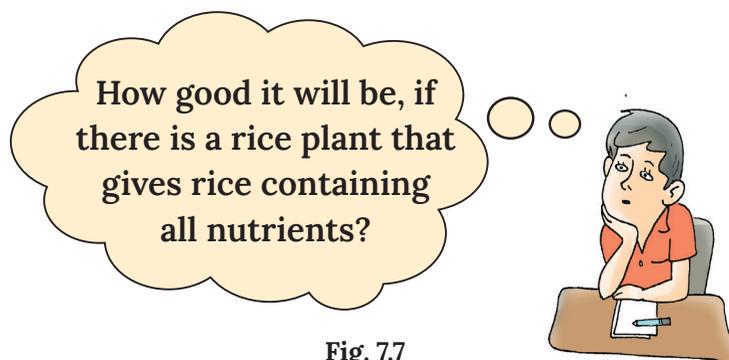


Fig. 7.7

Do you have the same opinion? Analyse the description given and draw inferences.



Fig. 7.8

GM Crops (Genetically modified crops)

In crops, new traits can be incorporated by altering its genetic constitution through genetic engineering. Cotton plant that resists pest attack, soyabean that resist weedicides, rice varieties that contain vitamin A etc are examples for these crops.



Fig. 7.9

Tissue culture

This technique helps to produce a large number of plants having all the characteristics of the parent plant. Tissues separated from the suitable part of a plant are grown in special nutrient medium to produce saplings.

The methods of grafting, budding, layering and tissue culture are adopted to produce saplings having the characteristics of the parent plant.

We have learned in previous classes that, with a little training, we can do grafting, budding and layering ourselves. But tissue culture requires more technical knowledge and training.

Collect more information about tissue culture and prepare a note for the bulletin board.

GM crops have many advantages. However, there is an opinion that these are a threat to the survival of indigenous species. Shall we interview experts in the relevant fields and prepare a report on these matters?

Utilisation of water

Observe the conversation between two farmers.



Fig. 7.10

What suggestions can you put forward to solve these problems.

-
-
-

Observe the given pictures and collect more information by field visits. Exhibit them on wall magazine.

Examine the validity of your suggestions by analysing the description given below.

Green House

This setup helps to cultivate both in rainy season and in summer season alike.

Green House is constructed using sheets of plastic, nylon, polyethylene, etc. Pest attack can also be reduced by this method as all the sides are covered.



Fig. 7.11



Fig. 7.12

Drip irrigation

This is an irrigation method using pipes and valves to water the roots in drops. By doing this, loss of water is reduced to maximum. Another significance of this method is that the availability of water to all plants is ensured.



Fig. 7.13

Wick Irrigation

A method of directly supplying water to the roots of plants through a cotton cloth filter from a water source is called wick irrigation. It requires less water than drip irrigation.



Fig. 7.14

Mulching

This is the traditional method of covering the soil in the fields using dry leaves, hay etc to reduce water loss due to evaporation. Through this method it is possible to reduce the growth of weeds and to make the soil enriched.

Pest control

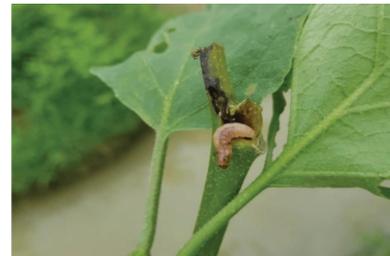
Below shown figures indicate a problem. Discuss.



A. Pod borer (Legume)



B. Leaf-rolling Caterpillar (Okra)



C. Stem Borer (Brinjal)

Fig. 7.15

Indicators

- Which are the major pests that affect the crops in our locality?
- Which are the different methods adopted to control pests by the farmers in your locality?

Integrated Pest Management- IPM

You know that there are different methods for pest control. While selecting a pest control method, population density of the pest, nature of crop, etc. should be considered. The need of farmers is not to kill all the pests but control their multiplication without any harm to the crops.

For this it is not always necessary to use pesticides that are harmful to the environment and human health. Integrated pest management is the use of mechanical pest control methods with different kinds of nets and traps, utilising friendly pests, use of resistant varieties of seeds for farming and reduce the use of pesticides. During instances of increased pest attack and the threat of crop loss, pesticides should be used only in suggested quantities, keeping the precautions.

Integrated Farming



Fig. 7.16

Is farming just about the cultivation of plants?

When birds, fish and other animals are raised along with crops, it is also farming. Integrated farming is the practise of nurturing diverse living organisms together. Visit an integrated farm in your locality and analyse [illustration 7.4](#) based on the indicators. Prepare a report on integrated farming.

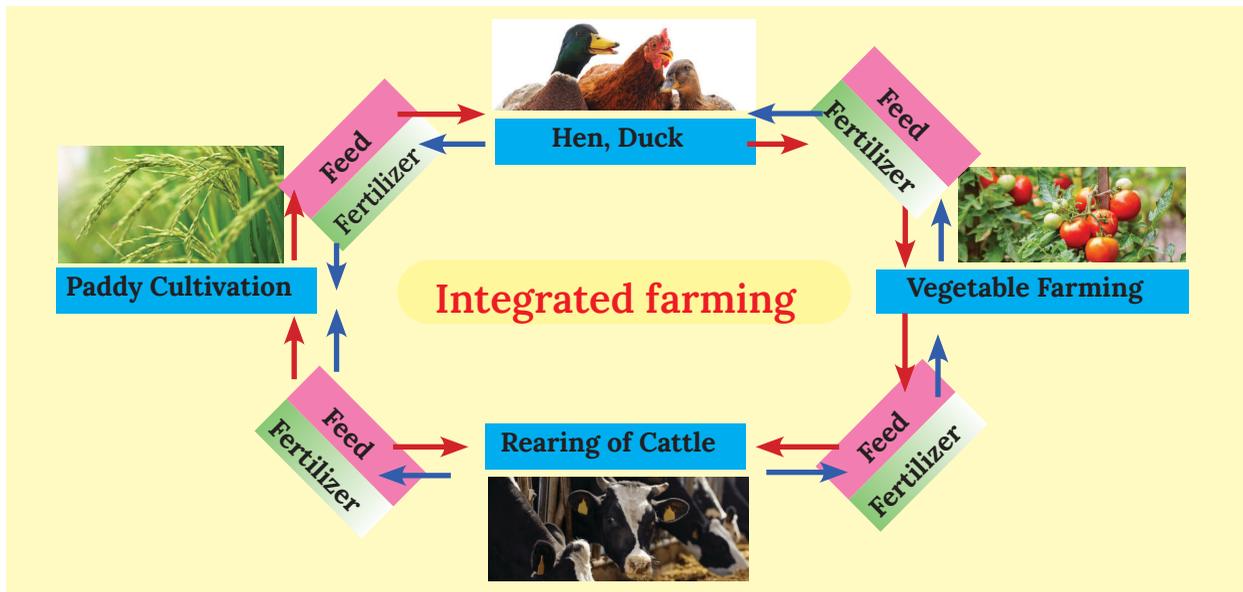


Illustration 7.4

Indicators

- Integrated farming—advantages and possibilities
- Food safety
- Reducing the cost of production

Smart Farming

Smart farming is the effective utilisation of modern technologies or practices in agriculture. Draw inferences based on the newspaper report and illustration 7.5.

The young farmer is the center of attention

Ernakulam: A young farmer in Ernakulam has become a role model by leaving his highly paid job in the IT sector to focus on farming. He has achieved great success by combining modern agricultural techniques with his IT expertise. He refers to his farming method as “Smart Farming”.

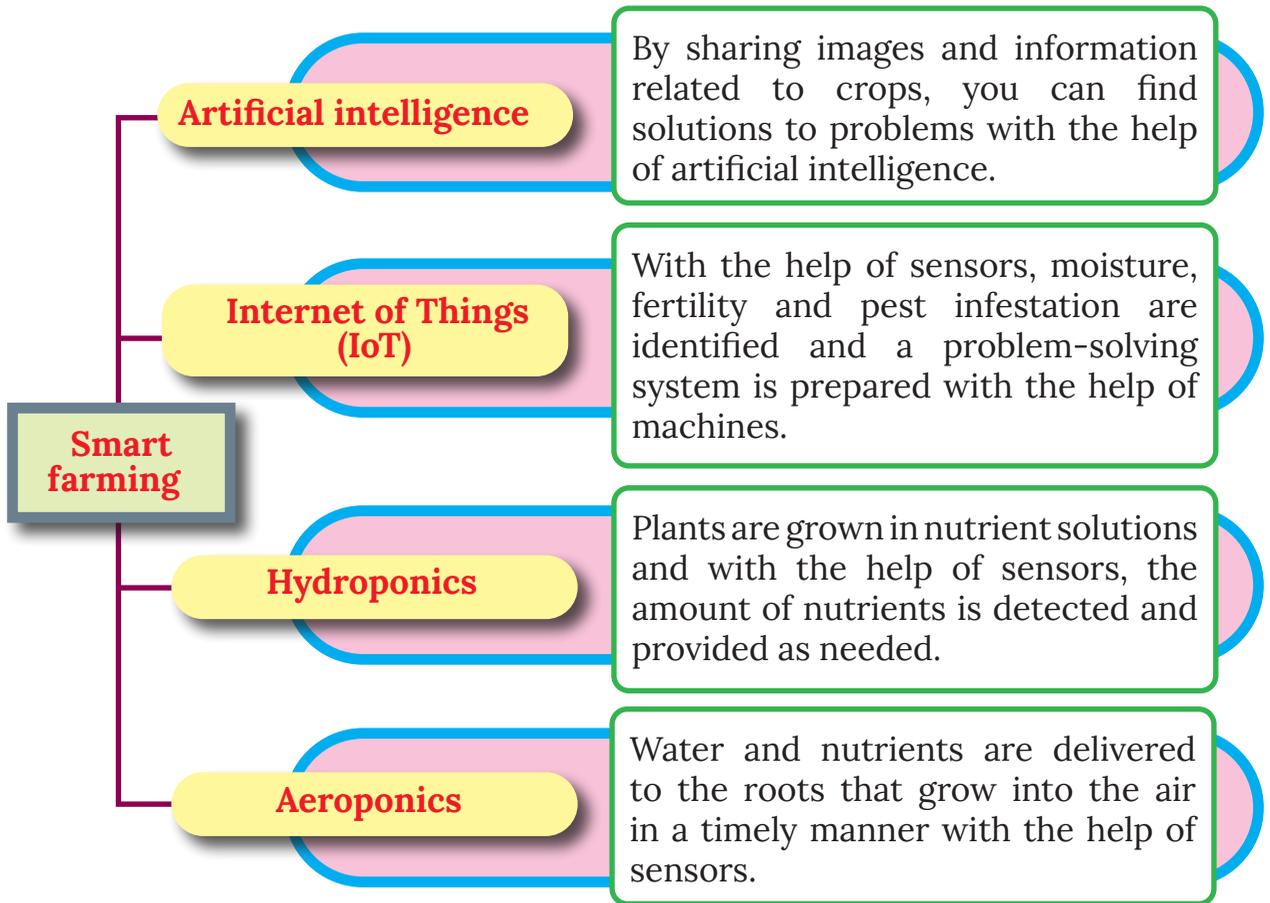


Illustration 7.5

Marketing

Should the farming alone be smart enough? In this era of online marketing, agricultural product marketing also needs to be smart. Making the processes from harvest to production visible to consumers directly can increase the credibility and market value of products. This can be easily achieved through sensors, drones and AI cameras in farms. Through this it's also possible to deliver the products directly to the consumers worldwide and increase the global marketing potential of products with geographical indication (GI) tags.

Geographical indication

Efforts underway to get geographical indication status for Kerala cashew

Kollam: Kerala is making a move to obtain a Geographical Indication (GI) tag for its cashews, specifically under the name "Kerala Cashew". This effort is being driven by the Kerala State Cashew Development Agency's Special Officer, who has submitted a recommendation to the central government. The Ministry of Commerce and Industry has to review and approve the application.

Haven't you observed the news report? The Geographical Indication (GI) tag is granted based on the unique characteristics of the geographical area where the product is cultivated, resulting in distinct differences in the product's taste, colour, aroma, and nutritional value. This is why certain products from specific regions receive the GI tag. Such products get a premium value in the market.

Some examples for agriculture products that received geographical indication are given below. Find out more products.



Palakkadan Matta rice



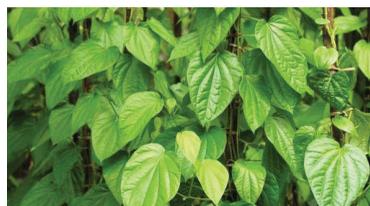
Malabar pepper



Kuttiattoor Mango



Kodungallur pottuvellari



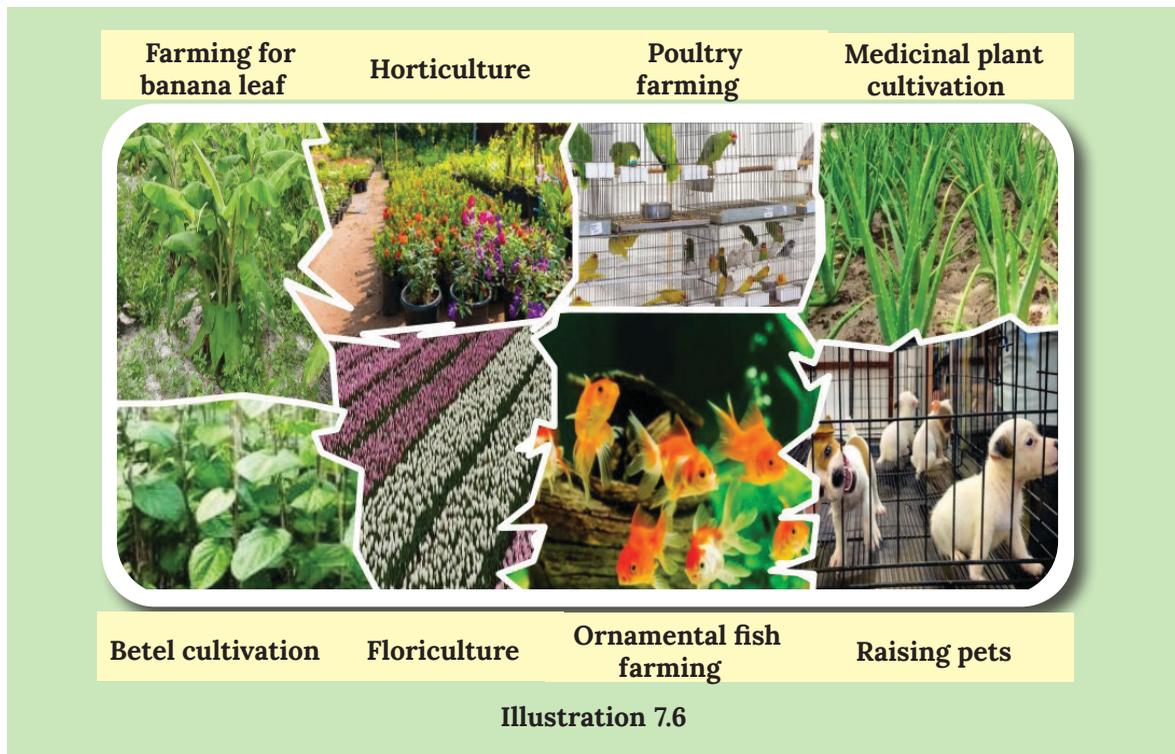
Tirur Vettila

Fig. 7.17

Diversity in Agriculture

Is agriculture only about producing food?

Analyse the given collage (Illustration 7.6) based on the indicators and prepare a note.



Indicators

- What are the benefits of diversifying agriculture?
- Which of these can be done even by those with limited space?

Mobile apps for farmers

There are apps that provide weather forecasts, pest and disease alerts, expert agricultural advice, market price information, benefit schemes for farmers and information on organic certification. If these facilities are properly utilised, the agricultural sector will undoubtedly flourish.

Ensuring nutritious food for all is a challenge. With day by day increasing population and changing food habits, expansion and modernisation of agriculture is of utmost importance.



Let's Assess

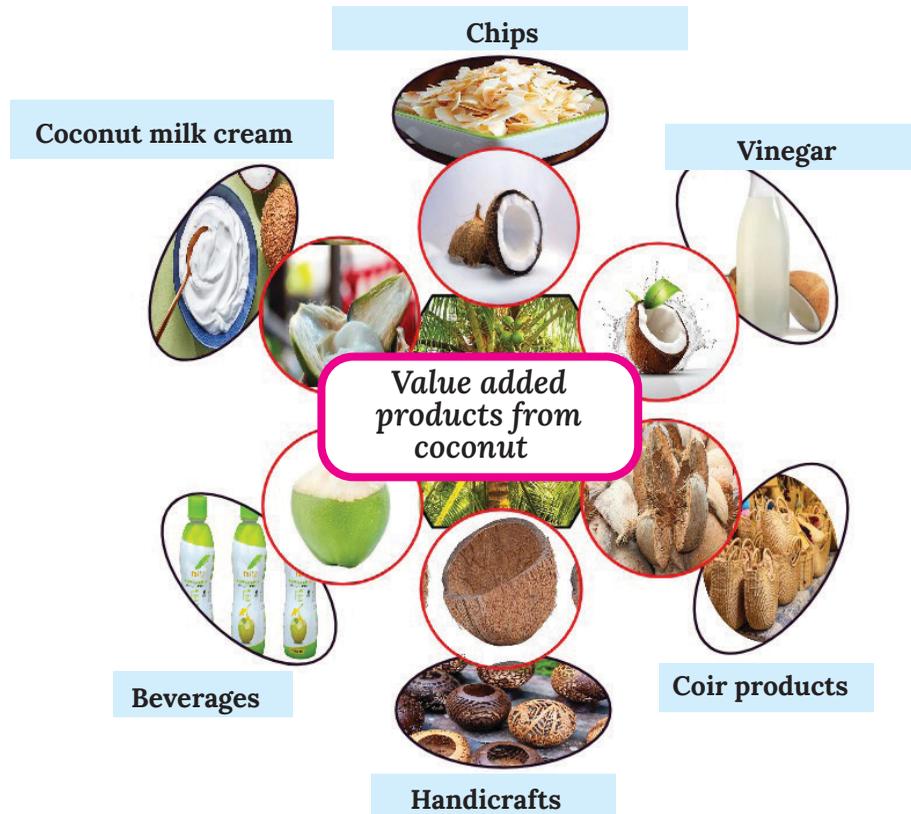
- 1) Arrange the information given in boxes A and B in the table suitably.

A	B
Space constraints Synthetic fertiliser Organic fertiliser	1) Vertical farming. 2) Anure 3) Urea 4) Vermicompost 5) Ammonium phosphate 6) Terrace farming 7) Bone meal 8) Sack farming 9) Superphosphate.

Space constraint		
		Superphosphate

- 2) Satheesh has 15 cents of homestead land and 30 cents of paddy field. He says that paddy cultivation is not profitable. What suggestions do you have to make farming profitable by making use of homestead land and paddy field?
- 3) Which is the odd one? What are the common features of the others?
- Wick irrigation, Vertical farming, Drip irrigation, Mulching
 - Hydroponics, aquaponics, aeroponics, geographical indication
- 4) 'Farming will be profitable only if all the pests are killed.' What is your response to this comment of a farmer? How can effective pest control be implemented?

5) Observe the illustration.



- a) What are the benefits to farmers by producing such products?
- b) Prepare a similar illustration of any other crop.



Extended Activities

- 1) Find out the common plant diseases in your area. Prepare a pictorial chart listing their pathogens, mode of transmission, symptoms and remedies and display it on the bulletin board
- 2) Collect information about the major agricultural research institutes in Kerala and their contributions to the agricultural sector and prepare a list of them.
- 3) You know that many machines are used in the agricultural sector to reduce the human effort. The results of thinking about how to alleviate the difficulties of farmers led to the discovery of most of the machinery seen today. Design a model of an innovative device that will be useful to the farmers in your area.

8

ORIGIN OF LIFE, ORIGIN OF LIVING THINGS



The living organisms that inhabited the earth millions of years ago were profoundly different from those that exist today. The evolution of living organisms was caused by adaptations to changes in environmental factors including habitat, climate and availability of food as well as internal cellular changes. This process ultimately gave rise to the diverse range of organisms that exist today.

For example, the ancestor of modern whales including the blue whale was an ancient mammal named pakicetus that inhabited the earth approximately 50 millions years ago. Fossil studies have revealed that this organism possessed physical characteristics similar to those of wolf along with the body shape adapted for swimming. As the descendants of these organisms spent more time in the water their limbs gradually evolved into flippers.

The evolutionary history of whales serves as an evidence for the fact that changes occur in living organisms as a part of their adaptation to changing environment. All living organisms including human beings have a curious evolutionary history of this kind.

Why do such changes occur to the living beings over time? If all organisms evolved from pre-existing ones, what was the first form of life?

Investigations are continuing in the world of science to find answer for such questions. It is believed that life emerged on Earth approximately 3.5 billion years ago. Some of the early simple organisms carried out photosynthesis, releasing oxygen, which eventually led to the evolution of more complex life forms. Over time, these complex organisms evolved into the diverse plant and animal species seen today.

Based on the existing evidences, scientific explanations have been proposed for questions related to this.

Conclusions drawn from scientific research on the origin of life can be analysed through Illustration 8.1.

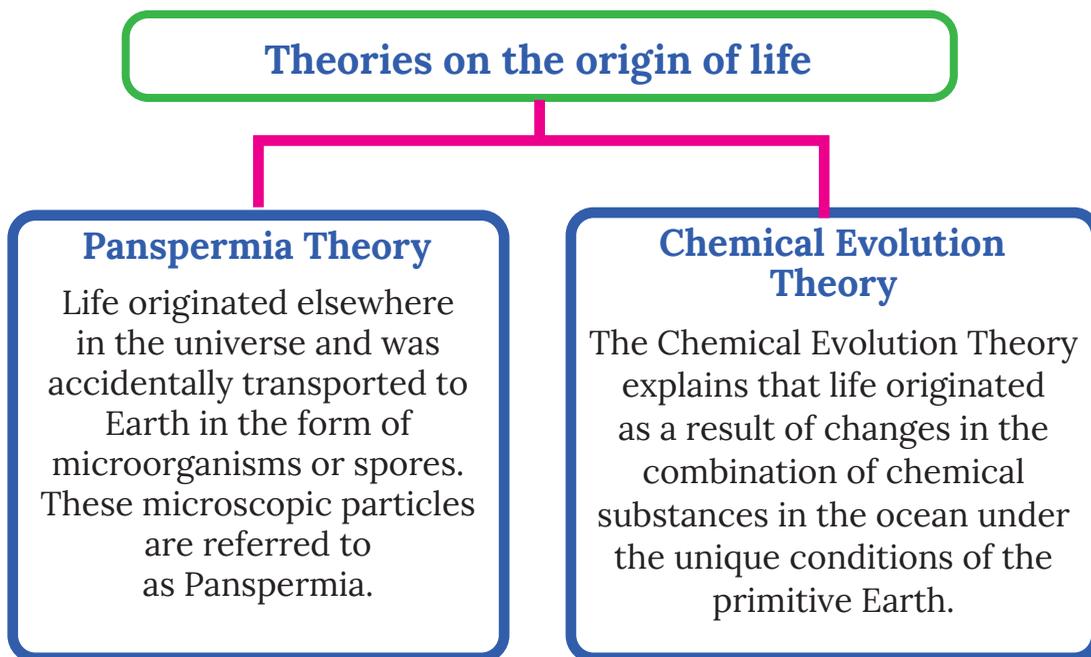


Fig. 8.1

Even though various theories have evolved at different times to explain the origin of life, the chemical evolution theory has gained more acceptance and has strong evidence based support to origin of life.

Origin of life

How would life have been originated through the chemical evolution process?

Analyse the given information and record your findings using indicators.

Atmosphere of primitive earth

- High temperature
- Hydrogen, Methane, Carbon dioxide, Hydrogen sulphide, Ammonia, Water vapour.
- No free oxygen.
- The condensation of steam, prolonged rainfall and the formation of oceans.
- Ocean formed by dissolving various substances.

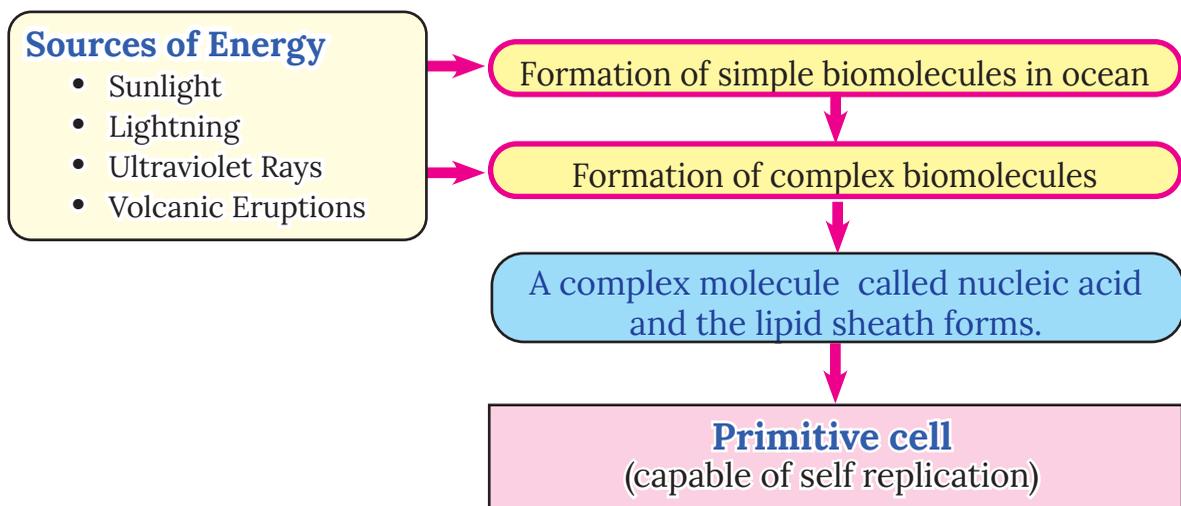


Illustration 8.2

Indicators

- Characteristics of primitive earth's atmosphere
- Formation of Ocean
- Energy sources that assist the formation of biomolecules.
- Formation of primitive cell.

From illustration 8.2, we have understood how the formation of the primitive cell occurred through the process of chemical evolution. Several experiments have been conducted to support this theory.

Analyse illustration 8.3 to learn about some of the scientists who contributed to this field.



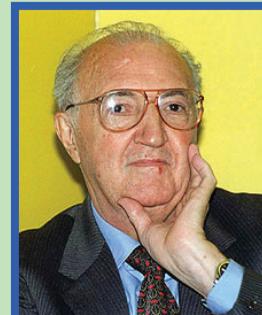
Harold Urey, Stanley Miller

Together proved that the fundamental units responsible for the origin of life can form from simple gases.



Sydney Fox

Proved that molecules similar to proteins can be synthesised artificially.



Joan Oro

Adenine, one of the key building blocks of nucleic acids, was artificially synthesised.

Illustration 8.3

There are several experimental evidences to substantiate chemical evolution theory. The Urey-Miller experiment, in which the atmosphere of primitive earth was recreated in the laboratory is one of the remarkable experiments in the history of scientific expedition in evolution.

Analyse **illustration 8.4** and its description. Complete **table 8.1** accordingly.

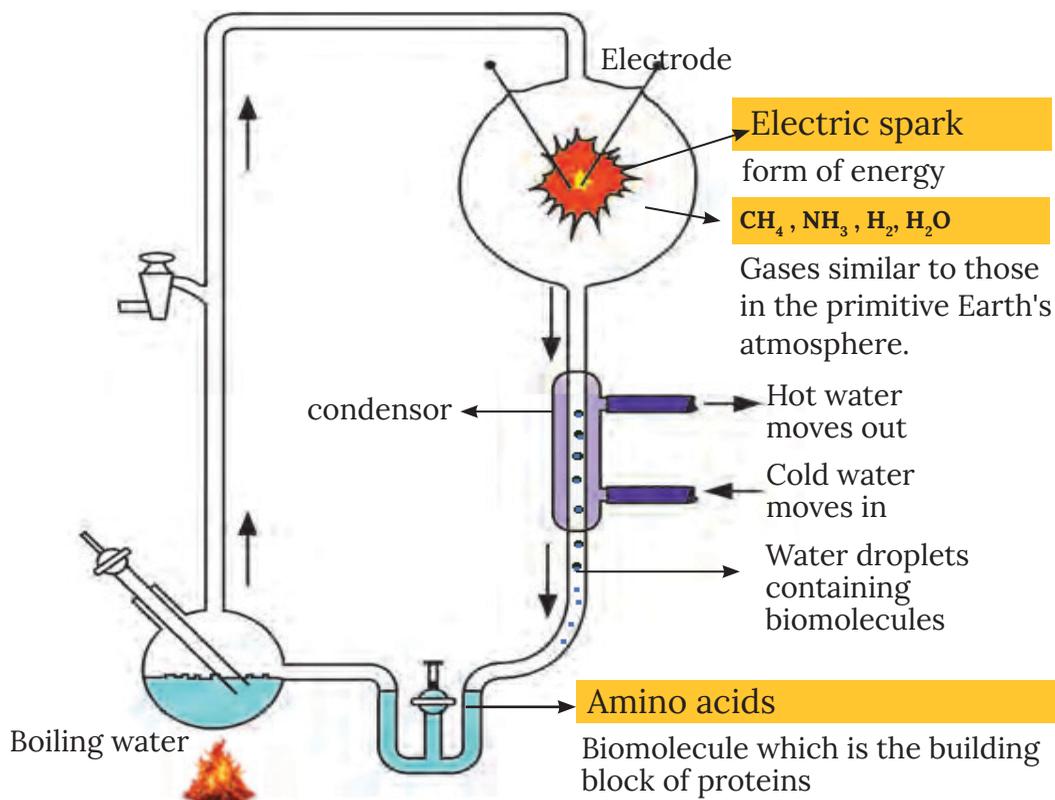


Illustration 8.4 Urey - Miller Experiment

This experiment was conducted by artificially recreating the conditions of primitive Earth in a laboratory. Through this experiment, scientists were able to synthesize amino acids, the biomolecules. It provided evidence that, under suitable conditions, biomolecules can be formed from inorganic components.

Indicators	Condition in the primitive earth	Experimental set up
Gases		
Energy source for chemical synthesis	<ul style="list-style-type: none"> • Lightning & Thunder • 	

Table 8.1

From primitive cells to complex organisms

Changes occurred in the primitive cell

The primitive cell is composed of nucleic acids capable of self replication and a lipid layer covering it. Primitive forms like bacteria evolved from this primitive cell. These simple structured cells which were formed in the beginning are called prokaryotes.

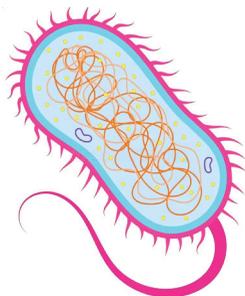
From prokaryotic cells to Eukaryotic cells

How did more complex structured eukaryotic cells form from prokaryotes ?

What is the significance of eukaryotes?

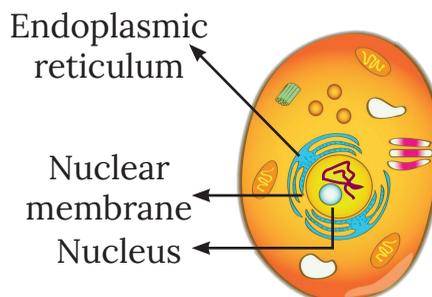
Analyse **illustration 8.5** based on the indicators and record your inferences in the Science Diary

Prokaryotic cell



- A few cell organelles.
- Cell organelles have no membranous covering.
- Membrane bound nucleus absent.

Eukaryotic cell



- Many cell organelles
- Organelles with membranous covering
- Membrane bound nucleus present.

Illustration 8.5

How might other organelles found in cells have been formed?

Analyse the given illustration 8.6 and prepare a note on it.

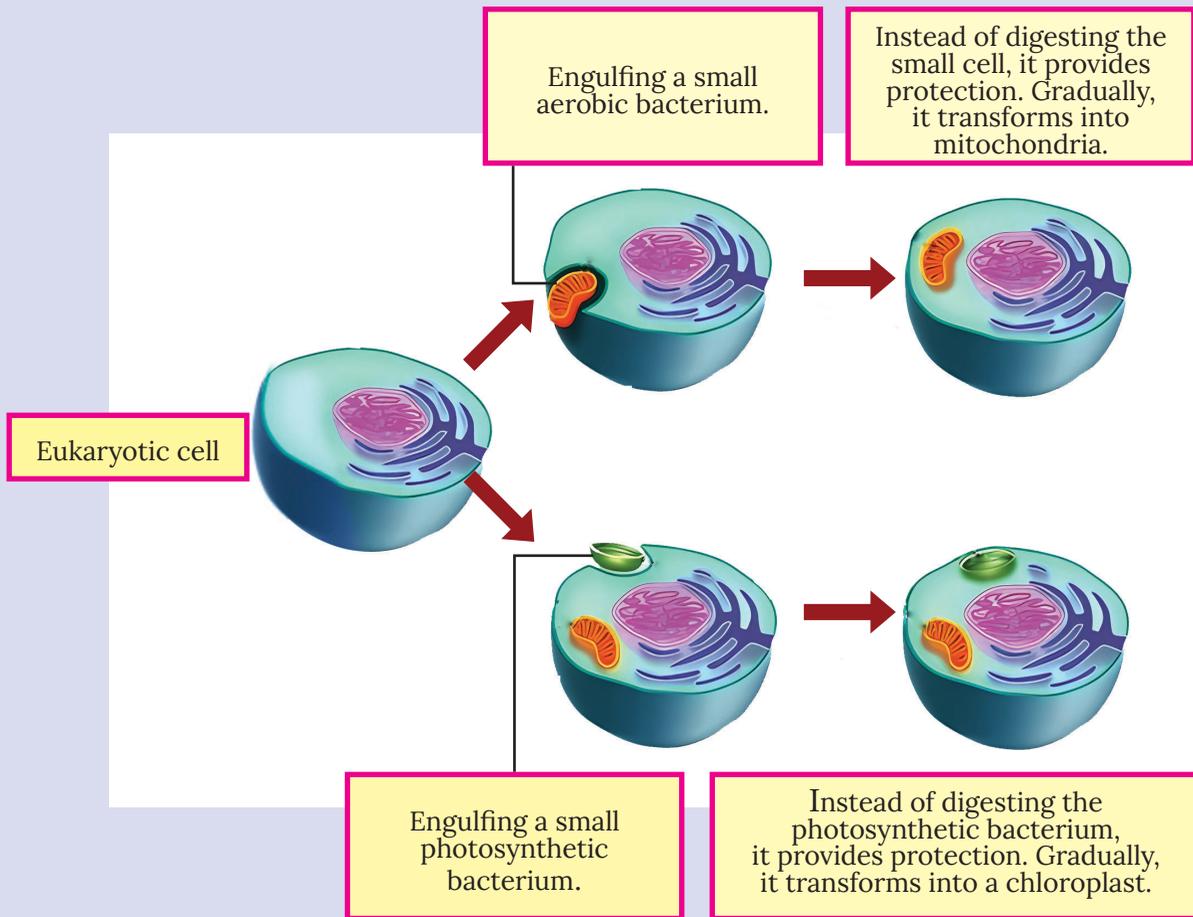


Illustration 8.6

In prokaryotes, genetic material is scattered within the cytoplasm. As part of the evolutionary process, the formation of a nuclear membrane was the key feature of eukaryotic cells. Additionally, membrane-bound organelles were evolved, enabling them to perform specialised functions.

Complete **Table 8.2**.

Indicators	Prokaryotic cell	Eukaryotic cell
Structure	Simple	
Nucleus		Well defined nucleus with membrane covering
Cell organelles such as mitochondria and chloroplasts		

Table 8.2

Around 3.8 billion years ago, primitive living cells were formed from the molecules present in earth's oceans. By 3.5 billion years ago, prokaryotic cells were evolved.

Approximately 2.5 billion years ago, the occurrence of photosynthesis led to the release of oxygen into the atmosphere. Later, eukaryotic cells with organelles such as mitochondria and chloroplasts were evolved. Over time, simple multicellular organisms appeared around 800 million years ago, followed by more complex life forms.

How long might it have taken for diverse life forms to evolve from prokaryotes? Analyse the timeline (**Table 8.3**) and prepare a note based on it.

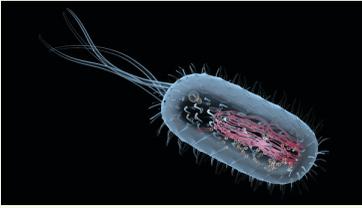
Period	Significance	
4.0 - 4.6 billion years	The origin of the earth 	
3.5 - 2.5 billion years	Formation of the first form of life: single-celled prokaryotes with simple structure. 	
2.5 billion - 541 million years	Eukaryotic multicellular organisms. 	
541 - 252 million years	Plants and animals on land 	
252 - 66 million years	Dinosaurs 	
From 66 million years ago to the present	Emergence of mammals, the origin of human being. 	

Table 8.3

You have understood the timeline of evolution from the origin of earth to the origin of human beings. If so, let's calculate the Geological Time Scale from the origin of universe to origin of human beings. Cosmic calendar is an illustration that helps us to understand this easily.

Cosmic calendar

Suppose we are preparing a cosmic calendar assuming the age of universe as one year. In this calendar one second is equivalent to around 438 years. A simple model of cosmic calendar is illustrated below. Analyse it on the basis of indicators and record your inferences.

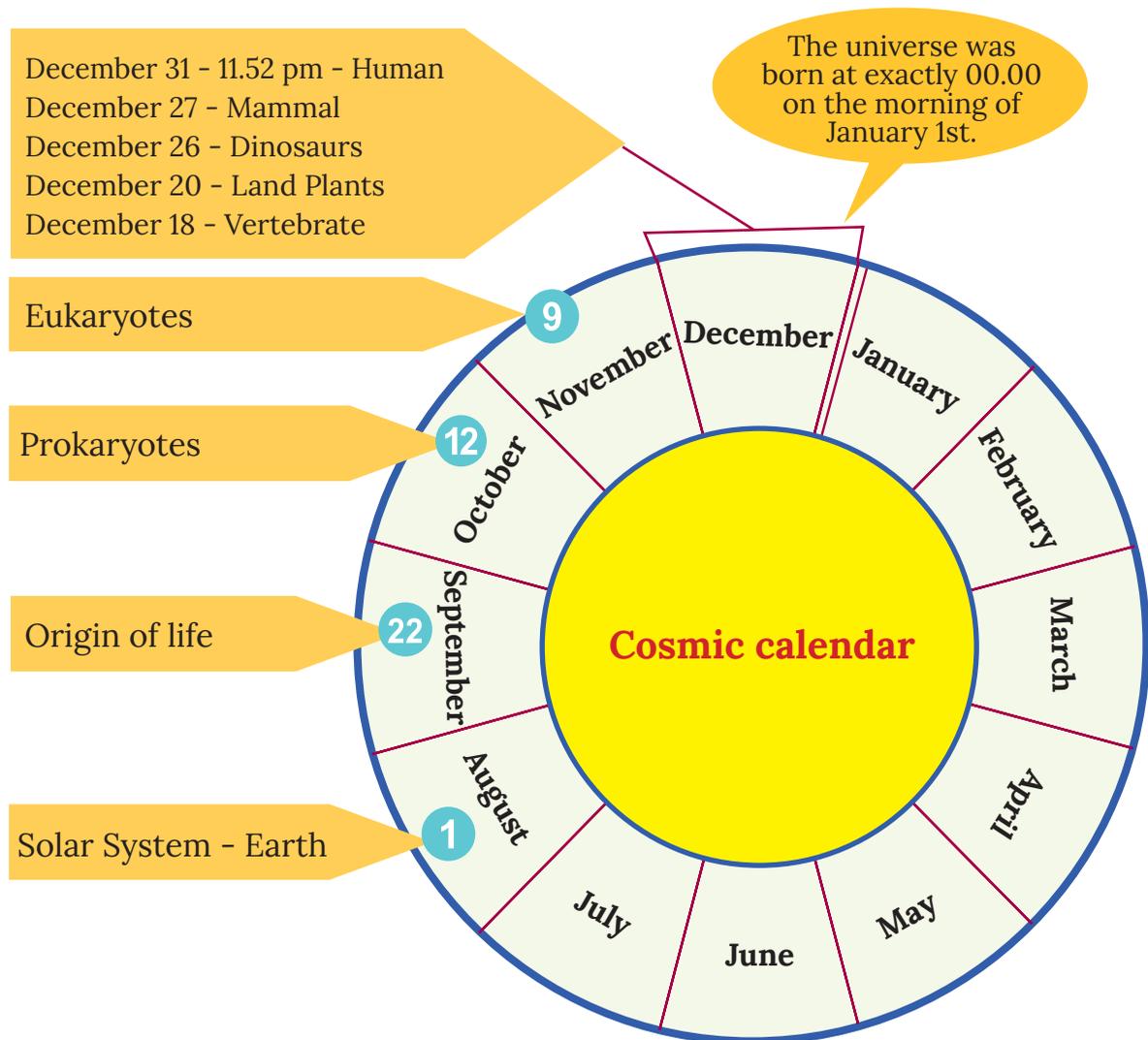


Illustration 8.7

According to the Cosmic Calendar, humans appeared in the final moments of the last day of the year. Doesn't this clearly show how recent the emergence of humans is in the timeline of the universe?

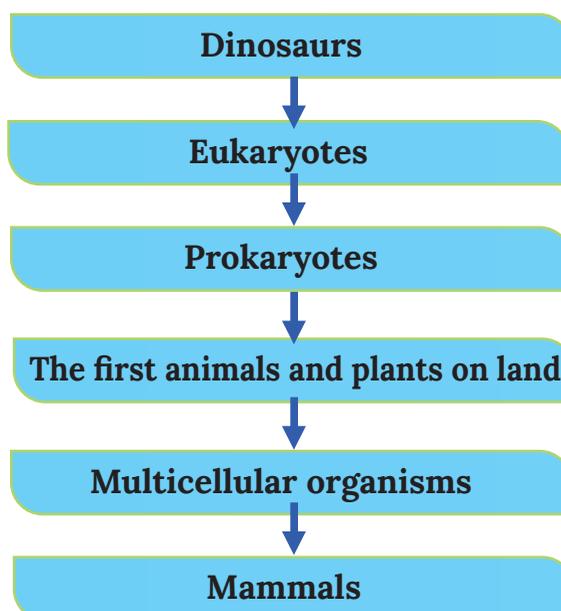
The process of evolution is the cause of present biodiversity. It is difficult to predict the direction of evolution as it is an accidental phenomenon. Imagine how evolution would be continued. Make your thoughts into creative writings.



Let's Assess

1. Write which of the given statements are not related to eukaryotes.
 - a) A clear nuclear membrane is seen.
 - b) Cell organelles have no membranous covering.
 - c) Genetic material is found inside the nuclear membrane.
 - d) Organelles that perform various functions are seen.

2. Arrange the timeline properly.



3. Match the following.

A	B
a) Urey - Miller b) Joan Oro c) Sidney Fox d) Oparin - Haldane	1) Theory of chemical evolution 2) Amino acids 3) Proteinoid 4) Nitrogen base 5) Eukaryotes



Extended Activities

- Make a model of the Urey-Miller experimental setup using the materials available from the surroundings and display it at the science corner.
- Prepare a digital model/chart of the Cosmic calendar including more information and exhibit in the classroom.

CELLS AND CELL CLUSTERS



Robert Hooke
(1635-1703)

Fig. 9.1



Leeuwenhoek
(1632-1723)

Fig. 9.3

This is an incident from the 17th century. A scientist named Robert Hooke was observing a thin piece of cork through his microscope. The small parts, like boxes, were not one, but a thousand! He called them 'cells', meaning chambers.

In the following years, Anton van Leeuwenhoek observed the water taken from a pond with the help of a much better microscope and discovered the micro-organisms in it.



Fig. 9.2

Cell Biology is the study of cells. It is a very broad and evolving branch of science.

History of Cell Biology

Let's familiarise the scientists who made important discoveries in the field of cell biology.

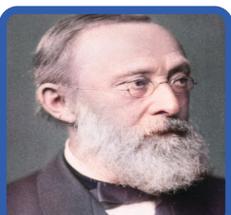
1838		<p>Matthias Jakob Schleiden</p> <p>Discovered that all plants are composed of cells.</p>
1839		<p>Theodor Schwann</p> <p>Discovered that all animals are composed of cells.</p>
1855		<p>Rudolf Virchow</p> <p>Introduced the concept that new cells are formed from pre-existing cells.</p>

Illustration 9.1

Cell theory is formulated by integrating the inferences of many scientists of 19th century. Cell Biology was developed on the basis of cell theory.

Cell Theory

- All organisms are made up of one or more cells.
- Cell is the basic unit of life.
- New cells originate from pre existing cells.

Discuss, plan and execute observation - experiment activities to prove the concept that all organisms are made up of one or more cells.

You know that different types of microscopes are used to observe very small or tiny cells. In simple microscopes, lenses are used to magnify objects.

Human eye can distinguish two spots having a distance of 0.2 mm in adequate light. This distance is called resolution of the eye. Lens is required to distinguish spots having a distance of less than 0.2 mm.

A simple microscope in which a single lens is used, can magnify an object upto 10 times than the original size. A compound microscope, in which more than one lens is used, can magnify an object up to 1000 times.



Fig. 9.4

Let's do an activity of observing a slide through compound microscope.

For this, you have to familiarise with the parts and functions of a microscope.

Complete the **illustration 9.2** and **table 9.1** by observing a compound microscope and a discussion based on the given indicators.

Indicators

- — Where should the slide be placed in a microscope?
- — Which is the part that regulates the light on the slide?
- — Which are the lenses used in microscopes?

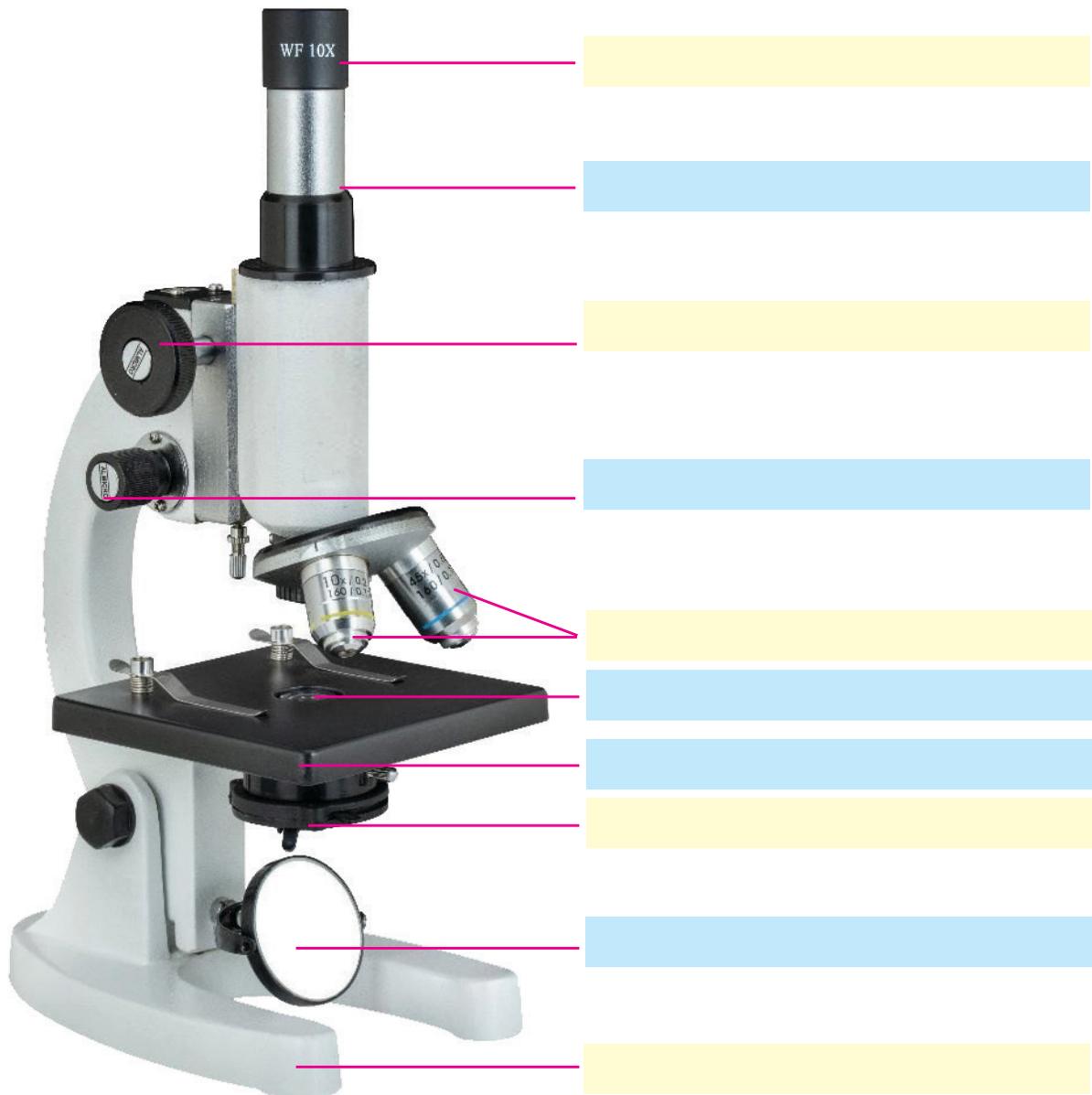


Illustration 9.2



Magnification Power

Magnification power of a lens is its ability to magnify objects. If eye piece lens magnifies the object to 10 x (10 times) and objective lens magnifies it into 40 x (40 times), the magnification power of the lens is 400 x.

Part of a microscope	Function
Eye piece lens	
Objective lens	
	Fixes the slide on the stage
	Helps to focus light on the object

Table 9.1

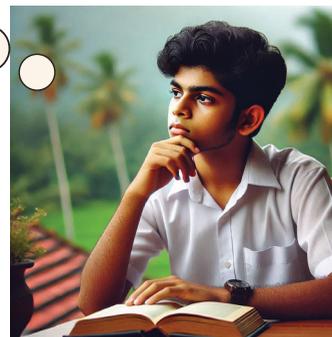
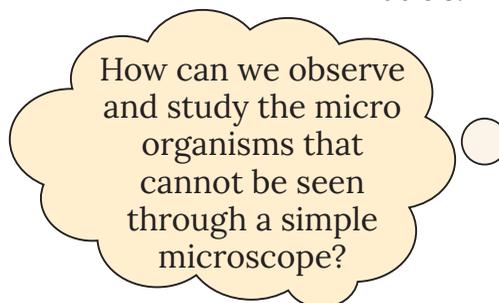


Fig. 9.5

Haven't you noticed the doubt of the child ?

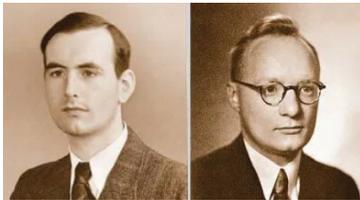
What is your opinion ?

Electron microscope is an instrument that magnifies objects more than a million times. It helps to observe cells, viruses and molecular structure in detail. In electron microscope electron beam is used instead of light. Different types of electron microscopes are used now a days. Collect more information on this, prepare slide and present it in your class.



Electron microscope

Fig. 9.6



Ernest Ruska, Max Knoll

Fig. 9.7

In 1934 German scientists **Ernest Ruska** and **Max Knoll** invented electron microscope. In an electron microscope, electromagnetic lenses are used to focus a beam of electrons onto the specimen, allowing for

much higher resolution imaging compared to light microscopes. Different types of electron microscopes are used for various purposes.



Red Blood cell



Covid-19 virus



Pollen grains

Fig. 9.8

View of certain specimens through electron microscope

Complete the **table 1.2** comparing the peculiarities of different types of microscopes.

Peculiarity	Compound microscope	Electron microscope
Need of light		
Magnifying power		
Lens		

Table 9.2

Upto what size tiny objects can be observed through different types of microscopes? Analyse the **illustration 9.3** and prepare a note on it.

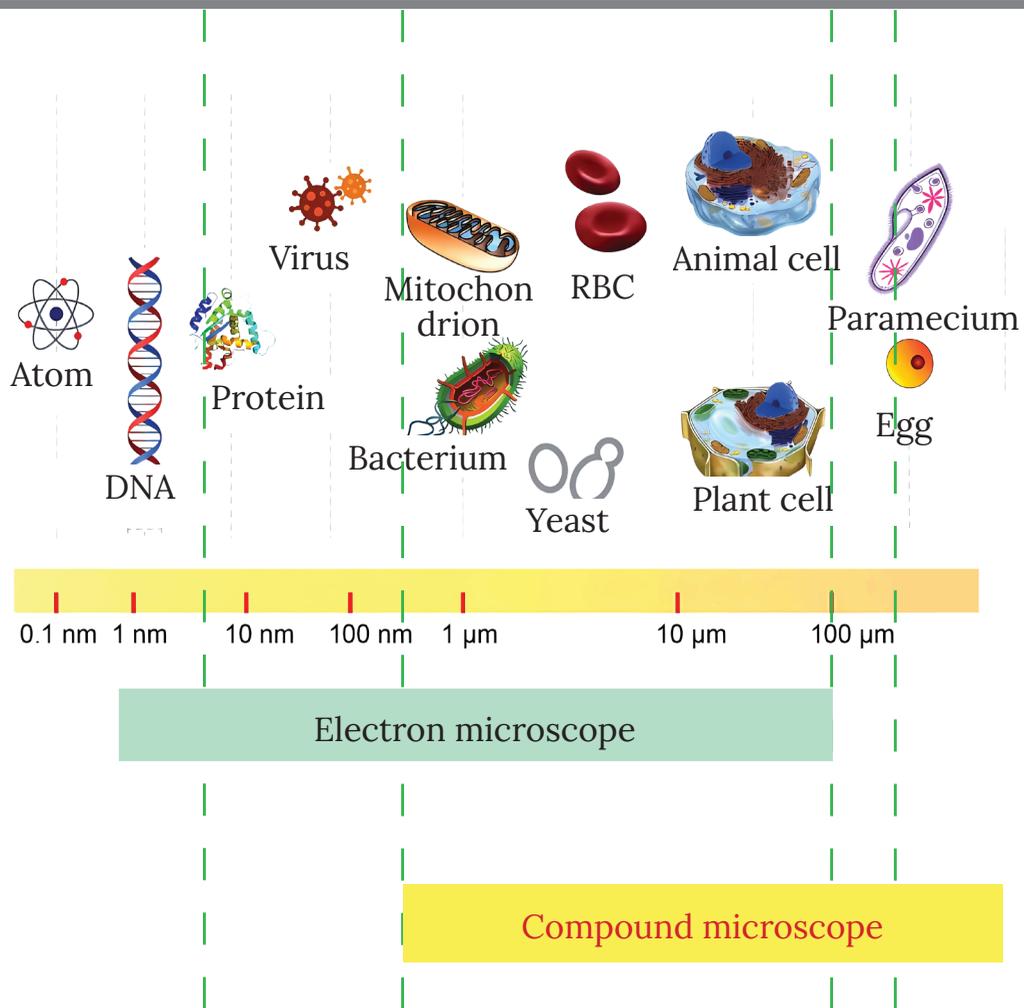


Illustration 9.3

Let's observe cells

You might have understood that organisms have cells of different shapes and sizes in their bodies. Do all these cells function individually or do they perform various functions together?

Observe the section of a stem and draw the diagram. Compare the diagram with the **figure 9.9**.

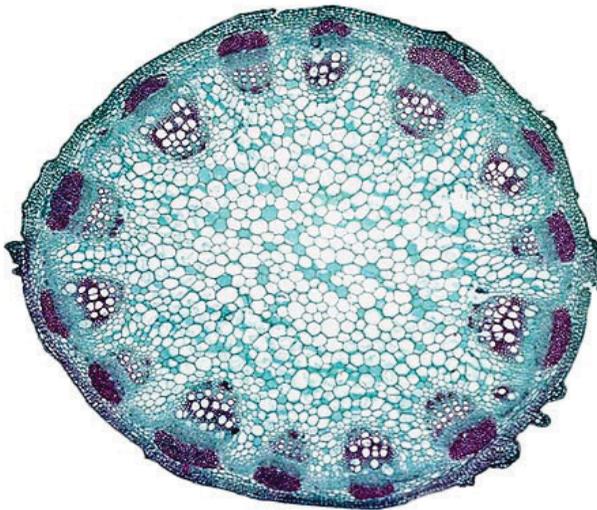


Fig. 9.9

What are the things to be taken care of when taking a cross section of a stem? Draw inferences by a discussion using the indicators given.

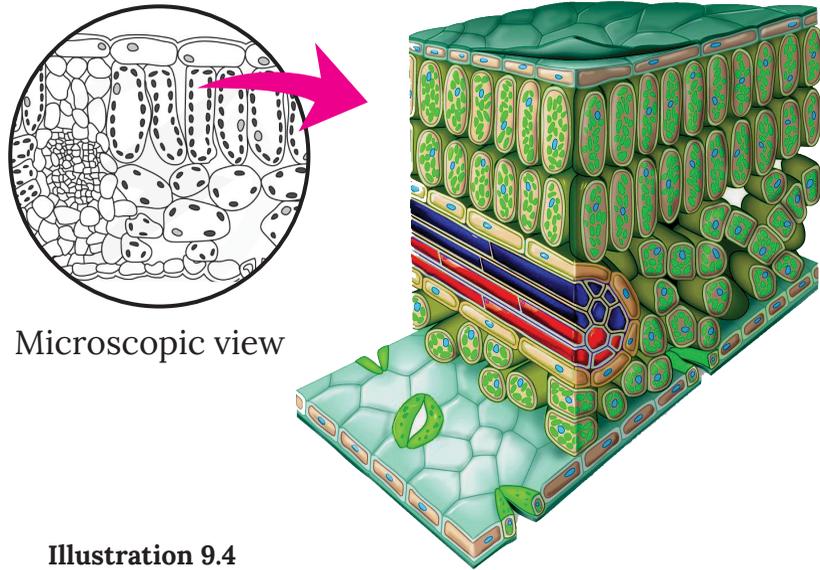
Indicators

- while preparing the slide,
- staining
- observing in high power and low power
- observing and illustrating.

A record should be accurately maintained as the procedure is completed.

Are the cells in the leaf similar to those in the stem?

Observe the slide of the section of leaf under a microscope. Compare it with **illustration 9.4**.



Microscopic view

Illustration 9.4

You have observed the diverse cells in the leaf and stem, haven't you?

Although cells vary in appearance, their basic structure remains the same.

Observe the structure of the plant cell given in **Illustration 9.5**.

Label the parts that you can observe.

Practical record



Practical record is a comprehensive note and evidence of experiments that are already done. It may contain the following headings:

- Name of the experiment
- Aim
- Materials required
- Procedure
- Observation
- Inference

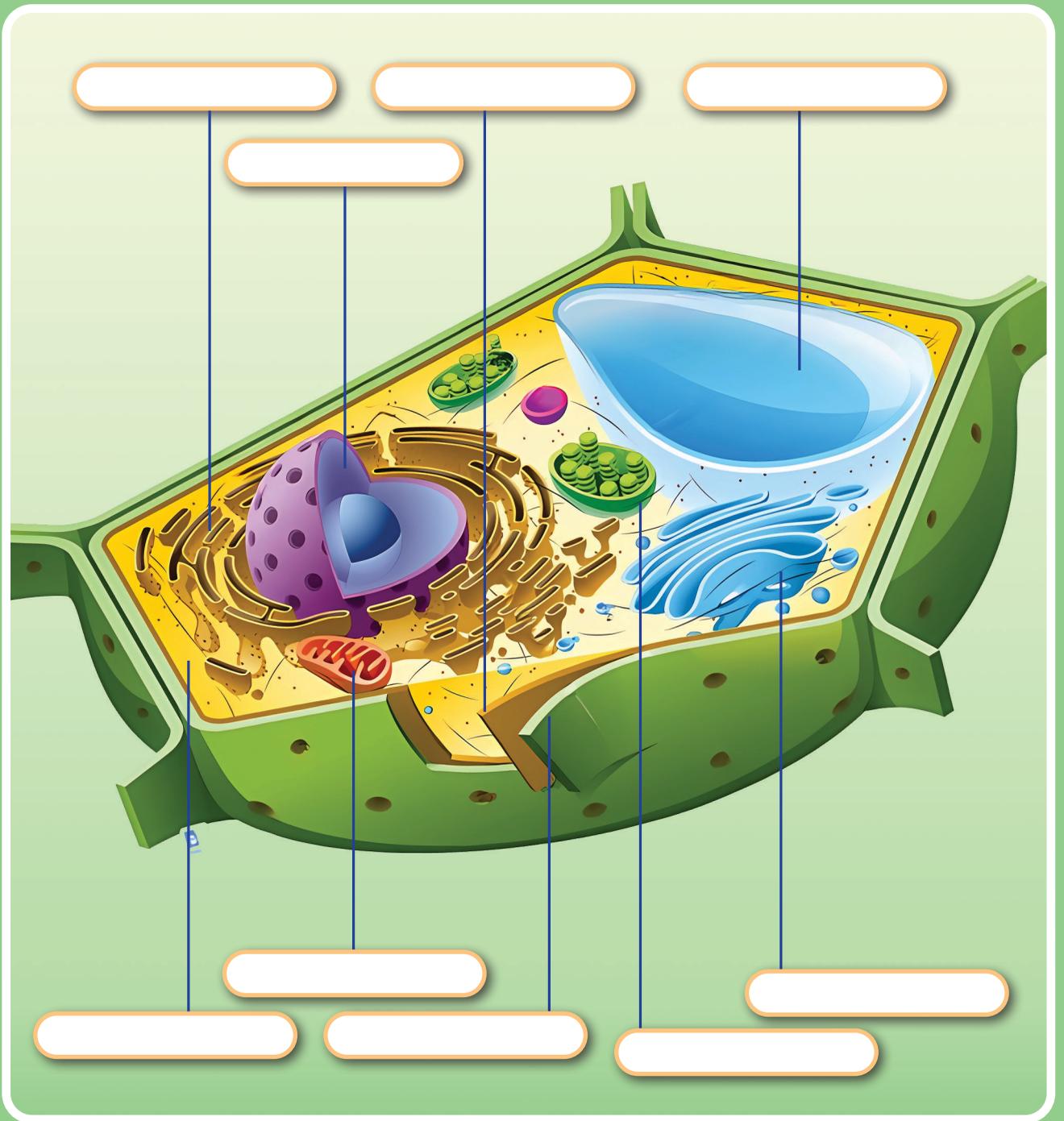


Illustration 9.5

By analysing the given description, related pictures, and illustrations prepare a note on cell organelles and their functions.

Cell wall

Cell wall is a rigid layer outer to the cell membrane. It provides protection and shape to the cell.

In plants, cell wall is mainly made up of cellulose.

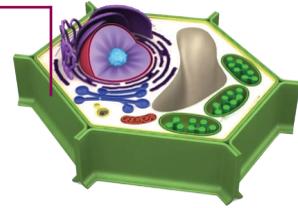


Fig. 9.10

Cell membrane (Plasma membrane)

The cell membrane is a thin, flexible layer that surrounds the cell. Substances enter and leave the cell through this membrane. The plasma membrane does not allow all substances to pass through. Therefore, the plasma membrane is known as a semi-permeable membrane. Observe the structure of the cell membrane as illustrated below.

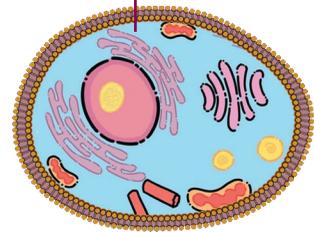


Fig. 9.11

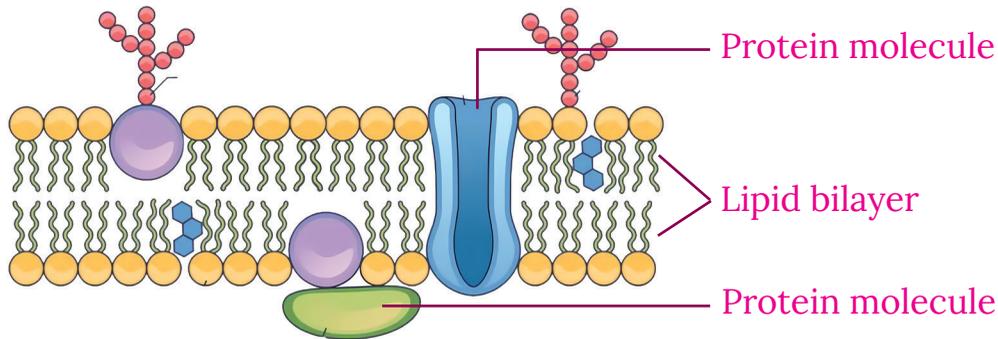


Illustration 9.6

Protoplasm

Protoplasm consists of all the components inside the cell membrane, including the nucleus and cytoplasm.

Cytoplasm

A jelly like fluid that fills the cell. It maintains all the organelles in their place and serves as the medium for chemical reactions.

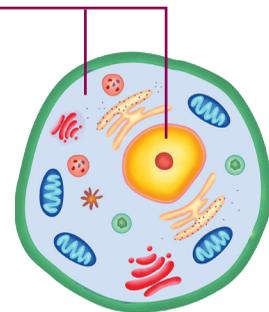


Fig. 9.12

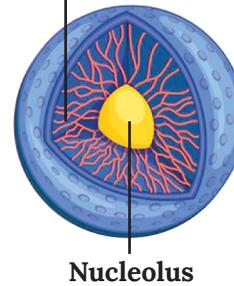
Cell Organelles

Cell organelles are the parts that perform the functions necessary for the survival and functioning of the cell. Let's familiarise certain major cell organelles.

Nucleus

Nucleus is the centre that controls the cell. Chromatin network is the structure that appears like a network of threads within the nucleoplasm. During cell division this chromatin networks condense into chromosomes. There is also a part called nucleolus within the nucleus.

Chromatin reticulum



Nucleolus

Fig. 9.13

Golgi Apparatus

These are cell organelles that appear as stacked membrane layers. These organelles transport proteins and lipids to various parts of the cell and outside the cell, wrapped in membranous sacs.



Fig. 9.14

Endoplasmic Reticulum

These organelles appear as a network of tubules within the cell, serve as pathways for conducting materials. It helps in the synthesis and removal of materials required by the cell.

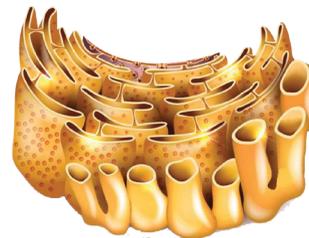


Fig. 9.15

Mitochondria

Energy production centre of the cell. It stores the energy obtained from the oxidation of glucose and distributes it as and when required.

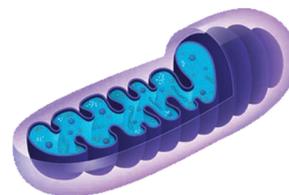


Fig. 9.16

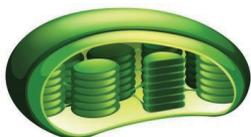


Fig. 9.17

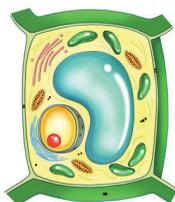


Fig. 9.18

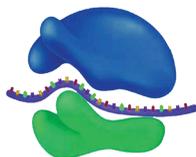


Fig. 9.19

Plastids

Plastids are specific parts in the plant cells that help in the synthesis and storage of food materials. They have a two layered membrane. Different types of plastids perform different functions.

Types of Plastids

Chloroplasts

The green plastids present in leaves and green stems. They contain a green pigment called chlorophyll. It helps to absorb sunlight for synthesising food.

Chromoplasts

These are coloured plastids seen in fruits and flowers. They contain pigments that impart red, orange and yellow colours. They attract the animals for pollination and seed dispersal.

Leucoplasts

White or colourless plastids found in seeds, roots and stems. Leucoplasts store substances like starch, oil and protein.

Vacuole

Stores water, nutrients and wastes. Usually large vacuoles are seen in plant cells.

Ribosome

They are found in the cytoplasm either freely or attached to endoplasmic reticulum. They function as centre for protein synthesis.

Make a model of any cell organelle. Prepare charts including their characteristics and the functions they perform. Exhibit the models and charts in the class.

Plant Tissues

A cross-section of a plant stem when observed under a microscope is shown in **illustration 9.7**.

Discuss and draw inferences based on the indicators as to where similar cells are found.

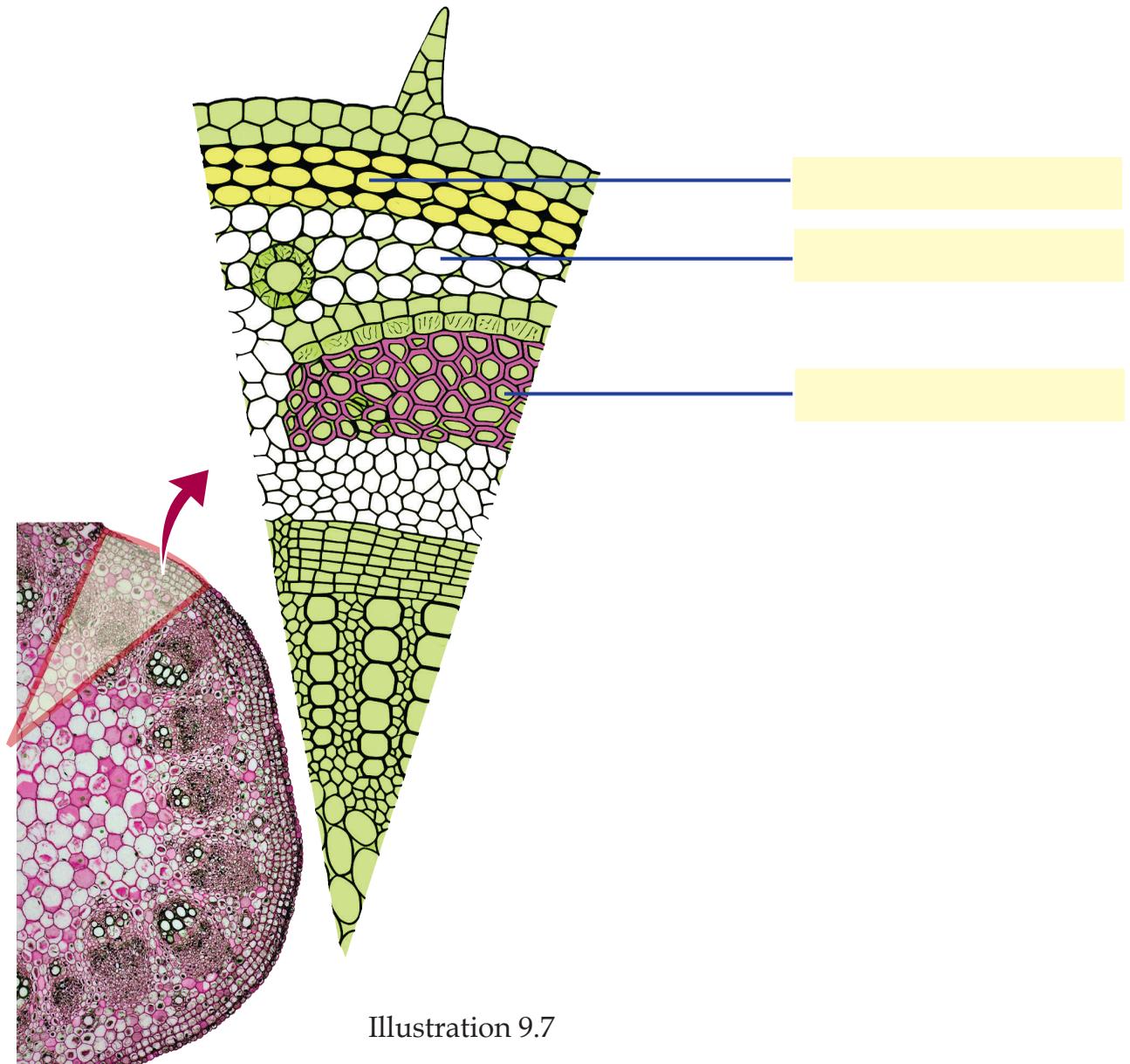
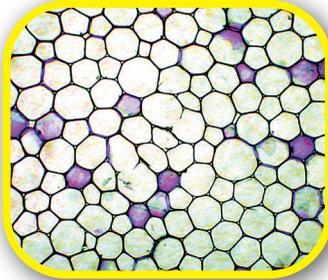


Illustration 9.7

Indicators

- — Cells with thin cell walls.
- — Cells with only the corners thick.
- — Cells with a thick cell wall throughout.

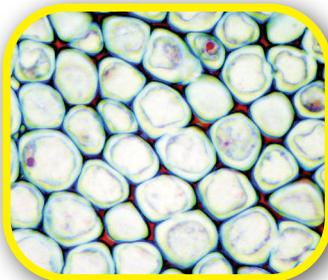
The group of similar type of cells are known as **tissues**. To understand more about the various tissues we have found, analyse the **illustration 9.7** and the description given below and complete the **table 9.3**.



Parenchyma

Fig. 9.20

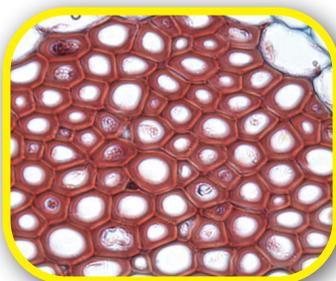
- Contain living cells.
- Thin cell wall.
- Intercellular spaces are present.
- Perform functions such as photosynthesis and food storage.
- Cells in some parts have the ability to divide.



Collenchyma

Fig. 9.21

- A tissue made up of living cells.
- Cell wall made of substances such as cellulose and pectin.
- The cell wall is thicker only in some parts.
- Helps maintain the shape of plant parts.



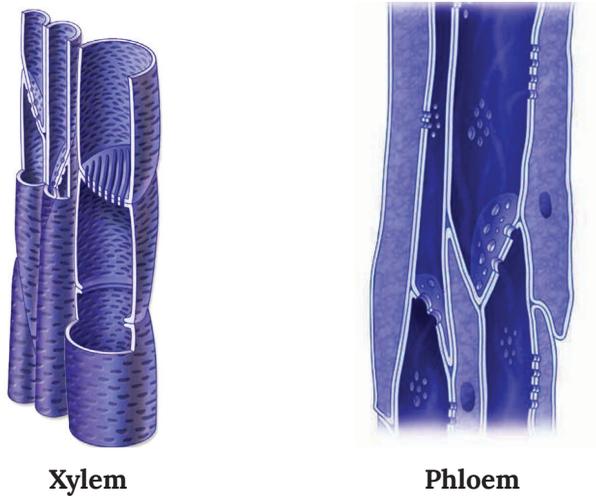
Sclerenchyma

Fig. 9.22

- A tissue consists of dead cells.
- Thick cell wall.
- The cell wall is of uniform thickness throughout, providing strength and support to plant parts.

Tissues that are composed of similar type of cells are known as simple tissues

Examine **figure 9.23** given below.



Xylem

Phloem

Fig. 9.23

Xylem and phloem are composed of cells with different shape and size. So they are called complex tissues. Conduction of water and salt to the leaves take place through xylem. Phloem carries food synthesised by the leaves to different parts of the plant body.

Plant tissues	Characteristics	Functions
Parenchyma		
	Living tissue. Certain parts of the cell wall has thickening.	

Table 9.3

Meristematic tissues

Meristematic tissues are composed of cells that are capable of continuous division. Meristematic cells cause growth of plants.

Observe the **figure 9.21** and list out the characteristics of meristematic cells.

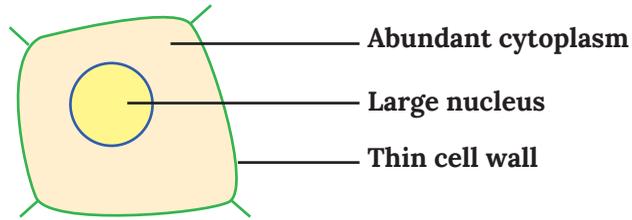
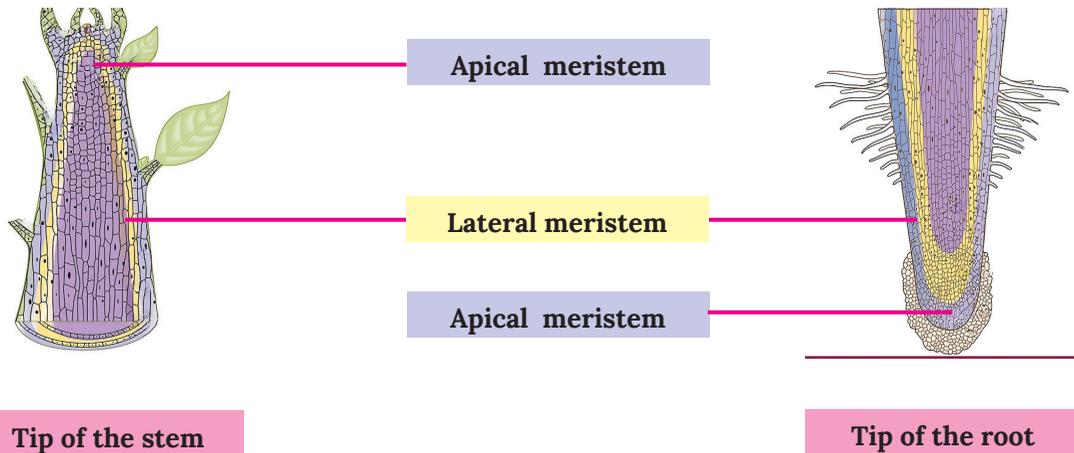


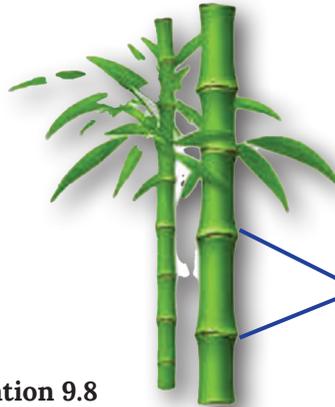
Fig. 9.24

Observe the **illustration 9.8**

Apical meristem is seen at the tip of root and stem. Those seen at the lateral sides are called **lateral meristem**. In monocot plants, the meristem seen in between two nodes is called **intercalary meristem**.



The stem of plants like a bamboo does not have lateral growth. Why? Find out the reason.



The location of intercalary meristem

Illustration 9.8

Cell clusters or tissues that have lost their ability to divide are known as **permanent tissues**. Parenchyma, sclerenchyma, collenchyma, xylem and phloem are examples for permanent tissues.

Complete **illustration 9.9**.

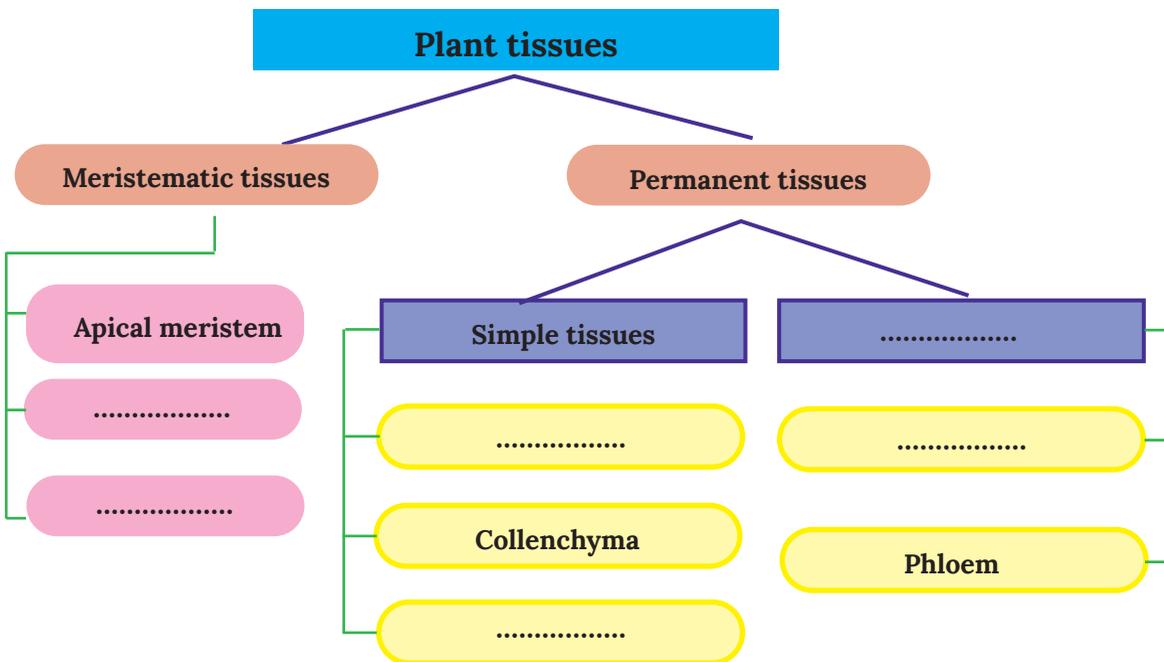


Illustration 9.9

Animal Cell

Isn't the animal body also composed of various types of cells? Which are the major cell organelles in animal cells?

Observe **illustration 9.10** and label the related parts.

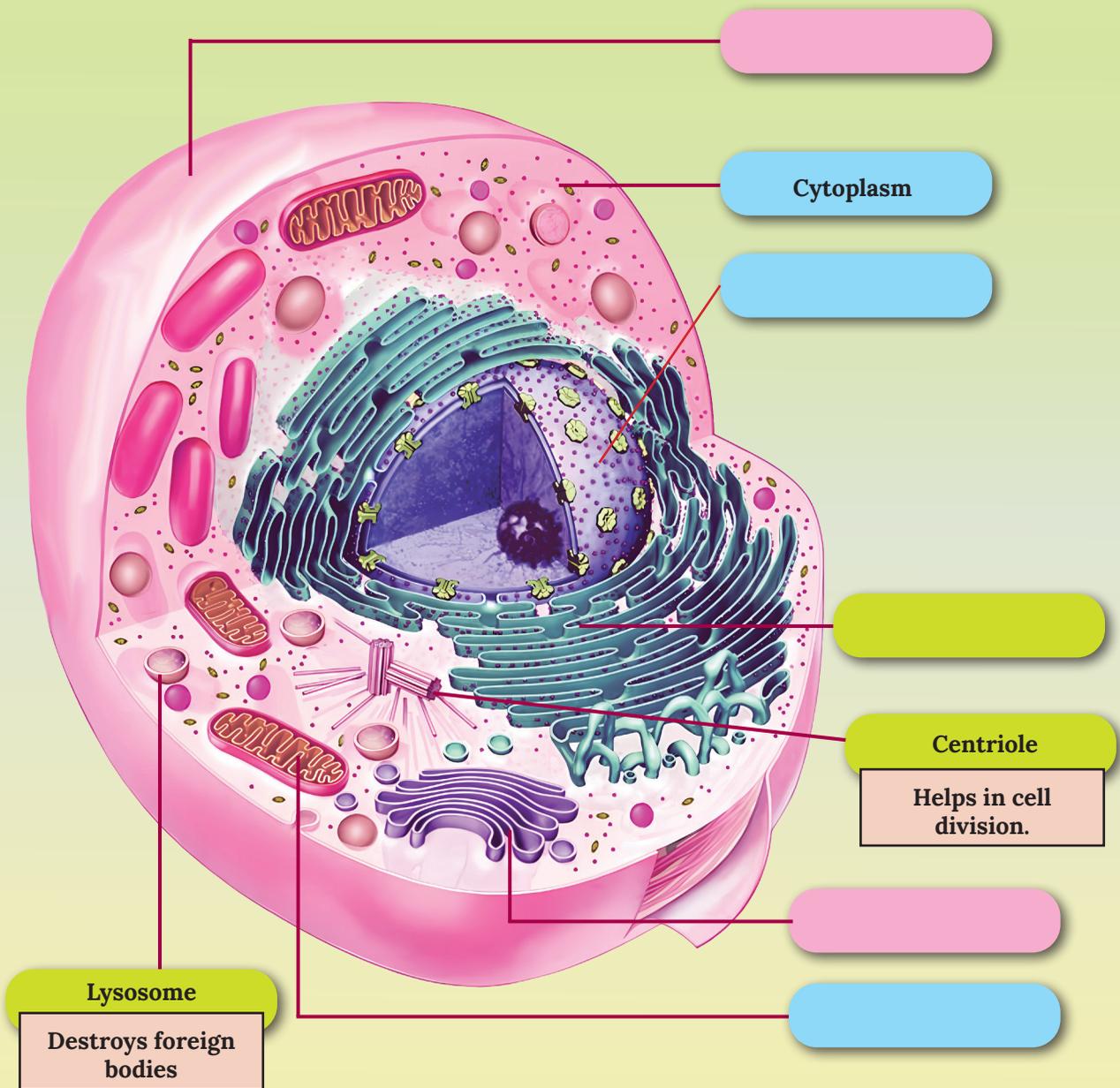


Illustration 9.10

Structure of an animal cell

Some cell organelles that are not found in plant cells exist in animal cells. Name them. What is their function? Complete the **table 9.4** through discussion.

Part	Plant cell	Animal cell	Function
Cell wall	present		
Centrioles			
Plastids		not present	
Lysosome			

Table 9.4

Animal Tissue

Tissues composed of group of similar cells perform various functions body of animals. Analyse the given description about various types of animal tissues and make an understanding on it.

Epithelial tissue

- Covers and protects the surfaces of the body and internal organs.
- Helps in the absorption of various substances.
- It produces secretions like mucus.

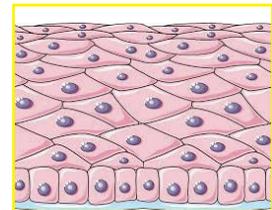


Fig. 9.25

Connective tissue

- Provides support to various parts of the body.
- Connects various parts together.
- Bone, blood, fibrous tissue, etc. are connective tissues.

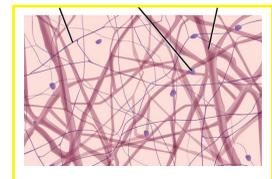


Fig. 9.26

Muscle tissue

- Helps in body movement and locomotion.
- Composed of cells capable of contraction and relaxation.

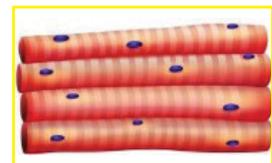


Fig. 9.27

Neural tissue

- Makes impulse transmission possible.
- Controls and coordinates bodily activities.



Fig. 9.28

Stem Cells

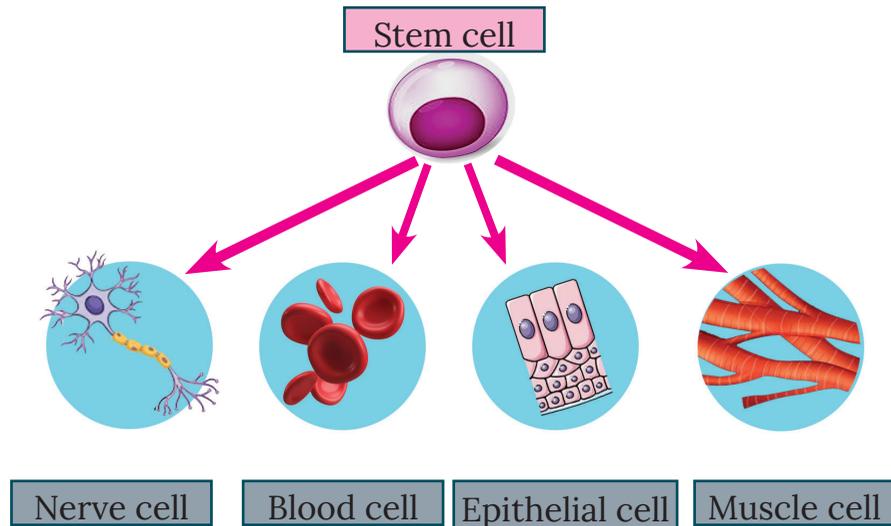


Illustration 9.11

Stem cells are specialised cells that can develop into various types of cells such as muscle cells, nerve cells, blood cells, etc. They are called the body's **master cells** because they have the ability to create new types of cells.

Stem cells help to eliminate damaged cells, promote the growth of new cells and maintain healthy tissues.

In modern medicine stem cells have great significance.

Prepare a poster emphasising the importance of stem cells through additional data collection and exhibit it in the classroom.

How many creatures of different shapes and sizes are there around us!

Despite these differences there are many similarities among living organisms. Most importantly all living things are made up of cells. Cell division is the fundamental reason for growth in all organisms except unicellular organisms. These common characteristics of living things lead us to the reality that the basis of life is one and the same.



Let's Assess

- Identify the word pair relationship and fill the blanks.
 - compound microscope : visible light
..... : electron beam
 - plant cells : eukaryote
..... : prokaryote
 - Endoplasmic reticulum : material transport in cytoplasm
..... : centre for production and distribution of energy
- Choose the statements related to plant cell from the following.
 - Centrosome is present
 - Plasma membrane is absent
 - Plastids are present
 - Presence of comparatively large vacuoles
- Information related to certain cell organelles are given in the table. Complete it by selecting suitable terms from the box.

A.	Helps to transport proteins and lipids to the target site	
B.	Contains pigments that absorbs sunlight	
C.	Site of protein synthesis	
D.	Stores starch, oil, protein	

- | | | |
|--------------------|----------------|--------------------------|
| a. Plasma membrane | b. Leucoplast | c. Endoplasmic reticulum |
| d. Ribosome | e. Chloroplast | f. Golgi apparatus |



Extended Activities

- Prepare models of Plant cell and Animal cell using materials available in your surroundings.
- Prepare a picture chart showing the diversity of cells and exhibit it in the class.
- Prepare a timeline showing the development of cytology and present it in the class.

CONSTITUTION OF INDIA

Part IV A

FUNDAMENTAL DUTIES OF CITIZENS

ARTICLE 51 A

Fundamental Duties- It shall be the duty of every citizen of India:

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence;
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievements;
- (k) who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

CHILDREN'S RIGHTS

Dear Children,

Wouldn't you like to know about your rights? Awareness about your rights will inspire and motivate you to ensure your protection and participation, thereby making social justice a reality. You may know that a commission for child rights is functioning in our state called the **Kerala State Commission for Protection of Child Rights**.

Let's see what your rights are:

- Right to freedom of speech and expression.
- Right to life and liberty.
- Right to maximum survival and development.
- Right to be respected and accepted regardless of caste, creed and colour.
- Right to protection and care against physical, mental and sexual abuse.
- Right to participation.
- Protection from child labour and hazardous work.
- Protection against child marriage.
- Right to know one's culture and live accordingly.
- Protection against neglect.
- Right to free and compulsory education.
- Right to learn, rest and leisure.
- Right to parental and societal care, and protection.

Major Responsibilities

- Protect school and public facilities.
- Observe punctuality in learning and activities of the school.
- Accept and respect school authorities, teachers, parents and fellow students.
- Readiness to accept and respect others regardless of caste, creed or colour.



Contact Address:

Kerala State Commission for Protection of Child Rights

'Sree Ganesh', T. C. 14/2036, Vanross Junction

Kerala University P. O., Thiruvananthapuram - 34, Phone : 0471 - 2326603

Email: childrights.cpcr@kerala.gov.in, rte.cpcr@kerala.gov.in

Website : www.kescpcr.kerala.gov.in

Child Helpline - 1098, Crime Stopper - 1090, Nirbhaya - 1800 425 1400

Kerala Police Helpline - 0471 - 3243000/44000/45000

Online R. T. E Monitoring : www.nireekshana.org.in