



GOVERNMENT OF TAMIL NADU

STANDARD SEVEN

TERM - I

VOLUME - 3

SCIENCE
SOCIAL SCIENCE

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Department of School Education

Untouchability is Inhuman and a Crime



Government of Tamil Nadu

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PREFACE

The Science textbook for standard Seven has been prepared following the guidelines given in the National Curriculum Framework 2005. The book enables the reader to read the text, comprehend and perform the learning experiences with the help of teacher. The Students explore the concepts through activities and by the teacher demonstration. Thus the book is learner centric with simple activities that can be performed by the students under the supervision of teachers.

HOW TO USE THE BOOK?

- ❖ The First term VII Science book has six units.
- ❖ Two units planned for every month including computer science chapter has been introduced.
- ❖ Each unit comprises of simple activities and experiments that can be done by the teacher through demonstration if necessary student's can perform them.
- ❖ Colorful info-graphics and info-bits enhance the visual learning.
- ❖ Glossary has been introduced to learn scientific terms.
- ❖ The "Do you know?" box can be used to enrich the knowledge of general science around the world.
- ❖ ICT Corner and QR code has been introduced in each unit for the first time to enhance digital science skills.

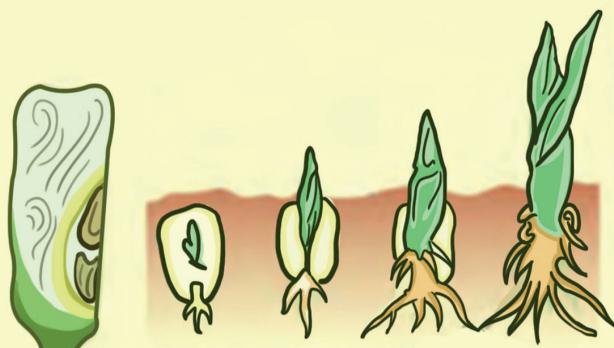
Lets use the QR code in the text books ! How ?

- ❖ Download the QR code scanner from the Google play store/ Apple App Store into your Smart phone.
- ❖ Open the QR code scanner application
- ❖ Once the scanner button in the application is clicked, camera opens and then bring it closer to the QR code in the text book.
- ❖ Once the camera detects the QR code, a URL appears in the screen.
- ❖ Click the URL and go to the content page.





Seed Germination of Monocot Plant



Seed Germination of Dicot Plant

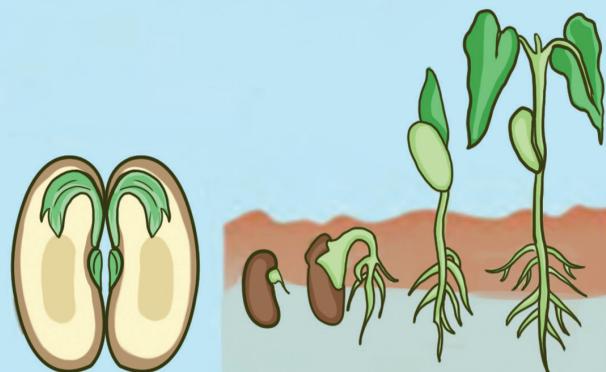


Table of Contents

Unit 1	Measurement	1
Unit 2	Force and Motion	16
Unit 3	Matter Around Us	29
Unit 4	Atomic Structure.....	46
Unit 5	Reproduction and Modification in Plants	60
Unit 6	Health and Hygiene.....	81
Unit 7	Visual Communication	98



E - book



Assessment



DIGI links



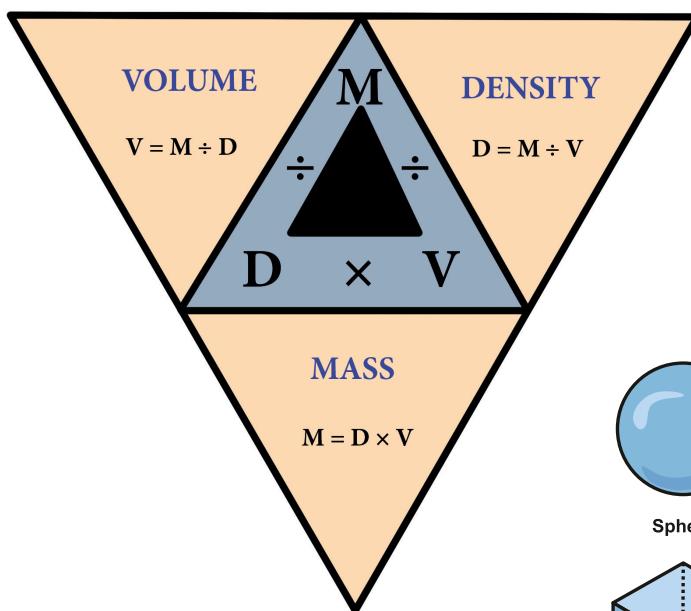
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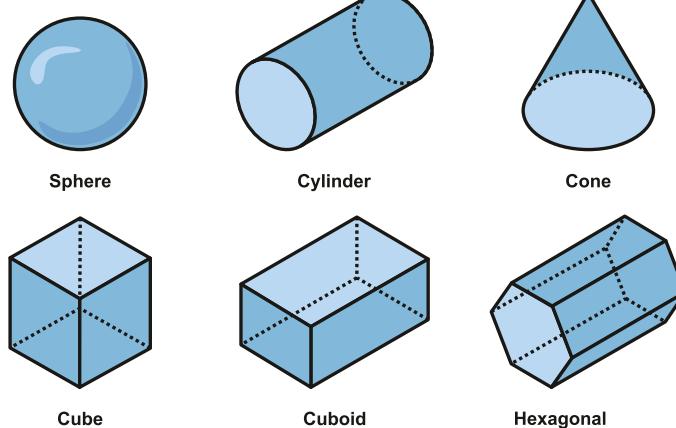


Unit 1

Measurement



3D Solid Shapes



Learning Objectives

After studying this unit, students will be able

- ❖ To identify fundamental and derived physical quantities.
- ❖ To identify fundamental and derived units.
- ❖ To obtain units for certain derived quantities.
- ❖ To measure the area and volume of some regular shaped and irregular shaped objects.
- ❖ To convert the volume of objects from cubic metre to litre and vice versa.
- ❖ To calculate the density of solids and liquids.
- ❖ To define Astronomical unit and light year.





Introduction:

How are the various articles and materials shown in the picture measured?

Vegetables	Cloth	Milk	Time
_____	_____	_____	_____
Litre	Metre	Second	Kilogram

In day to day life, we measure many things such as the weight of fruits, vegetables, food grains, volume of liquids, temperature of the body, speed of the vehicles etc., Quantities such as mass, weight, distance, temperature, volume are called physical quantities.

A value and a unit are used to express the magnitude of a physical quantity. For example Suresh walks 2 kilometre everyday. In this example '2' is the value and 'kilometre' is the unit used to express the magnitude of distance which is a physical quantity.

1.1 Fundamental and derived quantities:

Generally, physical quantities are classified into two types, namely, (i) Fundamental quantities and (ii) Derived quantities.

Fundamental quantities:

A set of physical quantities which cannot be expressed in terms of any other quantities are known as "Fundamental quantities". Their corresponding units are called "Fundamental units".

There are seven fundamental physical quantities in SI Units (System of International Units).

S.No.	Fundamental quantity	Fundamental unit
1	Length	Metre (m)
2	Mass	Kilogram (kg)
3	Time	Second (s)
4	Temperature	Kelvin (K)
5	Electric current	Ampere (A)
6	Amount of substance	Mole (Mol)
7	Luminous (light) intensity	Candela (cd)

Derived quantities:

All other physical quantities which can be obtained by multiplying, dividing or by mathematically combining the fundamental quantities are known as "derived quantities".

Their corresponding units are called "Derived units". Some of the derived quantities and their units are given in table 1.1.

1.2 Area:

The area is a measure of how much space there is on a flat surface.

The area of the plot of land is derived by multiplying the length and breadth

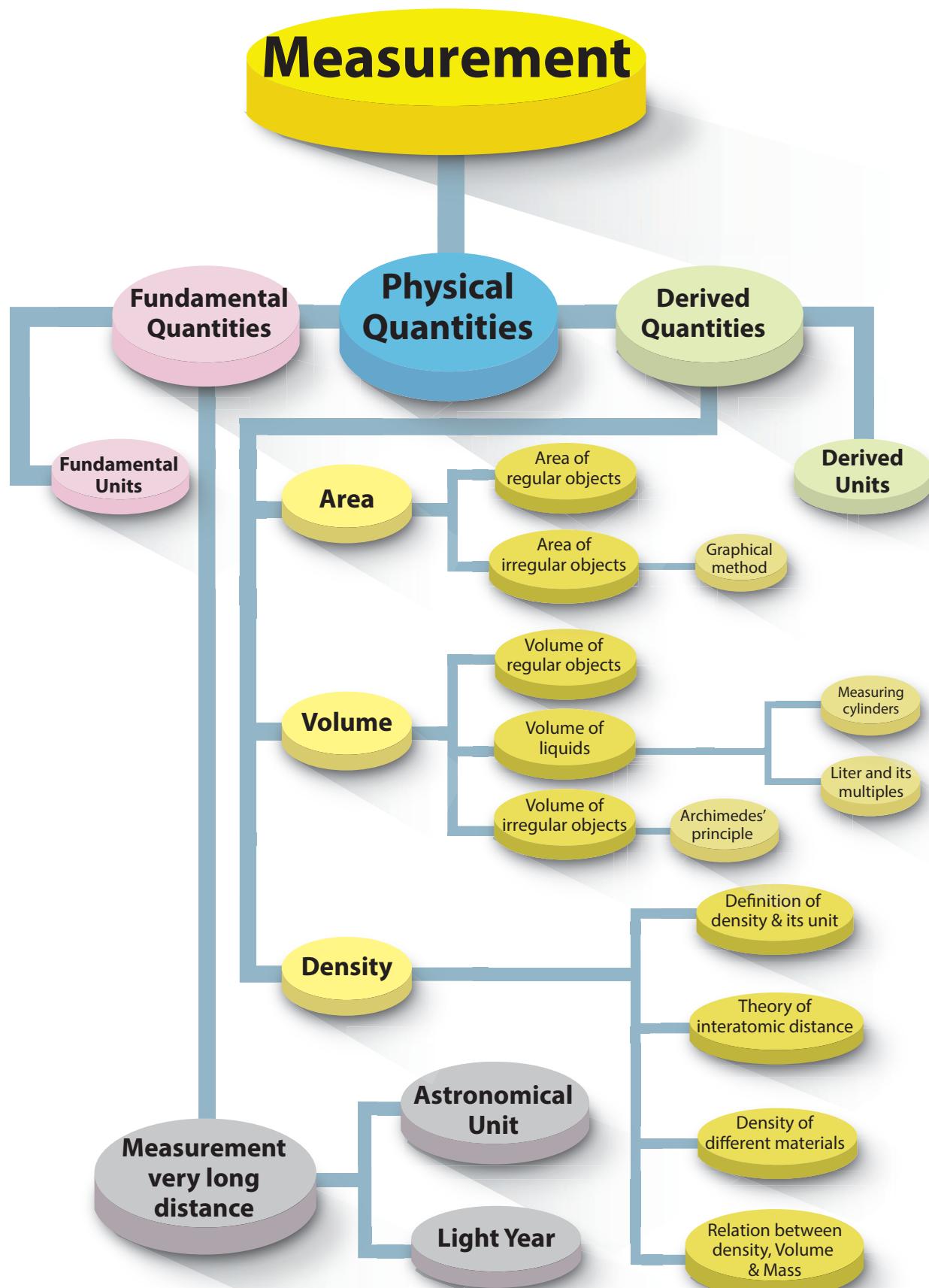
$$\text{Area} = \text{length} \times \text{breadth}$$

The unit of the area is = metre \times metre

$$\begin{aligned} &= \text{metre}^2 \\ &= \text{m}^2 \quad (\text{Read as square metre}) \end{aligned}$$

Table 1.1 Some of the derived quantities and their units in SI System of units

S.No.	Derived quantity	Unit
1	Area = length \times breadth	$\text{m} \times \text{m} = \text{square metre}$ (or) m^2
2	Volume = length \times breadth \times height	$\text{m} \times \text{m} \times \text{m} = \text{cubic metre}$ (or) m^3
3	Speed = distance / time	m / s (or) m s^{-1}
4	Electric charge = electric current \times time	$\text{A} \times \text{s} = \text{As}$ (or) Coulomb (C)
5	Density = mass / volume	Kg / m^3 (or) kg m^{-3}





Area is a derived quantity as we obtain area by multiplying twice of the fundamental physical quantity length.



One square metre is the area enclosed inside a square of side 1 metre.

Problem 1.1

What is the area of a 10 squares each of side of 1 m.

$$\text{Area of a square} = \text{side} \times \text{side}$$

$$= 1 \text{ m} \times 1 \text{ m}$$

$$= 1 \text{ m}^2 \text{ or } 1 \text{ square metre}$$

$$\begin{aligned}\text{Area of 10 squares} &= 1 \text{ square metre} \times 10 \\ &= 10 \text{ square metre}\end{aligned}$$

(Even though the area is given in square metre , the surface need not to be square in shape)

Area of regularly shaped figures

The area of regularly shaped figures can be calculated using the relevant formulae. In the table 1.2, the formulae used to calculate the area of certain regularly shaped figures are given.

Problem 1.2

Find the area of the following regular shaped figures: (Take $\pi = 22/7$)

- A rectangle whose length is 12 m and breadth is 4 m.
- A circle whose radius is 7 m.
- A triangle whose base is 6 m and height is 8 m.

Solution:

(a) Area of rectangle	= length × breadth
	= 12×4
	= 48 m^2
(b) Area of circle	$= \pi \times r^2 = (22/7) \times 7 \times 7$
	= 154 m^2

Table 1.2 Area of some regularly shaped figures

S.No.	Plane figure	Diagram of figure	Area
1	Square		$\text{side} \times \text{side}$ $a \times a = a^2$
2	Rectangle		$\text{length} \times \text{breadth}$ $l \times b = l \cdot b$
3	Circle		$\pi \times (\text{radius})^2$ $\pi \times r^2$ πr^2
4	Triangle		$(1/2) \times \text{base} \times \text{height}$ $1/2 \times b \times h$



$$\begin{aligned}\text{(c) Area of triangle} &= (1/2) \times \text{base} \times \text{height} \\ &= (1/2) \times 6 \times 8 \\ &= 24 \text{ m}^2\end{aligned}$$

Area of irregularly shaped figures

In our daily life, we encounter many irregularly shaped figures like leaves, maps, stickers of stars or flowers, peacock feather etc. The area of such irregularly shaped figures cannot be calculated using any formula.

How can we find the area of these irregularly shaped objects?

We can find the area of these figures with the help of a graph sheet.

The following activity shows how to find the area of irregularly shaped plane figures.

The graphical method explained above can be used to find the area of regularly shaped figures also. In the case of square and rectangle, this method gives the area accurately.

1.3 Volume

The amount of space occupied by a three dimensional object is known as its volume.

volume = surface area \times height

The SI unit of volume is cubic metre or m^3 .

Volume of regularly shaped objects

As in the case of area, the volume of the regularly shaped objects can also be determined using an appropriate formula.

Table 1.3 gives the formulae used to calculate the volume of these regularly shaped objects.

Problem 1.3

Find the volume of (Take $\pi = 22/7$)

- a cube whose side is 3 cm.

ACTIVITY 1

Take a leaf from any one of trees in your neighbourhood. Place the leaf on a graph sheet and draw the outline of the leaf with a pencil (Figure 1.2). Remove the leaf. You can see the outline of the leaf on the graph sheet.

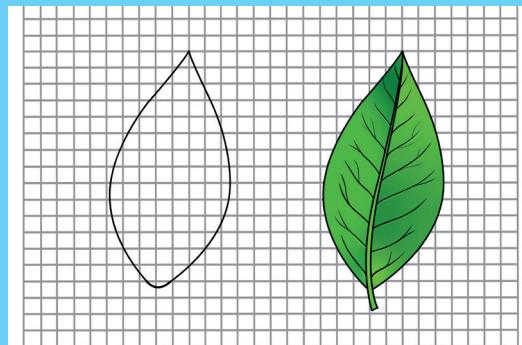


Figure 1.1 Area of an irregularly shaped plane figure

- Now, count the number of whole squares enclosed within the outline of the leaf. Take it to be M.
- Then, count the number of squares that are more than half. Take it as N.
- Next, count the number of squares which are half of a whole square. Note it to be P.
- Finally, count the number of squares that are less than half. Let it be Q.
- $M = \underline{\hspace{2cm}}$; $N = \underline{\hspace{2cm}}$;
 $P = \underline{\hspace{2cm}}$; $Q = \underline{\hspace{2cm}}$

Now, the approximate area of the leaf can be calculated using the following formula:

Approximate area of the leaf = $M + (3/4)N + (1/2)P + (1/4)Q$ square cm.

Area of the leaf = _____.

This formula can be used to calculate the area of any irregularly shaped plane figures.



ACTIVITY 2

Draw the following regularly shaped figures on a graph sheet and find their area by the graphical method. Also, find their area using appropriate formula. Compare the results obtained in two methods by tabulating them.

- A rectangle whose length is 12 cm and breadth is 4 cm.
- A square whose side is 6 cm.
- A circle whose radius is 7 cm.
- A triangle whose base is 6 cm and height is 8 cm.

S. No.	Shape	Area using formula	Area using graphical method

- ii. a cylinder whose radius is 3 m and height is 7 m.

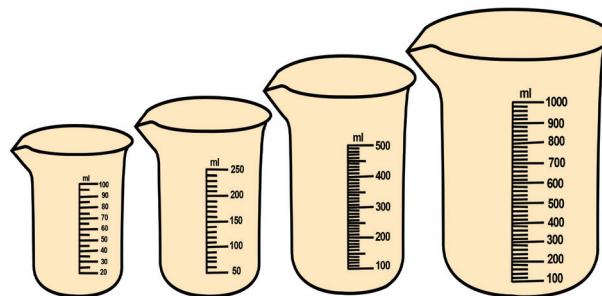
Solution:

- Volume of a cube = side \times side \times side = $3 \text{ cm} \times 3 \text{ cm} \times 3 \text{ cm} = 27 \text{ cubic cm or } \text{cm}^3$.
- Volume of a cylinder = $\pi \times r^2 \times \text{height} = (22/7) \times 3 \times 3 \times 7 = 198 \text{ m}^3$.

Volume of liquids

Liquids also occupy some space and hence they also have volume. But, liquids do not possess any definite shape. So, the volume of a liquid cannot be determined as in the case of solids. When a liquid is poured into a container, it takes the shape and volume of the container. The volume of any liquid is equal to the space that it fills and it can

be measured using a measuring cylinder or measuring beaker. The maximum volume of liquid that a container can hold is known as the “capacity of the container”. A measuring container is graduated as shown in figure.



Measuring containers

The volume of a liquid is equal to the volume of space it fills in the container. This can be directly observed from the readings marked in the measuring containers. If we notice the measuring cups given in figure carefully, we can observe that the readings are marked in the unit of “ml”. This actually represents millilitre. To understand this unit of volume, let us first understand how much a litre means. Litre is the commonly used unit to measure the volume of liquids. We can understand that the unit of volume is cubic cm if the dimensions of the object are given in cm. This cubic cm is commonly known as cc. A volume of 1000 cc is termed as one litre (l).

$$1 \text{ litre} = 1000 \text{ cc or } \text{cm}^3$$

$$1000 \text{ ml} = 1 \text{ litre}$$



To measure the volume of liquids, some other units are also used. Some of them are gallon, ounce, and quart.

$$1 \text{ gallon} = 3785 \text{ ml}$$

$$1 \text{ ounce} = 30 \text{ ml}$$

$$1 \text{ quart} = 1 \text{ litre}$$



Table 1.3 Volume of regularly shaped objects

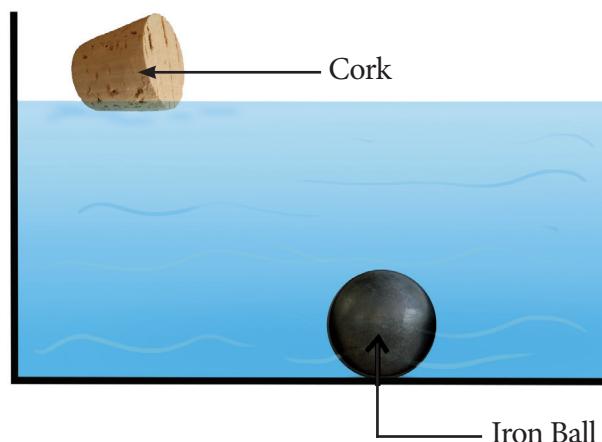
S.No.	Objects	Figure	Volume
1	Cube		$\text{side} \times \text{side} \times \text{side}$ $a \times a \times a$ a^3
2	Cuboid		$\text{length} \times \text{breadth} \times \text{height}$ $l \times b \times h$ lbh
3	Sphere		$\frac{4}{3} \times \pi \times (\text{radius})^3$ $\frac{4}{3} \times \pi \times r^3$ $\frac{4}{3} \pi r^3$
4	Cylinder		$\pi \times (\text{radius})^2 \times \text{height}$ $\pi \times r^2 \times h$ $\pi r^2 h$

Volume of irregularly shaped objects

As we discussed earlier for the case of area, there are no formulae to determine the volume of irregularly shaped objects. For such cases, their volume can be determined using a measuring cylinder and water.



float is water”, then, why does a metal coin sink in water whereas a much heavier wooden log floats? These questions can be answered when we understand the concept of density.



Iron ball sinks while cork floats in water

1.4 Density

Take water in a beaker and drop an iron ball and a cork bowl into the water. What do you observe? The iron ball sinks and the cork floats as shown in figure. Can you explain why? If your answer is “heavy objects sink in water and lighter objects



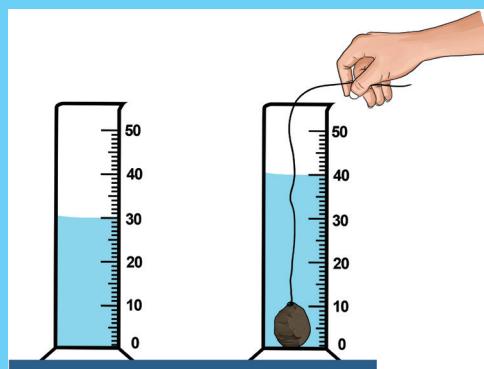
Lighter coin sinks while heavier wooden log floats

ACTIVITY 3

Take a measuring cylinder and pour some water into it (Do not fill the cylinder completely). Note down the volume of water from the readings of the measuring cylinder. Take it as V_1 . Now take a small stone and tie it with a thread. Immerse the stone inside the water by holding the thread. This has to be done such that the stone does not touch the walls of the measuring cylinder (Figure). Now, the level of water has raised. Note down the volume of water and take it to be V_2 . The volume of the stone is equal to the raise in the volume of water.

$$V_1 = \underline{\hspace{2cm}}; V_2 = \underline{\hspace{2cm}};$$

$$\text{Volume of stone} = V_2 - V_1 \\ = \underline{\hspace{2cm}}.$$



Volume of an irregularly shaped object

From the activity 4, we observe that wooden block occupies more volume than the iron ball of same mass. Also, we observe that wooden block is lighter than the iron block of same size.

The lightness or heaviness of a body is due to density. If more mass is packed into the same volume, it has greater density. So, the iron block will have more mass than the wooden block of the same size. Therefore iron has more density.

Definition of density:

Density of a substance is defined as the mass of the substance contained in unit volume (1 m^3).

If the mass of a substance is "M" whose volume is "V", then, the equation for density is given as

$$\text{Density } (D) = \frac{\text{mass } (M)}{\text{volume } (V)}$$

$$D = \frac{M}{V}$$

ACTIVITY 4

- (a) Take an iron block and a wooden block of same mass (say 1kg each). Measure their volume. Which one of them has more volume and occupies more volume?

Ans: _____

- (b) Take an iron block and a wooden block of same size. Weigh them and measure their mass. Which one of them has more mass?

Ans: _____



Unit of density

SI unit of density is kg/m^3 . The CGS unit of density is g/cm^3 .

Density of different materials

Different materials have different densities. The materials with higher density are called “denser” and the materials with lower density are called “rarer”.

The density of some widely used materials are listed in the following table 1.4.

Table 1.4 Density of some common substances, at room temperature

S.No.	Nature	Materials	Density (kg/m^3)
1	Solid	Air	1.2
2		Kerosene	800
3		Water	1,000
4		Mercury	13,600
5		Wood	770
6		Aluminium	2,700
7		Iron	7,800
8		Copper	8,900
9		Silver	10,500
10		Gold	19,300

Suppose you have one Kg of iron and gold, which of them would have more volume than the other? Give your reason.

Problem 1.4

A solid cylinder of mass 280 kg has a volume of 4 m^3 . Find the density of cylinder.

Solution:

$$\begin{aligned}\text{Density of cylinder} &= \frac{\text{mass of cylinder}}{\text{volume of cylinder}} \\ &= \frac{280}{4} = 70 \text{ kg/m}^3\end{aligned}$$

Problem 1.5

A box is made up of iron and it has a volume of 125 cm^3 . Find its mass. (Density of iron is $7.8 \text{ g}/\text{cm}^3$).

Solutiion:

$$\begin{aligned}\text{Density} &= \text{Mass} / \text{Volume} \\ \text{Hence, Mass} &= \text{Volume} \times \text{Density} \\ &= 125 \times 7.8 = 975 \text{ g.}\end{aligned}$$

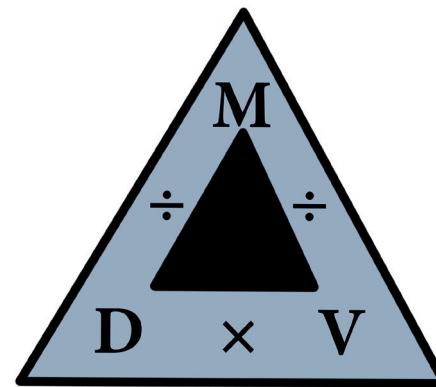
Problem 1.6

A sphere is made from copper whose mass is 3000 kg. If the density of copper is $8900 \text{ kg}/\text{m}^3$, find the volume of the sphere.

Solutiion:

$$\begin{aligned}\text{Density} &= \text{Mass} / \text{Volume} \\ \text{Hence, Volume} &= \text{Mass} / \text{Density} \\ &= 3000 / 8900 = 30 / 89 \\ &= 0.34 \text{ m}^3\end{aligned}$$

The relationship between Mass, density and volume are represented in the following density triangle:



- Density = Mass/ Volume
- Mass = Density \times Volume
- Volume = Mass / Density

Relationship between density, mass and volume

1.5 Measuring distance of celestial bodies

Normally, we use centimeter, metre and kilo metre to express the distances that we measure in our day to day life. But, for space research, astronomers need to measure very long



distances such as the distance between the earth and a star or the distance between two stars. To express these distances, we shall learn about two such units, namely,

- i. Astronomical unit
- ii. Light year



Water has more density than oils like cooking oil and castor oil, although these oils appear to be denser than water.

Density of castor oil is 961 kg/m^3 . If we put one drop of water in oil, water drop sinks. But, if we put one drop of oil in water, oil floats and forms a layer on water surface. However, some oils are denser than water.

Astronomical unit

We all know that the earth revolves around the sun in an elliptical orbit. Hence, the distance between the sun and the earth varies every day. When the earth is in its perihelion position (Perihelion is position of the shortest distance between the earth and the sun), the distance between the earth and the sun is about 147.1 million kilometre. When the earth is in its farthest position, that is when the distance between Earth and Sun is the largest (called aphelion position) the distance

is 152.1 million kilometer. The average distance between the earth and the sun is about 149.6 million kilometer. This average distance is taken as one astronomical unit.

Neptune is 30 AU away from the Sun. It means it is thirty times farther than the Earth.

One astronomical unit is defined as the average distance between the earth and the sun.

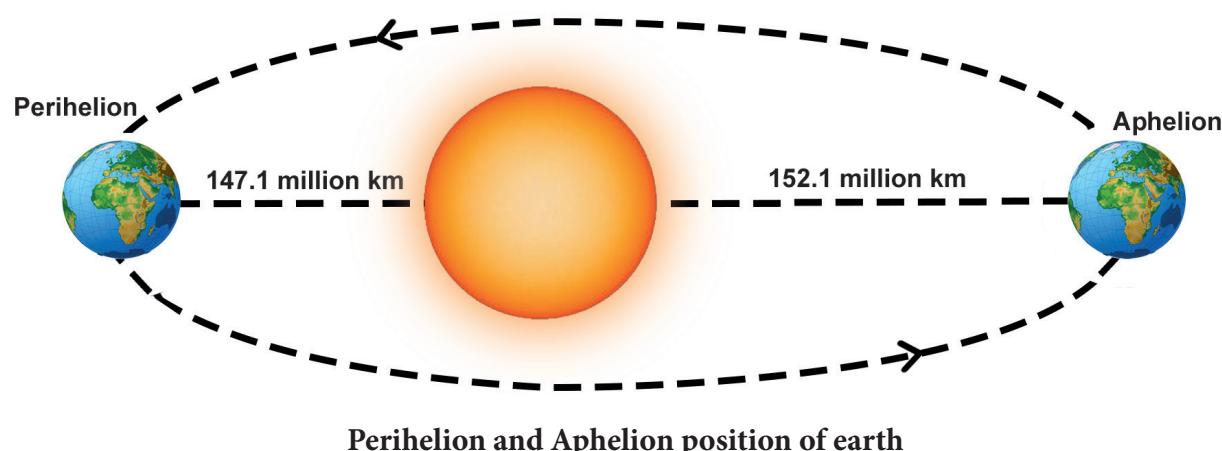
$$\begin{aligned}1 \text{ AU} &= 149.6 \text{ million km} = 149.6 \times 10^6 \text{ km} \\&= 1.496 \times 10^{11} \text{ m.}\end{aligned}$$

Light year

The nearest star to our solar system is Proxima Centauri. It is at a distance of 2,68,770 AU. We can clearly see that using the AU for measuring distances of stars would be unwieldy. Therefore, astronomers use a special unit, called 'light year', for measuring the distance in deep space. We have learnt that the speed of light in vacuum is $3 \times 10^8 \text{ m/s}$. This means that light travels a distance of $3 \times 10^8 \text{ m}$ in one second. In a year (non-leap), there are 365 days. Each day has 24 hours; Each hour has 60 minutes; Each minute has 60 seconds.

Thus, the total number of seconds

$$\begin{aligned}\text{in one year} &= 365 \times 24 \times 60 \times 60 \\&= 3.153 \times 10^7 \text{ second}\end{aligned}$$





If light travels a distance of 3×10^8 m in one second, then the distance travelled by light in one year = $3 \times 10^8 \times 3.153 \times 10^7 = 9.46 \times 10^{15}$ m. This distance is known as one light year.

One light year is defined as the distance travelled by light in vacuum during the period of one year.

$$1 \text{ Light year} = 9.46 \times 10^{15} \text{ m.}$$

In terms of light year, Proxima Centauri is at 4.22 light-years from Earth and the Solar System (and Earth). The Earth is located about 25,000 light-years away from the galactic center.

Points to remember:

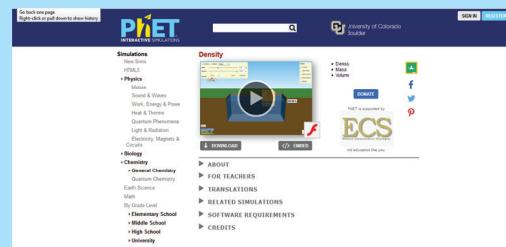
- ❖ A set of physical quantities which cannot be expressed in terms of any other quantities are known as “Fundamental quantities”. Their corresponding units are called “Fundamental units”.
- ❖ The physical quantities which can be obtained by mathematically combining (i.e., multiplying and dividing) the fundamental quantities are known as “Derived quantities”. Their corresponding units are called “Derived units”.
- ❖ The area of a figure is the region covered by the boundary of the figure. Its SI unit is square metre or m^2 .
- ❖ The area of irregularly shaped figures can be calculated with the help of a graph sheet.
- ❖ The amount of space occupied by a three dimensional object is known as its volume. The SI unit of volume is cubic metre or m^3 .
- ❖ The volume of liquids are expressed in terms of litre. One litre = 1000 cc.
- ❖ The maximum volume of a liquid that a container can hold is known as the capacity of the container.
- ❖ Density of a substance is defined as the mass of the substance contained in unit volume (1 m^3).
- ❖ SI unit of density is kg/m^3 . The CGS unit of density is g/cm^3 . $1\text{g/cm}^3 = 10^3 \text{ kg/m}^3$.
- ❖ The materials with higher density are called “denser” and the materials with lower density are called “rarer”.
- ❖ If the density of a solid is higher than that of a liquid, it sinks in that liquid. If the density of a solid is lower than that of a liquid, it floats in that liquid.
- ❖ Density = Mass / Volume
- ❖ Mass = Density × Volume
- ❖ Volume = Mass / Density
- ❖ One astronomical unit is defined as the average distance between the earth and the sun. $1 \text{ AU} = 149.6 \times 10^6 \text{ km} = 1.496 \times 10^{11} \text{ m}$.
- ❖ One light year is defined as the distance travelled by light in vacuum during the period of one year. $1 \text{ Light year} = 9.46 \times 10^{15} \text{ m}$.



ICT CORNER

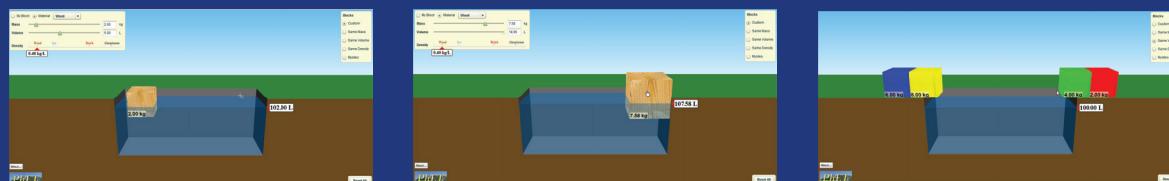
Measurement

Let's know about the effects of mass and volume on density.



PROCEDURE :

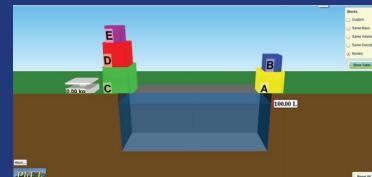
- Step 1:** Use the URL or scan the QR code to open the activity page.
- Step 2:** Select the options at top right side window to customize
- Step 3:** Move the sliders on the top left-side window to change the Material and Mass, Volume. Now see the effects of mass and volume on density.
- Step 4:** Click 'Reset all' button to refresh



Step 1

Step 2

Step 3



Step 4

Measurement URL:

<https://phet.colorado.edu/en/simulation/density> (or) scan the QR Code

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.





Evaluation

I. Choose the appropriate answer:

1. Which of the following is a derived unit?
 - a) mass
 - b) time
 - c) area
 - d) length

2. Which of the following is correct?
 - a) $1\text{L} = 1\text{cc}$
 - b) $1\text{L} = 10 \text{ cc}$
 - c) $1\text{L} = 100 \text{ cc}$
 - d) $1\text{L} = 1000 \text{ cc}$

3. SI unit of density is
 - a) kg/m^2
 - b) kg/m^3
 - c) kg/m
 - d) g/m^3

4. Two spheres have equal mass and volume in the ratio 2:1. The ratio of their density is
 - a) 1:2
 - b) 2:1
 - c) 4:1
 - d) 1:4

5. Light year is the unit of
 - a) Distance
 - b) time
 - c) density
 - d) both length and time



III. State whether the following statements are true or false:

1. The region covered by the boundary of the plane figure is called its volume.
2. Volume of liquids can be found using measuring containers.
3. Water is denser than kerosene.
4. A ball of iron floats in mercury.
5. A substance which contains less number of molecules per unit volume is said to be denser.

IV. Match the items in column-I to the items in column-II:

(1)	Column-I	Column-II
i.	Area	(a) light year
ii.	Distance	(b) m^3
iii.	Density	(c) m^2
iv.	Volume	(d) kg
v.	Mass	(e) kg / m^3

(2)	Column-I	Column-II
i.	Area	(a) g / cm^3
ii.	Length	(b) measuring jar
iii.	Density	(c) amount of a substance
iv.	Volume	(d) rope
v.	Mass	(e) plane figures

V. Arrange the following in correct sequence:

1. Volume of irregularly shaped objects are measured using the law of _____.
2. One cubic metre is equal to _____ cubic centimetre.
3. Density of mercury is _____.
4. One astronomical unit is equal to _____.
5. The area of a leaf can be measured using a _____.

VI. Use the analogy to fill in the blank:

1. Area: m^2 :: Volume: _____
2. Liquid: Litre :: Solid: _____
3. Water: kerosene :: _____ : Aluminium



VII. Assertion and reason type questions:

Mark the correct choice as

- a. If both assertion and reason are true and reason is the correct explanation of assertion.
 - b. If both assertion and reason are true, but reason is not the correct explanation of assertion.
 - c. Assertion is true but reason is false.
 - d. Assertion is false but reason is true.
1. **Assertion:** Volume of a stone is found using a measuring cylinder.
Reason: Stone is an irregularly shaped object.
2. **Assertion:** Wood floats in water.
Reason: Water is a transparent liquid.
3. **Assertion:** Iron ball sinks in water.
Reason: water is denser than iron.

VIII. Give very short answer:

1. Name some of the derived quantities.
2. Give the value of one light year.
3. Write down the formula used to find the volume of a cylinder.
4. Give the formula to find the density of objects.
5. Name the liquid in which an iron ball sinks.
6. Name the units used to measure the distance between celestial objects.
7. What is the density of gold?

IX. Give short answer:

1. What are derived quantities?
2. Distinguish between the volume of liquid and capacity of a container.
3. Define the density of objects.
4. What is one light year?
5. Define -one astronomical unit?

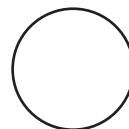
X. Answer in detail.

1. Describe the graphical method to find the area of an irregularly shaped plane figure.
2. How will you determine the density of a stone using a measuring jar?

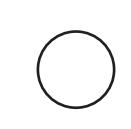
XI. Questions based on Higher Order Thinking skills:

1. There are three spheres A, B, C as shown below:

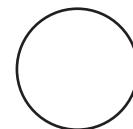
Sphere A



Sphere B



Sphere C



Sphere A and B are made of the same material. Sphere C is made of a different material. Spheres A and C have equal radii. The radius of sphere B is half that of A. Density of A is double that of C.

Now answer the following questions:

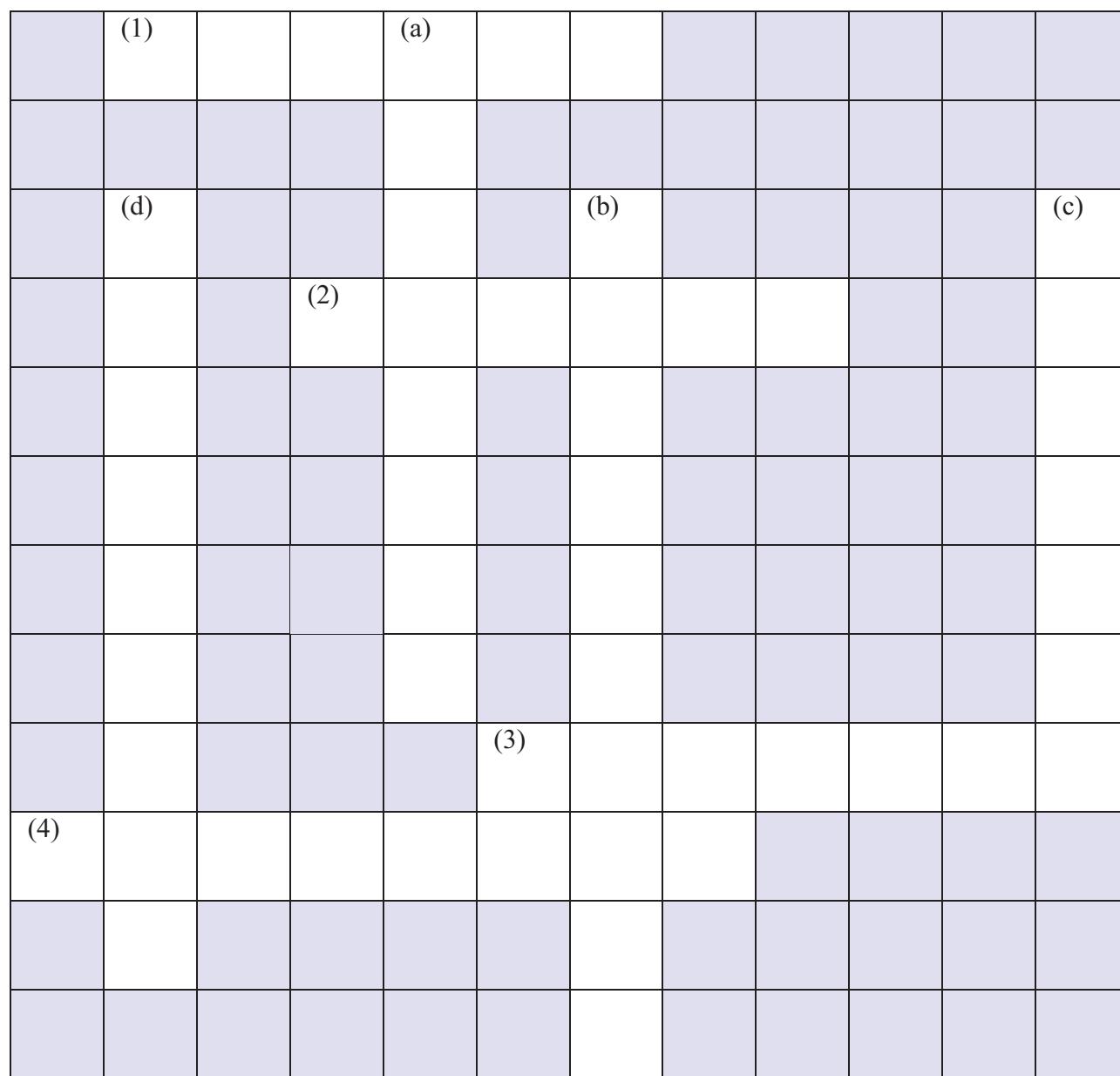
- i. Find the ratio of masses of spheres A and B.
- ii. Find the ratio of volumes of spheres A and B.
- iii. Find the ratio of masses of spheres A and C.

XII. Numerical problems:

1. A circular disc has a radius 10 cm. Find the area of the disc in m^2 . (Use $\pi = 3.14$).
2. The dimension of a school playground is $800 \text{ m} \times 500 \text{ m}$. Find the area of the ground.
3. Two spheres of same size are made from copper and iron respectively. Find the ratio between their masses. Density of copper $8,900 \text{ kg/m}^3$ and iron $7,800 \text{ kg/m}^3$.
4. A liquid having a mass of 250 g fills a space of 1000 cc. Find the density of the liquid.
5. A sphere of radius 1cm is made from silver. If the mass of the sphere is 33g, find the density of silver. (Take $\pi = 3.14$).



XIII. Cross word puzzle:



CLUES – ACROSS

1. SI unit of temperature
2. A derived quantity
3. Mass per unit volume
4. Maximum volume o liquid a container can hold

CLUES – DOWN

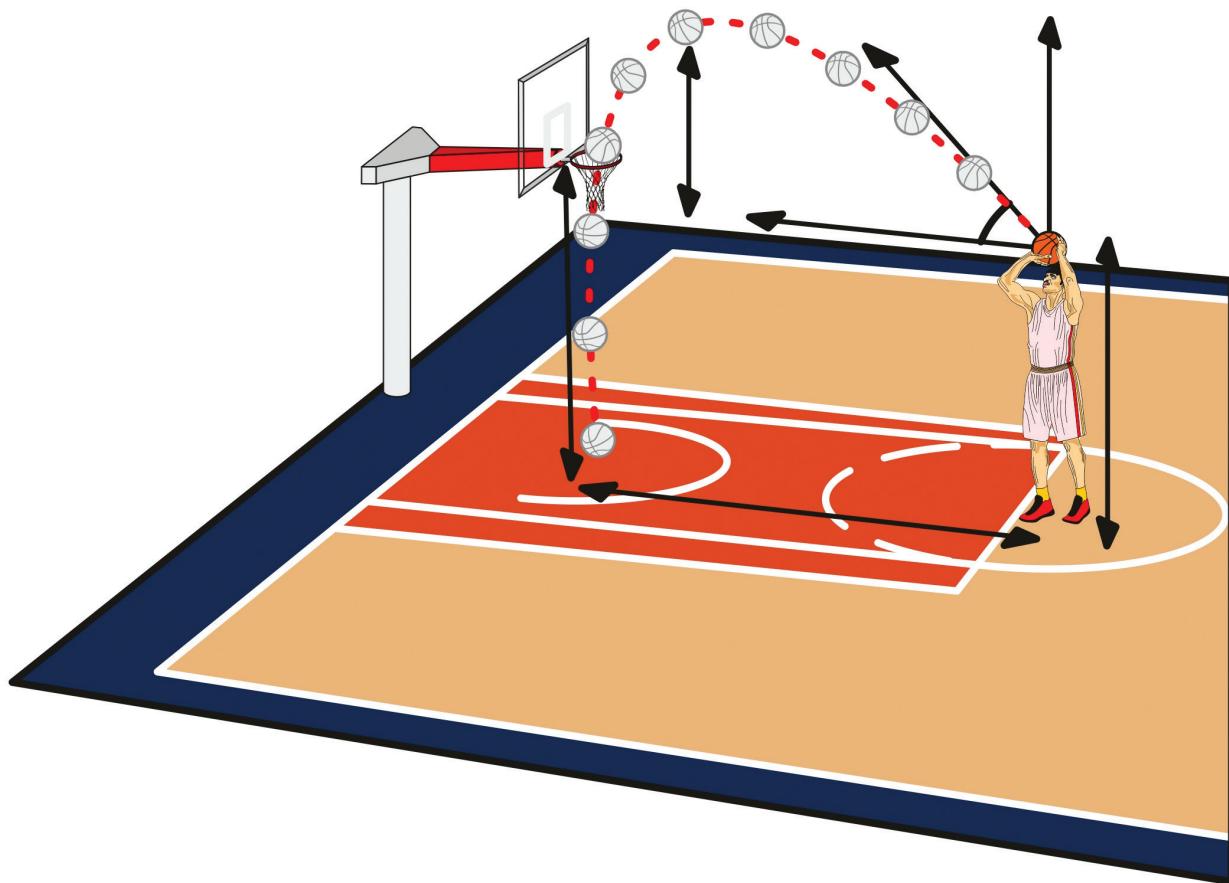
- a. A derived quantity
- b. SI unit of volume
- c. A liquid denser than iron
- d. A unit of length used to measure very long distances

Ans: [1. Kelvin; 2. Volume; 3. Density; 4. Capacity]
[a. Velocity; b. Cubic metre; c. Mercury; d. Lightyear]



Unit 2

Force and Motion



Learning Objectives

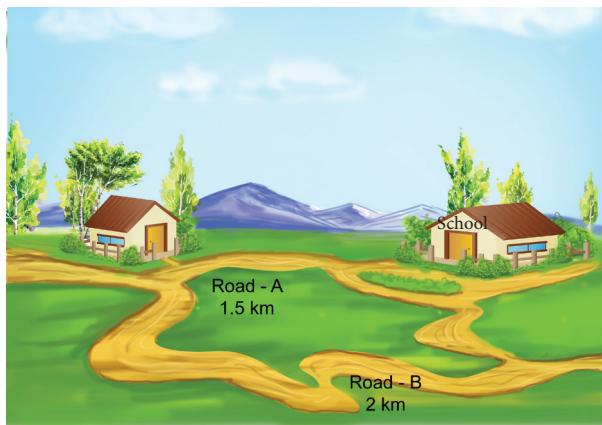
After studying this unit, students will be able

- ❖ To define distance and displacement.
- ❖ To differentiate distance and displacement
- ❖ To define speed, velocity and acceleration.
- ❖ To differentiate speed and velocity
- ❖ To draw and explain distance-time and velocity time graphs.
- ❖ To measure and calculate the speed of the moving objects.
- ❖ To know the day to day uses of centre of gravity and stability.





Introduction

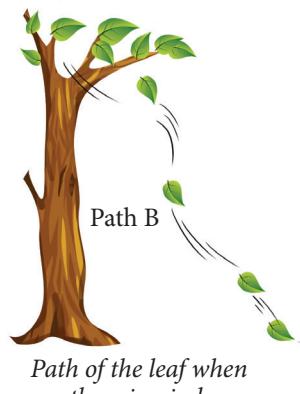


As shown in the above picture, Kavitha can reach her school in two ways. Can you tell, by choosing which path she could reach the school early.

Road A

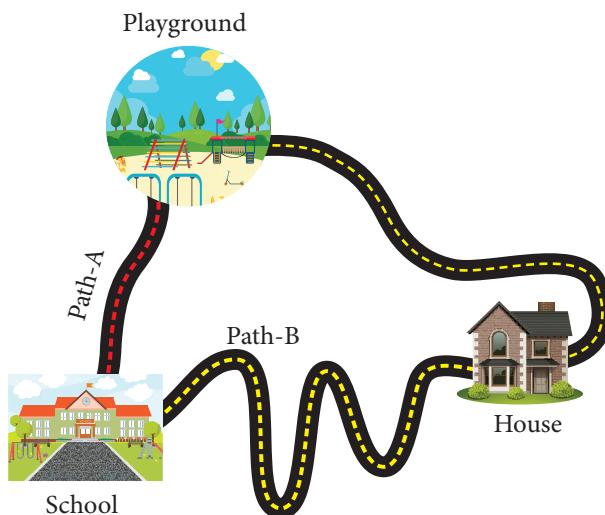
Road B

Look at the nearby picture



In which path the leaf will reach the ground first?

Uma and Priya are friends studying in the same school. After school hours, they go to the nearby playground, play games and return back home. One day Uma told that she would reach the playground after visiting her grandmother's house. The path in which they took reached the playground is shown here.



Take a twine and measure the length of the two paths (A & B). Which is the longest path among the two? _____.

From the above examples, we could conclude that when an object travels from one place to another, it will reach faster if it travels along the straight line path. The straight line path is the shortest distance between two points.

Distance and Displacement

Distance - The total length of a path taken by an object to reach one place from the other is called distance.

Displacement – The shortest distance from the initial to the final position of an object.

Both the distance and displacement possess the same unit. The SI unit is meter (m).

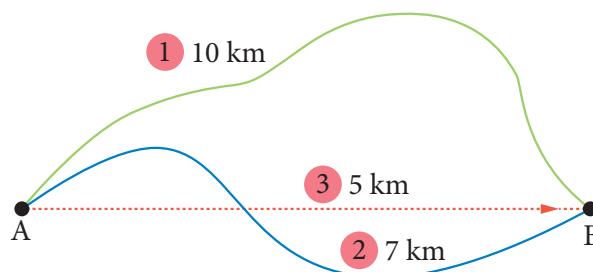
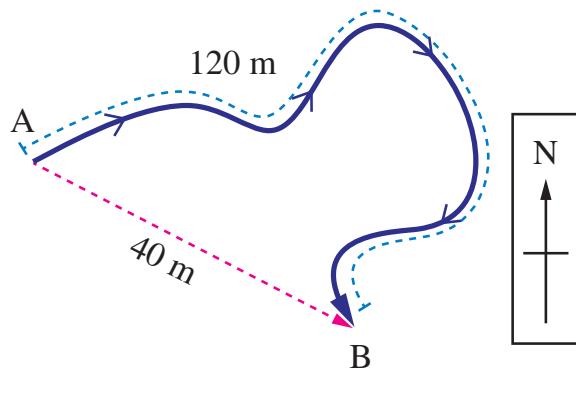


Figure shows the motion of a person between two places A and B.



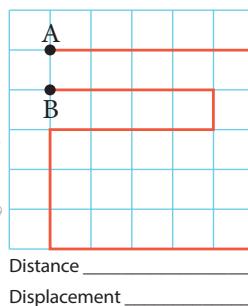
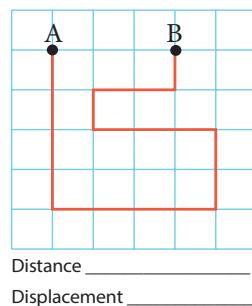
He travels 10 km in first path. In the second path, he travels 7 km.

The distance between A and B via first path is 10 km. In the second path the distance is 7 km. The shortest distance between the two places is 5 km represented as 2. So the displacement is 5 km. (In east direction)



The path of an object travelling from A to B is shown in figure. Total distance travelled by the object is 120 m. The displacement of the object is 40 m (south-east direction)

The path in which a rabbit ran is shown in figure. Find the distance and displacement of it in the two figures. Let us consider that each square is in an unit of one square meter. The rabbit starts from point A and reaches the point B.

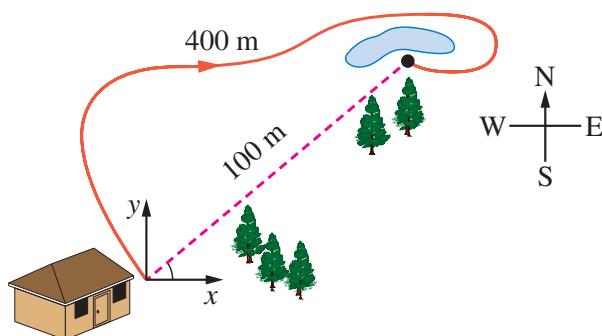


When will the distance and displacement be equal. Explain. But the starting and finishing points should be different.

When we represent the displacement, we use a positive or negative sign depending on the direction with which it travels.



Here we can consider the starting point as A and while the object moves from A to B the displacement is considered to be positive and from B to A it is negative.



Answer the following questions:

- ❖ Subha goes to the nearby playground from her home.
 1. What is the distance she travelled?
 2. What is her displacement?
- ❖ The distance travelled by an object is 15 km and its displacement is 15 km. What do you infer from this?
- ❖ The distance of a person is 30 km and his displacement is 0 km. What do you infer from this?



Nautical mile

Nautical mile is the unit for measuring the distance in the field of aviation and sea transportation. One nautical mile is 1.852 km.

The unit for measuring the speed of aeroplanes and ships is knot. One knot is the speed taken to travel one nautical mile in hour.



2.2 Speed - Velocity

Speed

Recapitulation

In sixth standard we already studied about the speed in detail.



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

How we got this?

$$1 \text{ km} = 1000 \text{ m}$$

$$1 \text{ h} = 3600 \text{ s}$$

$$1 \text{ km/h} = 1000 \text{ m} / 3600 \text{ s} = 5/18 \text{ m/s}$$

Speed is the rate of change of distance.

$$\text{Speed} = \text{distance} / \text{time}$$

Unit is metre/second (m/s)

We can classify speed into two types.

Uniform speed

If a body in motion covers equal distances in equal intervals of time, then the body is said to be in uniform speed.

Non-uniform speed

If a body covers unequal distances in equal intervals of time, the body is said to be in non-uniform speed.

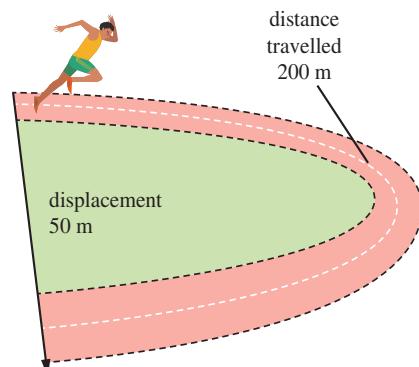
$$\text{Average speed} = \frac{\text{total distance travelled}}{\text{time taken to travel the distance}}$$

Velocity

Velocity is the rate of change in displacement.

$$\text{Velocity (v)} = \frac{\text{displacement}}{\text{time}}$$

SI unit of velocity is meter / second (m/s).



If an athlete in the diagram takes 25 s to complete a 200 m sprint event. Find her speed and velocity.

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$= 200 / 25$$

$$= 8 \text{ m/s}$$

$$\text{velocity} = \frac{\text{displacement}}{\text{time}}$$

$$= 50 / 25$$

$$= 2 \text{ m/s}$$

Uniform velocity

A body has uniform velocity, if it covers equal displacement in the same direction in equal intervals of time. E.g. light travels through vacuum.

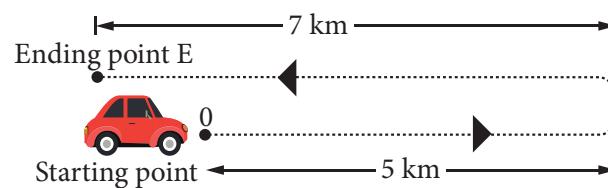
Non uniform velocity

If either speed or direction changes, the velocity is non uniform. E.g. a train starting and moving out of the station.

Average velocity

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

E.g. Figure shows a car that travels 5 km due east and makes a U – turn to travel another 7 km. If the time taken for the whole journey is 0.2 h. Calculate the average velocity of the car.



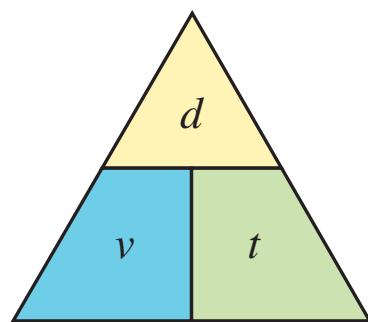
Average velocity = $\frac{\text{total displacement}}{\text{time taken}}$.
(taking the direction due east of point O as positive)

$$= (5 - 7) / 0.2$$

$$= -2 / 0.2$$

$$= -10 \text{ km/h} (\text{or } -10 \times 5/18 = 25/9)$$

$$= -0.28 \text{ m/s}$$

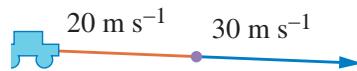


The triangle method can help you to recall the relationship between velocity (v), displacement (d), and time(t).

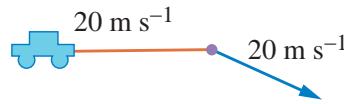
$$v = d / t, t = d / v, d = v \times t$$

Answer the following questions:

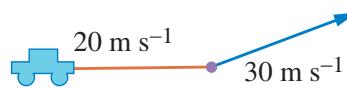
- ❖ Calculate the velocity of a car travelling with a uniform velocity covering 100 m distance in 4 seconds.
- ❖ Usain Bolt covers 100 m distance in 9.58 seconds. Calculate his speed. Who will be the winner if Usain Bolt competes with a Cheetah running at a speed of 30 m/s?
- ❖ You are walking along east covering a distance of 4 m, then 2 m towards south,



(a) Change in speed



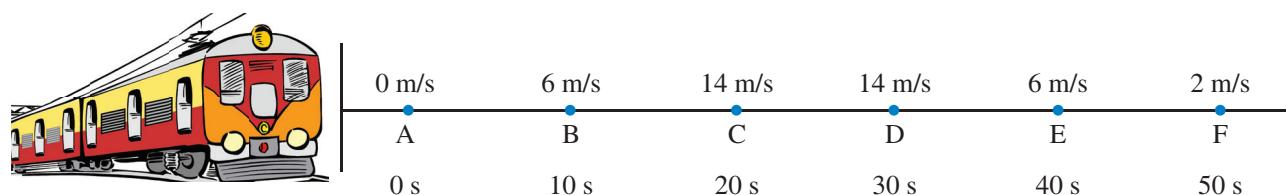
(b) Change in direction



(c) Change in both speed and direction

The distance travelled by train	Initial velocity (u) m/s	Final velocity (v) m/s	Change in velocity (v - u) m/s	Time taken (t) s	Acceleration = change in velocity / time $a = (v - u) / t$ m / s ²
A-B	0	6	6	10	0.6
B-C					
C-D					
D-E					
E-F					

The velocity at different times of a train departing direction is given in the figure. Analyse this and complete the table .



then 4 m towards west and at last 2 m towards north. You cover the total distance in 21 seconds, what is your average speed and average velocity?

2.3 Acceleration

Acceleration (a)

Acceleration is the rate of change in velocity. In other words if a body changes its speed or direction then it is said to be accelerated.



$$\text{Acceleration} = \text{change in velocity} / \text{time}$$

$$= [\text{final velocity (v)} - \text{initial velocity (u)}] / \text{time (t)}$$

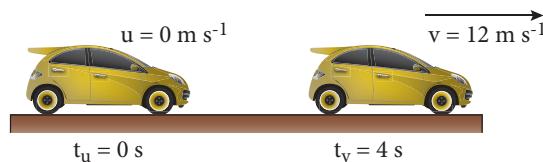
$$a = (v - u) / t$$

SI unit of acceleration is m/s²

In other words, the object undergoes acceleration when its speed and/or direction change(s).



Tell me



A car at rest starts to travel in a straight path. It reaches a velocity of 12 m/s in 4 s. What is its acceleration. Assuming that it accelerates uniformly?
Initial velocity $u = 0 \text{ m/s}$ (since the car starts from rest)

$$\begin{aligned}\text{Final velocity } (v) &= 12 \text{ m/s} \\ \text{Time taken } (t) &= 4 \text{ s} \\ \text{acceleration } (a) &= (v - u) / t \\ &= (12 - 0) / 4 \\ &= 3 \text{ m/s}^2\end{aligned}$$

DO YOU KNOW?

See how brisk I am !

My name is cheetah. I can run at a great speed. Do you know what my speed is? 25 m/s to 30 m/s. My speed changes from 0 to 20 m/s in 2 second. See how good my acceleration is !

Tell me

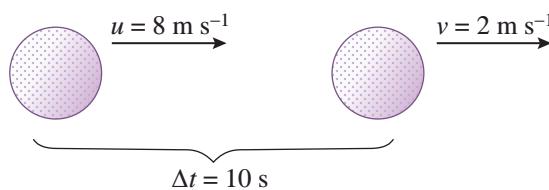
From the above information, can you calculate the acceleration of the cheetah?

Positive acceleration

If the velocity of an object increases with respect to time, then the object is said to be in positive acceleration or just acceleration.

Negative acceleration or deceleration or retardation

If the velocity of an object decreases with respect to time, then the object is said to be in negative acceleration or deceleration or retardation.



The velocity of a golf ball rolling in a straight line changes from 8 m/s to 2 m/s in 10 s. What is its deceleration, assuming that it is decelerating uniformly?

$$\begin{aligned}\text{Initial velocity } (u) &= 8 \text{ m/s} \\ \text{Final velocity } (v) &= 2 \text{ m/s} \\ \text{Time taken } (t) &= 10 \text{ s} \\ \text{Acceleration } (a) &= (v - u) / t \\ &= (2 - 8) / 10 \\ &= -0.6 \text{ m/s}^2\end{aligned}$$

The deceleration is -0.6 m/s^2

Uniform acceleration

An object undergoes uniform acceleration when the change (increase or decrease) in its velocity for every unit of time is the same.

Table shows a moving bus with uniform acceleration.

Time (s)	1	2	3	4	5
Velocity (m/s)	20+20	40+20	60+20	80+20	100+20
(acceleration)					
	100 - 20	80-20	60-20	40-20	20-20
(deceleration)					

When the velocity of the object is increasing by 20 m/s the acceleration is 20 m/s^2 . When the velocity of the object is decreasing by 20 m/s the deceleration is 20 m/s^2 .

Non – uniform acceleration

An object undergoes non uniform acceleration if the change in its velocity for every unit of time is not the same.

Time (s)	0	1	2	3	4	5
Velocity (m/s)	0	10	40	60	70	50
Change in Velocity (m/s)	0	10	30	20	10	20

Note that the change in velocity is not the same for every second. The moving object is undergoing non uniform acceleration.



2.4 Distance – Time Graphs

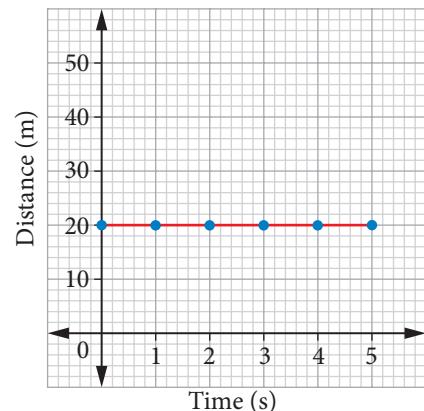
Starting point



Figure shows a car travelling along a straight line away from the starting point O. The distance of the car is measured for every second. The distance and time are recorded and a graph is plotted using the data. The results for four possible journeys are shown below.

(a) Car at rest

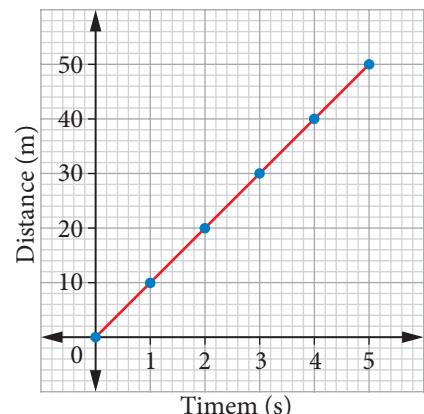
Time (s)	0	1	2	3	4	5
Distance (m)	0	20	20	20	20	20



The graph has zero gradient. The distance is a constant for every second.

(b) Car travelling at uniform speed of 10 m s^{-1}

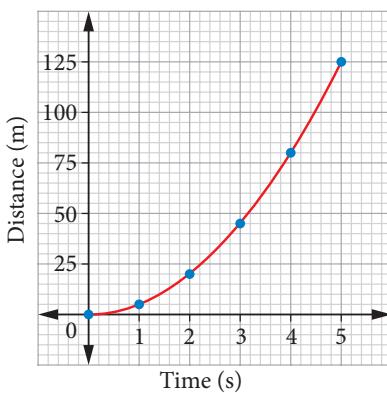
Time (s)	0	1	2	3	4	5
Distance (m)	0	10	20	30	40	50



The graph has a zero constant gradient. The distance increases 10 m every second.

(C) Car travelling at increasing speed

Time (s)	0	1	2	3	4	5
Distance (m)	0	5	20	45	80	125

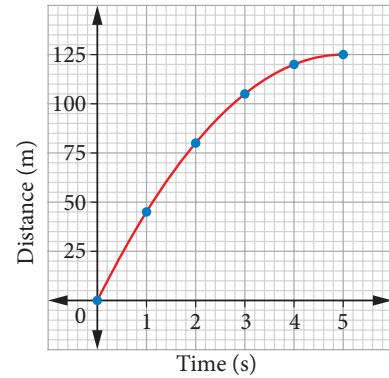


The graph has an increasing gradient. The speed increases

The instantaneous speed of the car at $t = 3 \text{ s}$ is given by the gradient of the tangent at the point.

(D) Car travelling at decreasing speed

Time (s)	0	1	2	3	4	5
Distance (m)	0	45	80	105	120	125



The graph has a decreasing gradient. The speed decreases

2.5 Speed – time graphs

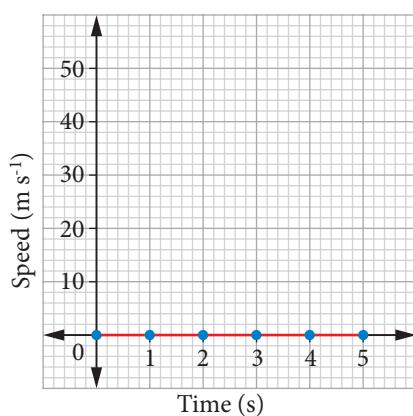
Let us consider a bus travelling from Thanjavur to Trichy. The speed of the bus is measured for every second. The speed and time are recorded and a graph is plotted using the data. The results for four possible journeys are shown.





1. Bus at rest

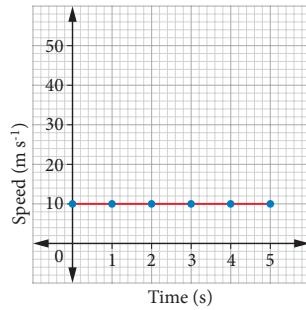
Time (s)	0	1	2	3	4	5
Speed (m s^{-1})	0	0	0	0	0	0



The speed remains at 0 m s^{-1} , so the car has zero acceleration.

2. Bus travelling at uniform speed of 10 m/s

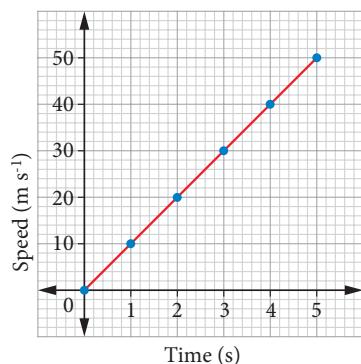
Time (s)	0	1	2	3	4	5
Speed (m s^{-1})	10	10	10	10	10	10



The speed remains at 10 m s^{-1} , so the car has zero acceleration.

3. Bus travelling with uniform acceleration

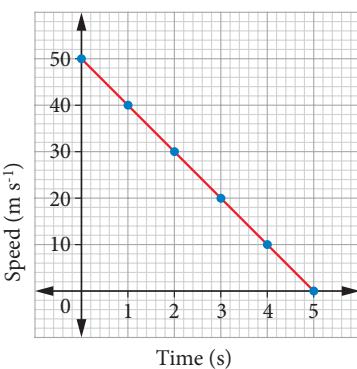
Time (s)	0	1	2	3	4	5
Speed (m s^{-1})	10	10	20	30	40	50



The speed of the car increases by 10 m s^{-1} , every second. Hence, the graph has a positive and constant gradient, and the acceleration is constant.

4. Bus travelling with uniform deceleration

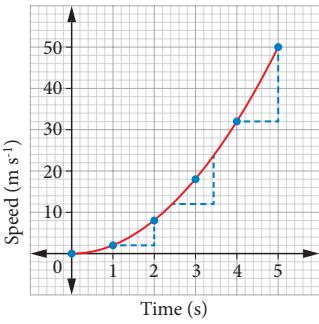
Time (s)	0	1	2	3	4	5
Speed (m s^{-1})	50	40	30	20	10	0



The speed of the car decreases by 10 m s^{-1} , every second. Hence, the graph has a negative and constant gradient, and the acceleration is constant.

5. Bus travelling with increasing acceleration (non-uniform acceleration)

Time (s)	0	1	2	3	4	5
Speed (m s^{-1})	0	2	8	18	32	50

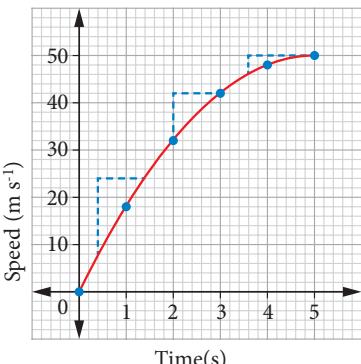


The increase in speed is increasing with time. Hence, the graph has a positive and increasing gradient, and the acceleration increases.

The instantaneous acceleration of the car at $t = 3 \text{ s}$ is given by the gradient of the tangent at the point.

6. Bus travelling with decreasing acceleration (non-uniform acceleration)

Time (s)	0	1	2	3	4	5
Speed (m s^{-1})	0	18	32	42	48	50



The increase in speed is decreasing with time. Hence, the graph has a positive and decreasing gradient and the acceleration decreases.

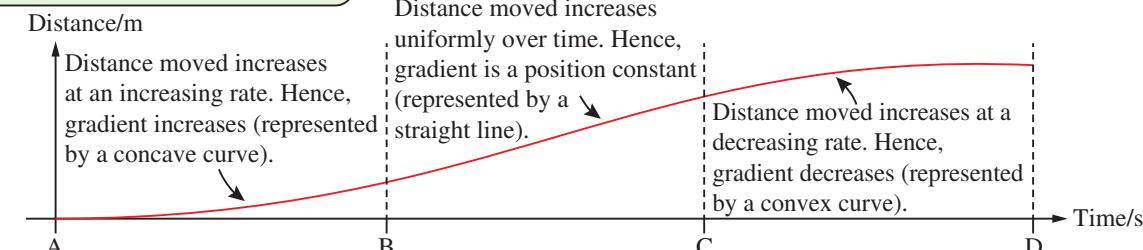
Comparisons between distance – time and speed – time graphs

Speed – time graphs and Distance – time graphs look very similar, but they give different information. We can differentiate them by looking at the labels.

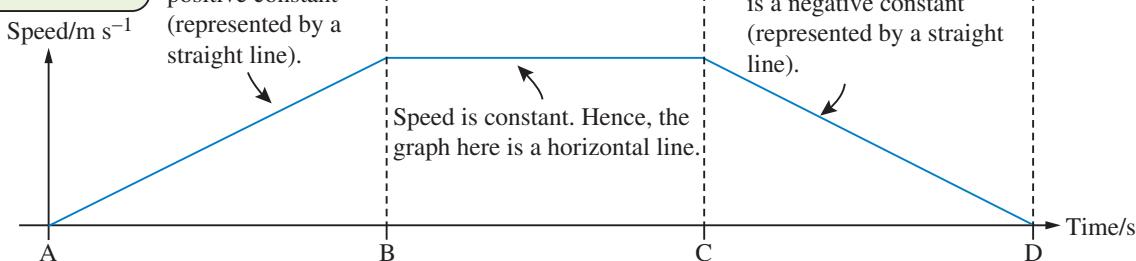


From A to B	From B to C	From C to D
Car accelerates uniformly from rest.	Car moves at constant speed.	Car decelerates uniformly to a stop.

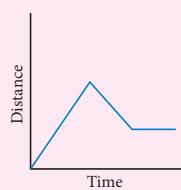
The y-axis indicates distance. Thus, this is a distance-time graph.



The y-axis indicates speed. Thus, this is a speed-time graph.

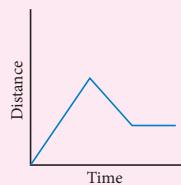


Graph and Story



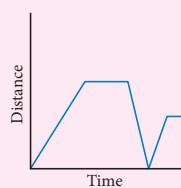
Raju began walking to his school. He remembered that he forgot his pen and walked back home, but he stopped suddenly when he heard a noise.

Draw a graph for the given story.



Rani was waiting for her mother for some time. When she saw her mother, she ran out of her home hugged her and stood there for a while.

Imagine and write a story on your own for the given graph?



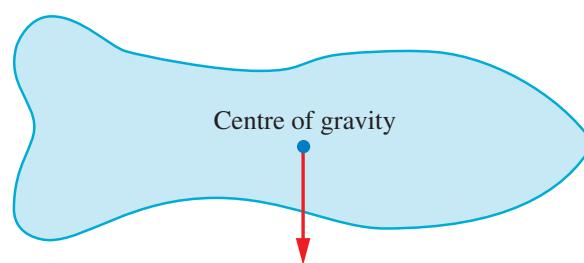
2.6 Centre of Gravity and Stability

Centre of gravity

Try to balance a cardboard on your figure tip.

What do we observe. We observe there is

only one point which the cardboard is balanced. The point which the cardboard is balanced is called the centre of gravity of the cardboard.



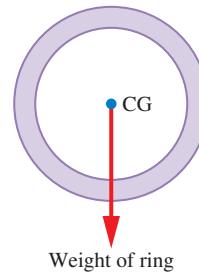
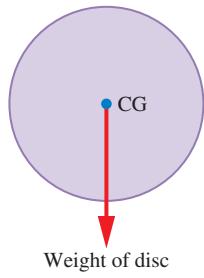
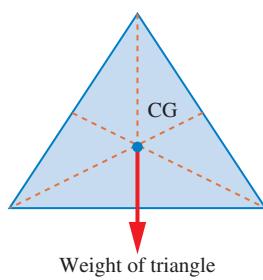
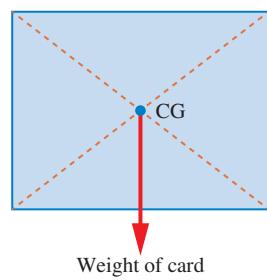
Total pull of the earth (weight) appears to act through the centre of gravity

Centre of gravity: The centre of gravity of an object is the point through which the entire weight of the object appears to act.

How to we find the centre of gravity of a object ?



Centre of gravity for Regular – shaped objects



Generally the centre of gravity of the geometrical shaped object lie on the geometric centre of the object.

Examples of centre of gravity for Regular-shaped objects. 1. Weight of Card, 2. Weight of Triangle, 3. Weight of Disc, 4. Weight of Ring.

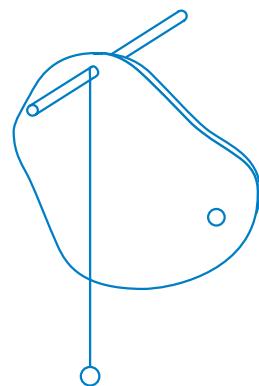
What about irregular shaped objects ?

Apparatus : Irregularly shaped card, string, pendulum bob, stand

1. Make three holes in the lamina.
2. Suspend the lamina from the optical pin through one of the holes as shown.
3. Suspend the plumbline from the pin and mark the position of the plumbline on the lamina.
4. Draw lines on the lamina representing the positions of the plumbline.
5. Repeat the above steps for the holes.
6. Label the intersection of the three lines as X, the position of the centre of gravity of the lamina.

Meter Rule

The ruler is in equilibrium when supported at its centre of gravity.



For a regular object such as a uniform meter rule , the centre of gravity is at the centre of the object. When the object is supported at that point, it will be balanced. If it is supported at any other point, it will topple.

2.7 Stability

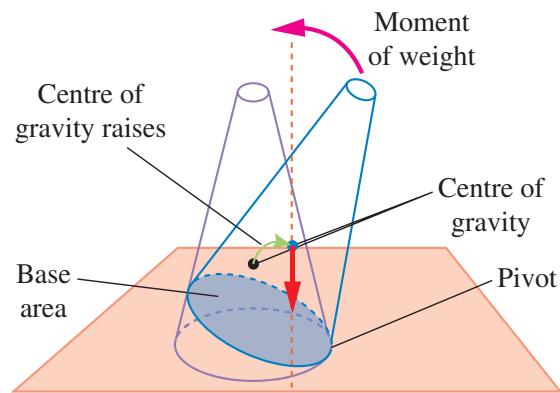
Stability is a measure of the body's ability to maintain its original position.

The three types of stability are

- (a) Stable equilibrium
- (b) Unstable equilibrium
- (c) Neutral equilibrium

Stable Equilibrium

The frustum can be tilted through quite a big angle without toppling.



Its centre of gravity is raised when it is displaced.

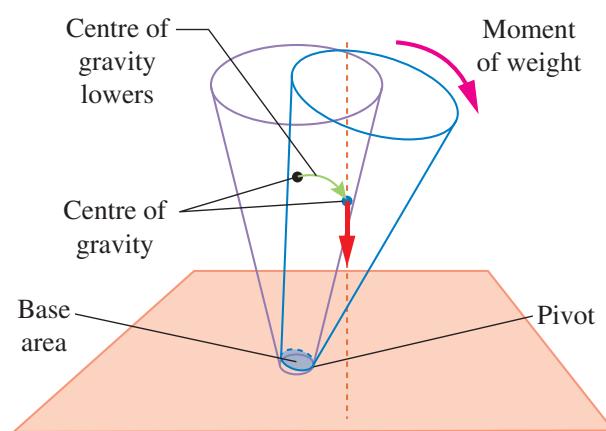
The vertical line through its centre of gravity still falls within its base.

So it can return to its orginal positionl.

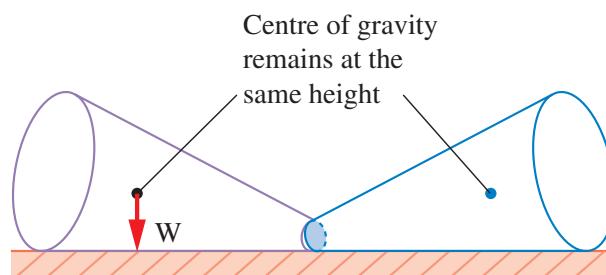


Unstable Equilibrium

The frustum will topple with the slightest tilting. Its centre of gravity is lowered when it is displaced.



The vertical line through its centre of gravity falls outside its base.



Neutral Equilibrium

- (d) It causes frustum to topple.
- (e) The frustum will roll about but does not topple.
- (f) Its centre of gravity remains at the same height when it is displaced.
- (g) The body will stay in any position to which it has been displaced.

Condition for Stability

To make a body more stable

- ❖ Lower its centre of gravity
- ❖ Increase the area of its base
- ❖ This box is at the point of tipping over
- ❖ A heavy base lowers the centre of gravity
So the box does not tip over
- ❖ A broad base makes the box more difficult to tip over

The Thanjavur Doll

It is a type of traditional Indian toy made of terracotta material. The centre of gravity and the total weight of the doll is concentrated at its bottom most point, generating a dance-like continuous movement with slow oscillations.



Real Life Applications of Centre of Gravity

It is for the reasons of stability that the luggage compartment of a tour bus is located at the bottom and not on the roof. Extra passengers are not allowed on the upper deck of a crowded double decker bus. Racing cars are built low and broad for stability. Table lamps and fans are designed with large heavy bases to make them stable.

2.8 Science Today

Typical Speeds

Tortoise	0.1 m/s
Person walking	1.4 m / s
Falling raindrop	9-10 m / s
Cat running	14 m/s
Cycling	20-25 km/h
Cheetah running	31 m/s
Bowling speed of fast bowlers	90-100 miles / h
Badminton smash	80-90 m/s
Passenger jet	180 m/s



Points to Remember

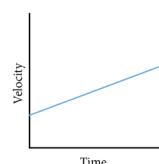
- ❖ **Distance** - The path taken by an object to reach one place from the other is called distance.
- ❖ **Displacement** – The straight line path between two points is called displacement
- ❖ **Velocity** is the rate of change in displacement. SI unit of velocity is meter / second (m/s).
- ❖ **Acceleration** is the rate of change in velocity. SI unit of acceleration is m/s²
- ❖ **Centre of gravity** : The centre of gravity of an object is the point through which the entire weight of the object appears to act.
- ❖ Generally the centre of gravity of the geometrical shaped object lie on the geometric centre of the object.
- ❖ **Stability** is a measure of the body's ability to maintain its original position.
- ❖ The three types of stability are : 1. Stable equilibrium 2. Unstable equilibrium 3. Neutral equilibrium.



Evaluation

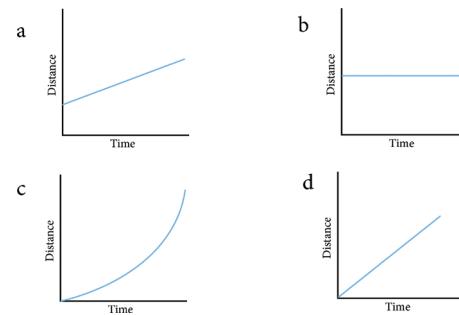
I. Choose the best answer.

1. A particle is moving in a circular path of radius r . The displacement after half a circle would be
a. Zero b. R
c. $2r$ d. $r/2$
2. From the given v-t graph it can be inferred that the object is



- a. in uniform motion
- b. at rest
- c. in non uniform motion
- d. moving with uniform acceleration

3. Which of the following figures represent uniform motion of a moving object correctly?



4. Suppose a boy is enjoying a ride on a marry go round which is moving with a constant speed of 10 m/s. It implies that the boy is
a. at rest
b. moving with no acceleration
c. in accelerated motion
d. moving with uniform velocity

5. What is one way you might increase the stability of an object?
a. lower the centre of gravity
b. raise the centre of gravity
c. increase the height of the object
d. shorten the base of the object

II. Fill in the blanks.

1. The shortest distance between the two places is _____.
2. The rate of change of velocity is _____.
3. If the velocity of an object increases with respect to time, then the object is said to be in _____ acceleration.
4. The slope of the speed-time graph gives _____.



5. In _____ equilibrium its centre of gravity remains at the same height when it is displaced.

III. Match the following:

Displacement	Knot
Light travels through vacuum	Geometric centre
Speed of ship	Metre
Centre of gravity of the geometrical shaped object	Larger base area
Stability	Uniform velocity

IV. Analogy

1. velocity : metre/ second :: acceleration : _____.
2. length of scale : metre :: speed of aeroplane : _____.
3. displacement / time : velocity :: speed / time : _____.

V. Give very short answer.

1. All objects having uniform speed need not have uniform velocity. Describe with the help of examples.
2. "She moves at a constant speed in a constant direction". Rephrase the same sentence in fewer words using concepts related to motion.
3. Correct your friend who says "The acceleration gives the idea of how fast the position changes".

IX. Fill in the boxes.

S.No.	First Move	Second Move	Distance (m)	Displacement
1.	Move 4 meters east	Move 2 meters west	6	2 m east
2.	Move 4 meters north	Move 2 meters south		
3.	Move 2 meters east	Move 4 meters west		
4.	Move 5 meters east	Move 5 meters west		
5.	Move 5 meters south	Move 2 meters north		
6.	Move 10 meters west	Move 3 meters east		

VI. Give short answer.

1. Show the shape of the distance – time graph for the motion in the following cases.
 - a. A bus moving with a constant speed.
 - b. A car parked on a road side.
2. Distinguish between speed and velocity.
3. What do you mean by constant acceleration?
4. What is centre of gravity ?

VII. Answer in detail.

1. Explain the types of stability with suitable examples.
2. Write about the experiment to find the centre of gravity of the irregularly shaped plate.

VIII. Numerical problems.

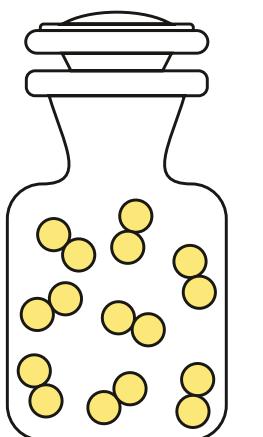
1. Geetha takes 15 minutes from her house to reach her school on a bicycle. If the bicycle has a speed of 2 m/s, calculate the distance between her house and the school.
2. A car started from rest and travelling with velocity of 20 m / s in 10 s. What is its acceleration?
3. A bus can accelerate with an acceleration $1 \text{ m} / \text{s}^2$. Find the minimum time for the bus to reach the speed of 100 km / s from 50 km / s.



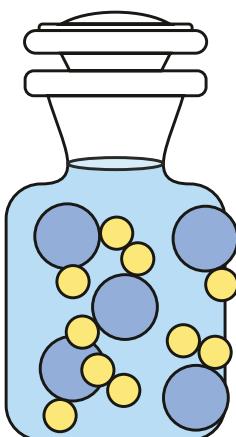
Unit 3

Matter Around Us

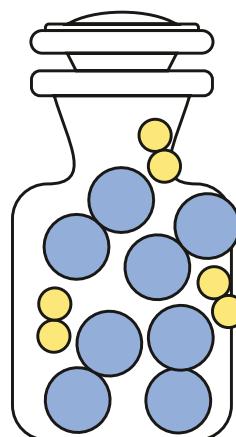
Elements, Compounds and Mixtures



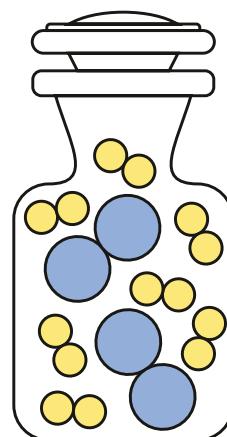
An Elements
(Hydrogen)



A Compound
(Water)



A Mixture
(Hydeogen & Oxygen)



A Mixture
(Hydeogen & Oxygen)

Learning Objectives

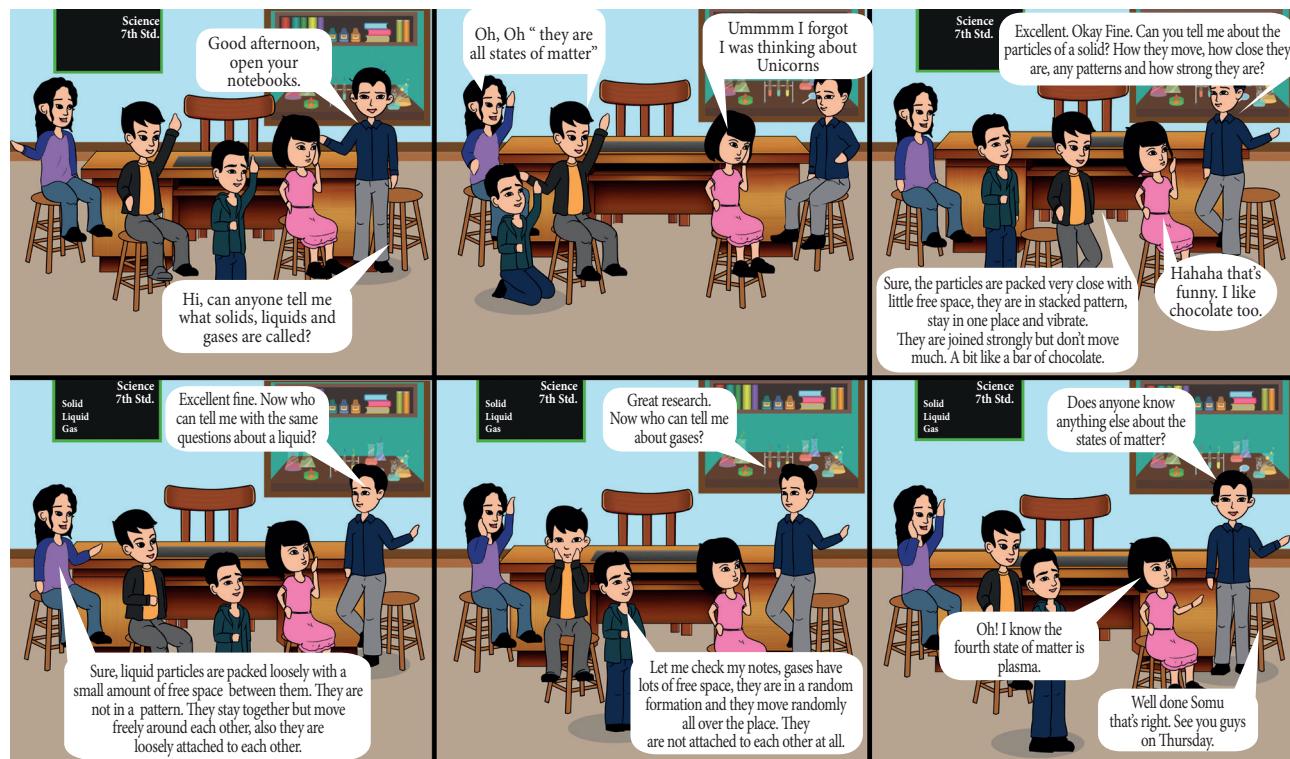
- ❖ To understand molecules of elements and compounds
- ❖ To recognize the symbols of common elements
- ❖ Able to calculate atomicity of commonly used elements
- ❖ To recognize the occurrences of elements and compounds in nature and human body / air
- ❖ To understand the effects of temperature on solid, liquid and gas



BUB 3D 7



Recap



We knew that everything we see around, that occupy space and have mass, is called matter. Heat, light and sound occupies space, but does not have mass. Hence these are not matter. Do you know what is matter is composed of? We studied earlier that matter is composed of tiny little particles, which cannot be seen with naked eye. Let us understand what these particles are?

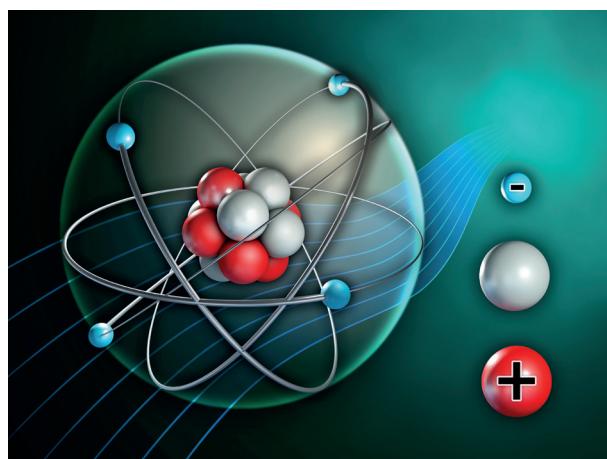
3.1 Atoms

The graphite refill used in pencil is made up of element called Carbon. We can break the graphite into smaller and smaller pieces. In fact, if we have an even finer knife, we can break it even smaller. If keep cutting the minuscule graphite into smaller and smaller particle, we will reach a point where we reach smallest constituent of graphite- carbon atom. If we break that carbon atom apart, then it will no longer exhibit the properties of carbon.

The smallest unit of an element that exhibits the properties of the element is called as 'atom'. All the matter is composed of tiny particles

called atom. Water , rice , in short everything we see around is made up of atoms.

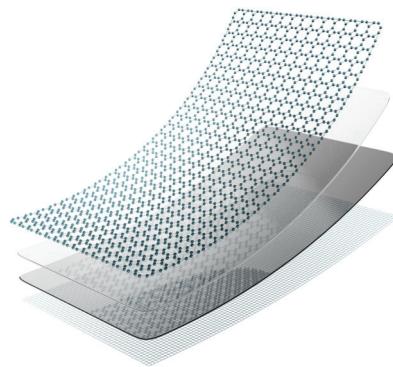
An atom is the basic unit of a matter.



Structure of an atom

Even with the best of optical microscope we cannot see atoms. However there are advanced instruments that help us to image the atoms on the surface of a material.

For example the following figure shows an image of the surface of silicon.



An image of the surface of Silicon

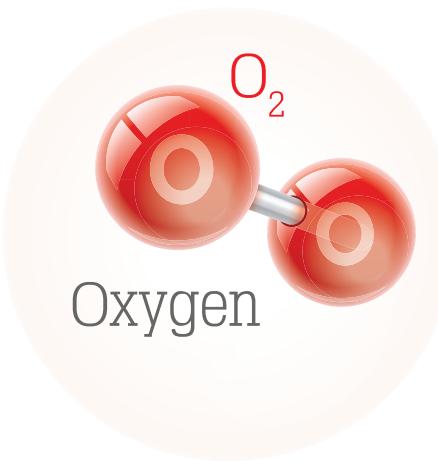


The most abundant type of atom in the universe is the hydrogen atom. Nearly 74% of the atoms in the universe are hydrogen atoms. However on Earth the three most abundant atom are iron, oxygen, and silicon.

3.2 Molecules

When an atom combines with another atom (or atoms) and forms a compound it is called as molecule. A *molecule is made up of two or more atoms chemically combined*.

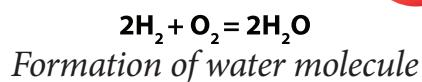
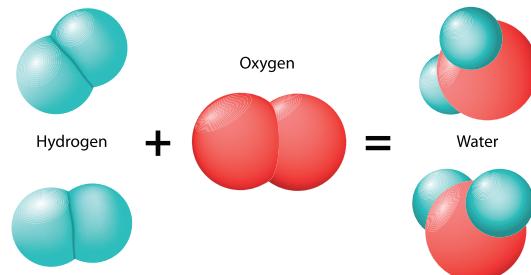
- Oxygen gas in the air that we breathe is made up of two oxygen atoms chemically combined.



- Ozone is a substance that is made up of three oxygen atoms chemically combined.



An atom of oxygen (O) and two atoms of hydrogen (H_2) combine to form a molecule of water (H_2O).



Molecules also exhibit properties of matter and have individual existence. A molecule can be formed by the same or different kinds of atoms.

Molecules can be classified as follow :

- A molecule which contains only one atom is called monatomic molecule (inert gases)
- A molecule which contains two atoms is called diatomic molecule (oxygen, nitric oxide, hydrogen, etc.)
- A molecule containing three atoms is called a triatomic molecule (ozone, sulphur dioxide, carbon dioxide, etc.)
- A molecule containing more than 3 atoms are known as polyatomic molecule (phosphate, sulphur, etc.)

Molecules of Elements

A molecule of an element consists of a fixed number of one types of atom chemically combined.



The table below shows gases that are made up of two atoms of the same type of element.

Molecules of Compounds

Molecule of a compound consists of a fixed number of different types of atoms chemically combined.

Molecule	Chlorine Gas	Oxygen Gas	Nitrogen Gas
Molecule Diagram			
Molecule Model (Ball-and-Stick)	 Chlorine Molecule	 Oxygen Molecule	 Nitrogen Molecule

For example, let us look at the model of a water molecule below:



Model of molecular water

Each molecule of water consists of one oxygen atom and two hydrogen atoms. This ratio of oxygen and hydrogen atom remains fixed whether water is in liquid, solid or gaseous state. This principle applies to the molecules of all compounds.

DO YOU KNOW?

Bismuth in diarrhea medicine

Bismuth is an element that occurs naturally. It is combined with other elements to make medicine for treating diarrhea.

Molecules of some compounds

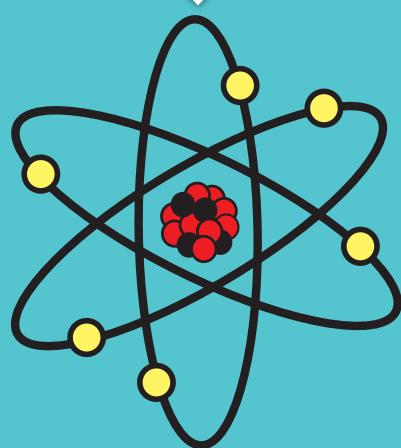
Molecule	Carbon-di-oxide	Ammonia	Hydrogen Chloride
Molecule Diagram			
Molecule Model (Ball-and-Stick)	 Carbon-di-Oxide Molecule	 Ammonia Molecule	 Hydrogen Chloride



Configuration of Matter

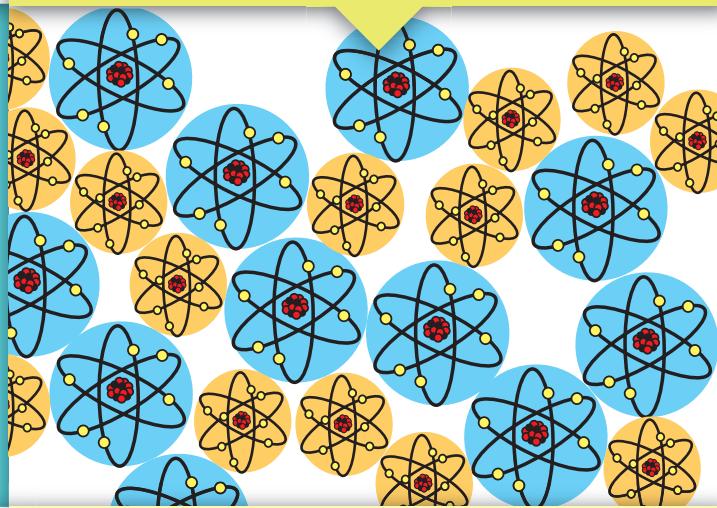
ATOM

Smallest particle of an Element



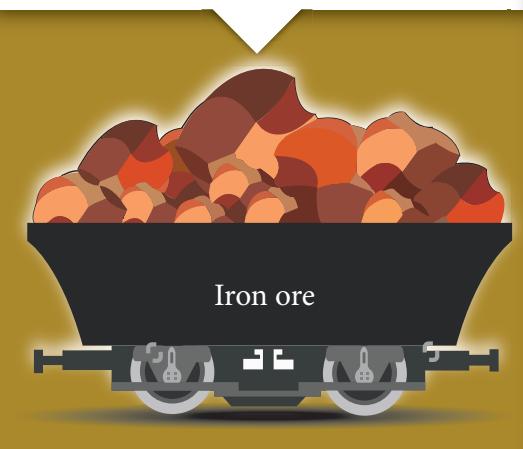
MOLECULE

Molecules are made up of atoms



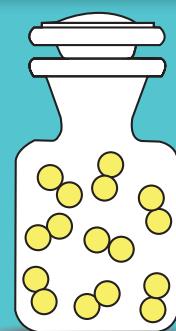
ELEMENT

Chemically simplest substance cannot be broken down

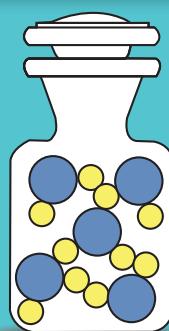


COMPOUND

Two or more elements are chemically bonded together



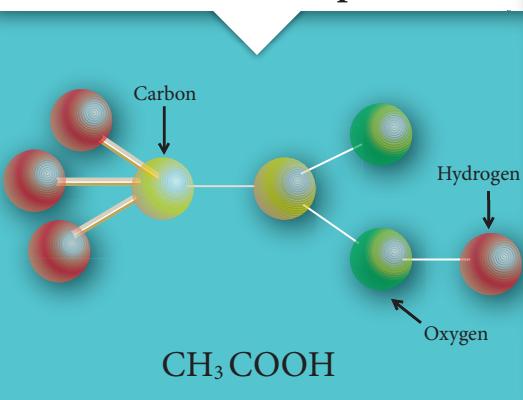
An Element (Hydrogen)



A Compound (Water)

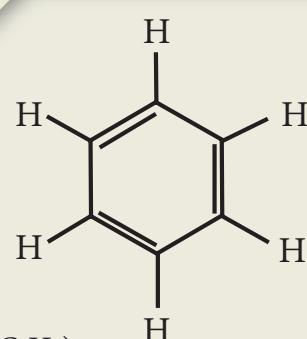
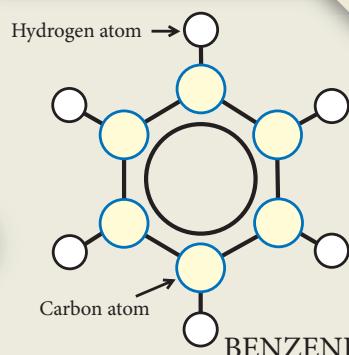
CHEMICAL FORMULA

Tells the number of atoms of element in a compound



CHEMICAL SYMBOL

Short representing of chemical element





Classification of Matter

Matter is classified into two broad categories, namely, pure substances and mixtures. Pure substances are further divided into categories as elements and compounds.



3.3 Elements

Matter in its simplest form is called an element. We are using many elements in our daily life. The common salt is consisting of elements of Sodium and Chlorine. Water consists of Hydrogen and Oxygen. Magnesium and Phosphorus used for making crackers. Sulphur is used as manure in agriculture. Gallium is used for making mobile phones and silicon is used for making computer chips.

There are 118 known elements till date. 94 of these elements occur naturally while 24 elements have been created artificially in the laboratory.

Classification of Elements

We can classify the elements broadly into

metals, non-metals and metalloids based upon their chemical properties.



The Robert Boyle is the first scientist used the term element. An early proponent of the elemental nature of matter and the nature of vacuum. He was known best for Boyle's Law.



Metals

We have tools, utensils and jewelry made from silver, copper, iron, gold, Aluminum. Using pressure like hammering or rolling we can deform these materials into various shapes. Such elements that are malleable (a material may be flattened into thin sheets or various shapes) is called as metals.

Metals are generally hard and shiny elements. Sodium is one of the exceptions as it is soft. All metals, except mercury are solids at



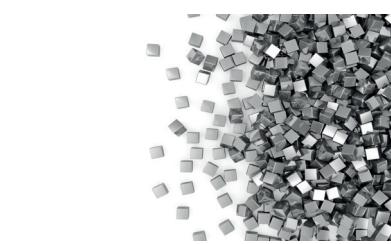
Copper



Lead



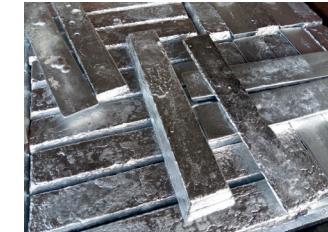
Iron



Nickel



Steel



Zinc



room temperature. Mercury is the only metal that is liquid at room temperature. Metals are malleable, can be bent or beaten into sheets. They can be drawn into wires. They are good conductors of heat and electricity. Copper, Lead, tin, nickel, iron, zinc, gold, magnesium and calcium are examples of metals.

Non-Metals

Non-metals are generally dull and soft. However, diamond is shiny and also the

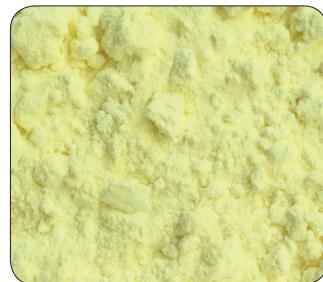
hardest natural substance on earth. Non-metals can be gases, solids, liquids. Non-metals such as oxygen, hydrogen and chlorine are gases at room temperature. Non-metals such as carbon, iodine, sulphur and phosphorus are solids at room temperature. Bromine is the only non-metal that is liquid at room temperature. Non-metals are poor conductors of heat and electricity. However, graphite (a form of the non-metal carbon) is a good conductor of electricity.



Carbon



Phosphorus



Sulfur

The difference between metals and non-metals

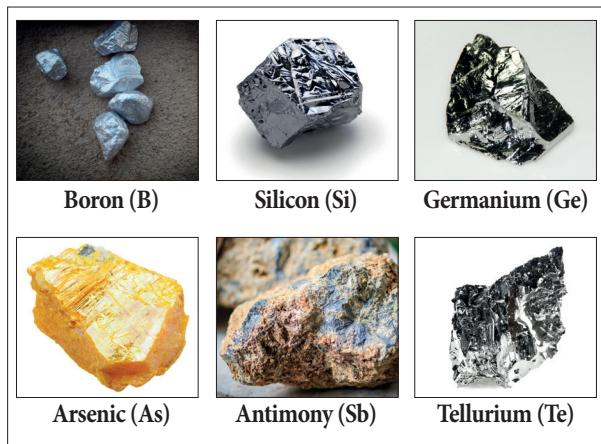
Metals	Non-Metals
Metals are lustrous. They have a shiny surface	Non metals are non lustrous. They have non-shiny surface
Metals are generally hard	Non-metals are generally soft
Most metals are bendable	Non-metals are non bendable
Most metals can be bent, beaten into sheets and they can be drawn into wires	Non-metals are non ductile
Most metals are good conductors of electricity	Non-metals are bad conductors of electricity
Most metals are good conductors of heat	Non-metals are bad conductors of heat
Most metals make ringing sound when struck. Hence, they are used to make objects like bells	Non-metals do not make any sound when they are struck

Metalloids

Metalloids exhibit the properties of both metals and non-metals. Silicon, arsenic, antimony, and boron are some examples of metalloids.

3.4 Compounds

A compound is a pure substance that is formed when the atoms of two or more elements combine chemically in definite proportions.





Compounds exhibit properties entirely different from the properties of their constituent elements. For example, the atoms of the elements hydrogen and oxygen combine chemically in a fixed ratio to form the compound water. However, water does not have the exact same properties as hydrogen and oxygen. For example, at room temperature water exist as

liquid while hydrogen and oxygen exist as gases. Also, oxygen supports fire whereas water is used as a fire extinguisher.

Similarly, common salt (sodium chloride) is a compound made up of elements sodium and chlorine. It is used in our food, whereas sodium and chlorine are poison, are both unsafe for consumption.



Sodium is a highly reactive solid at room temperature . It burns vigorously when in contact with water



Chlorine is yellowish green poisonous gas at room



Sodium Chloride
(Used for cooking)

Elements in the compound:

Table Salt



Sodium and Chlorine

Sugar



Carbon, Hydrogen and Oxygen

Chalk



Calcium, Carbon and Oxygen

ACTIVITY 1

Complete the following table by writing compounds of its constituents

Compound	Constituent Elements
Water	
Salt (Sodium chloride)	
Sodium carbonate	
Baking soda (sodium bicarbonate)	
Sugar	
Calcium oxide	
Calcium hydroxide	
Sodium hydroxide	
Potassium hydroxide	

Properties of Compounds

❖ A compound is formed only when the constituent elements combine in a fixed proportion.

- ❖ The properties of a compound are different from those of its constituent elements
- ❖ A compound cannot be broken down by physical methods. This is because a



compound is made up of different elements that are chemically combined. Sodium chloride cannot be separated by physical methods such as filtration.

- ❖ A compound can be separated into its constituent elements by chemical methods only.

Difference between an element and a compound

Elements	Compounds
An element is the simplest substance	A compound is a chemical substance formed by the combination of two or more elements
Elements combine to form compounds	Compounds can be split into elements
Atoms are the fundamental particle of an element	Molecules are the fundamental particles of a compound

ACTIVITY 2

Complete the following table by counting the number of different elements in a compound and give appropriate name.

Formula	No. of different elements	Name of Elements
H ₂ O		
NaCl		
C ₆ H ₁₂ O ₆		
NaOH		

Symbol of an element

A symbol is an abbreviation or short representation of a chemical element. There is a unique symbol for each element. It represents one atom of the element. The symbol is usually derived from the name of the element, which is either in English or Latin. These symbols are allocated by the International Union of Pure and Applied Chemistry (IUPAC).



Dalton was the first scientist to use the symbols for elements in a very specific sense. When he used a symbol for an element he also meant a definite quantity of that element, that is, one atom of that element. Berzelius suggested that the symbols of elements be made from one or two letters of the name of the element.

Symbols for some elements as proposed by Dalton

	Hydrogen		Carbon		Oxygen
	Phosphorus		Sulphur		Iron
	Copper		Lead		Silver
	Gold		Platinam		Mercury

The following rules are followed while assigning symbol to an elements:

- ❖ Chemical symbols usually consist of one or two letters
- ❖ The symbols of most elements correspond to the first letter (which is capitalized) of their English name. For example, the symbol for oxygen is "O" and that for hydrogen is "H".



Elements represented by single letter symbols

Element	Symbol	Element	Symbol
Hydrogen	H	Phosphorus	P
Fluorine	F	Sulphur	S
Oxygen	O	Potassium	K
Carbon	C	Uranium	U

When there is more than one element that begins with the same letter, their symbols take two letters. ***The first letter is capitalised while the second letter has a lower case.*** For example, the names of both hydrogen and helium begin with H. So, hydrogen is represented by the symbol H and Helium by He. Similarly, the symbol for carbon is C while the symbols for calcium, chlorine and chromium are Ca, Cl and Cr, respectively.

Elements represented by symbols of two letters

Element	Symbol	Element	Symbol
Aluminium	Al	Chromium	Cr
Argon	Ar	Cobalt	Co
Arsenic	As	Helium	He
Barium	Ba	Magnesium	Mg
Nickel	Ni	Calcium	Ca
Bromine	Br	Chlorine	Cl

The symbols for some elements are derived from their Latin names. For example, the symbol for gold is Au after its Latin name Aurum. Similarly, the symbols for copper is Cu after its Latin name Cuprum.

Element	Latin Name	Symbol
Copper	Cuprum	Cu
Lead	Plumbum	Pb
Potassium	Kalium	K
Iron	Ferrum	Fe
Mercury	Hydrargyrum	Hg
Sodium	Natrium	Na

ACTIVITY 3

Write down the symbols of the following elements

Elements	Symbol	Elements	Symbol
Gold		Aluminium	
Silver		Calcium	
Copper		Phosphorus	
Iron		Magnesium	
Nitrogen		Potassium	
Oxygen		Sodium	



DO YOU KNOW?

In the beginning, the names of elements were derived from the name of the place where they were found for the first time. For example, the name copper was taken from Cyprus. Some names were taken from specific colours. For example, gold was taken from the English word meaning yellow. Now-a-days, IUPAC approves names of elements. Many of the symbols are the first one or two letters of the element's name in English. The first letter of a symbol is always written as a capital letter (uppercase) and the second letter as a small letter (lowercase).

Chemical Formulae

Often we hear that water is H_2O . This is the chemical formula for water molecule. This means that each molecule of water has two hydrogen atoms combined with one oxygen atom. A chemical formula is a symbolic representation of one molecule of an element or a compound. It provides information about the elements present in the molecule and the number of atoms of each element. Can you guess the types of atoms and number of each of the atoms in $NaCl$, which is the chemical formula for cooking salt?

The chemical formula tells us the types of atoms and the number of each type of atom in one molecule of substance

Water
 H_2O

The small number beside the H symbol is called subscript. It tells us the number of atoms that element present in the molecule.

Hence, there are 2 hydrogen atoms in water molecule.

When there is no number besides O symbol, it means that there is only one atom of that element present in the molecule.

Hence, there is 1 oxygen atom in a water molecule.

Here are some examples of chemical formula

Sodium Chloride

$NaCl$

1 atom of Sodium and 1 atom of chlorine

Ammonia

NH_3

1 atom of Nitrogen and 3 atoms of Hydrogen

Glucose

$C_6H_{12}O_6$

6 carbon atoms, 12 Hydrogen atoms 6 oxygen atoms

Common compounds and their chemical formula

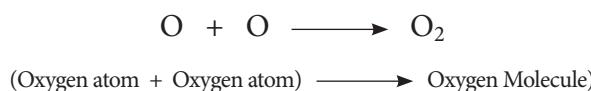
Examples of Compounds	
Examples of Formulas for compounds	Examples of names of common compounds
H_2O	Water
$C_6H_{12}O_6$	Glucose
$NaCl$	Salt (Sodium Chloride)
C_2H_6O	Ethanol
NH_3	Ammonia
H_2SO_4	Sulphuric Acid
CH_4	Methane
$C_{12}H_{22}O_{11}$	Sucrose



Atomicity

In chemistry we usually understand atomicity to imply the total number of atoms present in one molecule of an element, compound or a substance.

Let us see how to calculate the atomicity of elements. For example, Oxygen exists as a diatomic molecule which means that a molecule of oxygen contains two atoms hence its atomicity is 2.



Similarly a phosphorus (P_4) molecule contains 4 atoms; a sulphur (S_8) molecule contains 8 sulphur atoms. Hence their atomicity is 4 and 8 respectively.

For molecule containing more than one types of atoms, simply count the number of each atom and that would be its atomicity. For example, a molecule of sulphuric acid (H_2SO_4) consists of 2 hydrogen atom, 1 sulphur atom and 4 oxygen atoms. Hence its atomicity is $2+1+4=7$.

One molecule of water (H_2O) contains two atoms of hydrogen and one atom of oxygen, the atomicity of water is three.

Atomicity of some elements

Element	Atomicity	Elements	Atomicity
H	2	F	2
He	1	Ne	1
Li	1	Na	1
N	2	P	4
O	2	S	8

Elements in human Body

Nearly 99% of the mass of our human body consists of just 6 chemical elements: oxygen, carbon, hydrogen, nitrogen, calcium, and

phosphorus. Another 5 elements make up most of the least percentage point: potassium, sulphur, sodium, chlorine, and magnesium.

ACTIVITY 4

Write down atomicity of the following elements and compounds

Elements	Atomicity
Cl	
Na	
K	
Ca	
Compounds	
H_2O	
NaCl	

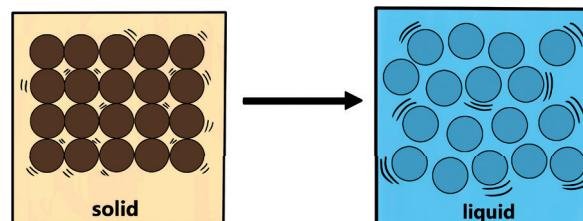
Elements in air

Air is a mixture of gases. The molecules of two different elements, nitrogen and oxygen, make up about 99% of the air. The rest includes small amounts of argon and carbon dioxide. (Other gases such as neon, helium, and methane are present in trace amounts.) Oxygen is the life-giving element in the air.

Effect of temperature on Solid, Liquid and Gas

What happens to matter during heating?

The following are models of particles in solids during heating. These models can be modified to represent heating in Solids, Liquids and Gas.



When solid is heated, the particles gain energy and vibrate vigorously. The particles move slightly further apart from one another.



This causes the volume of matter to increase. This process is called expansion. How it happens? The matter begins to expand when heated. The volume increases due to the greater distance between the particles. But the size of the particles remains the same size.

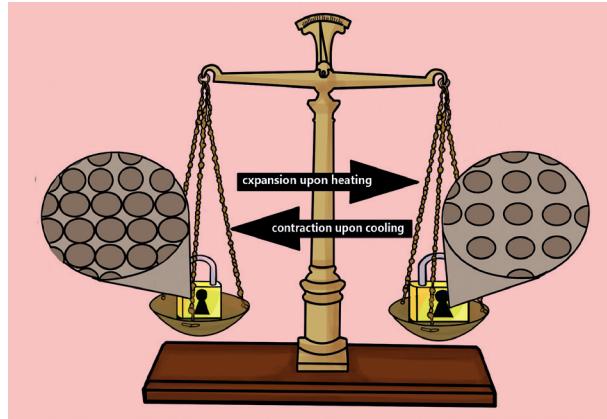
DO YOU KNOW?

How do hot-air balloons float? When air inside the hot air balloon is heated with a burner, it expands. The expansion causes the density of the air inside the balloon to decrease. Hence, the air inside the balloon has a lower density than the air outside of the balloon. This difference in density allows the hot-air balloon to float.



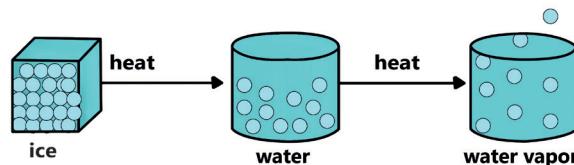
During heating or expansion, the mass of matter does not change. This is explained in the following way. During heating, the distance between the particles of the iron locks changes. Mass is conserved when matter expands.

Although the volume of the matter changes, the size and number of the particles of matter do not change. Hence, during heating, the mass of a matter is conserved. For example, in an iron lock the distance between the iron particles increases when they gain enough heat. However, the number of iron particles does not change. Hence the mass of the iron lock is conserved.



The melting of ice is an example of a change in the states of matter. The change in the states of matter occurs during melting, boiling and freezing and condensation.

When the particles possess enough energy, they overcome the strong forces of attraction between one another. The particles break free from one another and move randomly. For example, when solid ice is heated to 0°C , it melts to become liquid water. In the same way, liquid water is heated to 100°C , it boils to become steam.



1. Solid

When solid is heated, the particles gain energy and vibrate more vigorously

2. Liquid

Melting occurs when the melting point is reached. The solid changes to its liquid state.

When a liquid is heated the particles gain energy and vibrate more vigorously

3. Gas

Boiling occurs when the boiling point is reached. The liquid changes to its gaseous state.



Points to remember

- ❖ An atoms is the smallest particle of an element
- ❖ Elements are the simplest forms of pure substances
- ❖ Molecules of an element consist of a fixed number of one type of atom
- ❖ Molecules of a compound consist of a fixed number of different types of atom
- ❖ The molecules of the different element nitrogen and oxygen make up 99 percent of the air
- ❖ The particulate nature of matter can be used to explain heating effect of Solid, Liquid and Gas
- ❖ The mass of the matter remains same during expansion
- ❖ A molecule is made up of two or more atoms chemically combined
- ❖ We can represent a molecule using the chemical formula.



Evaluation

I. Choose the appropriate answer.

1. Which of the following is an example of a metal?
a. Iron
b. Oxygen
c. Helium
d. Water
2. Oxygen, hydrogen, and sulphur are examples of which of the following?
a. Metals b. Non-metals
c. Metalloids d. Inert gases
3. Which of the following is a short and scientific way of representing one molecule of an element or compound?



- a. Mathematical formula
 - b. Chemical formula
 - c. Mathematical symbol
 - d. Chemical symbol
4. The metals which is a liquid at room temperature
a. Chlorine
b. Sulphur
c. Mercury
d. Silver
 5. An element which is always lustrous, malleable and ductile
a. non-metal b. metal
c. metalloid d. gas

II. Fill in the blanks.

1. The smallest particle of matter that can exist by itself _____.
2. A compound containing one atom of carbon and two atoms of oxygen is _____.
3. _____ is the only non-metal conducts electricity.
4. Elements are made up of _____ kinds of atoms.
5. _____ of some elements are derived from Latin or Greek names of the elements.
6. There are _____ number of known elements.
7. Elements are the _____ form of pure substances .
8. The first letter of an element always written in _____ letter
9. Molecule containing more than three atoms are known as_____.
10. _____ is the most abundant gas in the atmosphere.

III. Fill in the Blanks.

1. Mercury: liquid at room temperature:
Oxygen: _____.



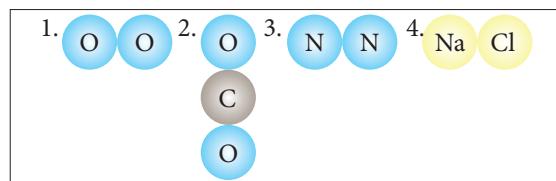
2. Non metal conducting electricity:
_____:: Metal conducting electricity: Copper
3. Elements: combine to form compounds::Compounds:_____.
4. Atoms: fundamental particle of an element::
_____ : fundamental particles of a compound.

IV. True or False. If False, give the correct statement.

1. Two different elements may have similar atoms.
2. Compounds and elements are pure substance.
3. Atoms cannot exist alone; they can only exist as groups called molecules.
4. NaCl represents one molecule of sodium chloride.
5. Argon is mono atomic gas.

V. Answer in brief.

1. Write the chemical formula and name the elements present in the following compounds:
 - a. Sodium chloride
 - b. Potassium hydroxide
 - c. Carbon-di-oxide
 - d. Calcium oxide
 - e. Sulphur dioxide
2. Classify the following molecules as the molecules of element or compound



3. What do you understand by chemical formula of a compound? What is its significance?
4. Define the following terms with an example of each:
 - a. Element
 - b. Compound

- c. Metal
 - d. Non-metal
 - e. Metalloid
5. Write the symbols for the following elements and classify them as solid, liquid and gas
Aluminum, carbon, chlorine, mercury, hydrogen and helium
 6. Classify the following as metals, non-metals and metalloids
Sodium, Bismuth, Silver, Nitrogen, Silicon, carbon, chlorine, Iron, copper
 7. Classify the following as elements and compounds
Water, common salt, sugar, carbon dioxide, iodine and lithium
 8. Write the chemical formula for the following elements
 - a. Hydrogen
 - b. Nitrogen
 - c. Ozone
 - d. Sulphur
 9. What are elements? What are they made of?
Give two examples.
 10. Define molecule.
 11. What are compounds? Give two examples.
 12. Give an example for the elements derived from their Latin names.
 13. What is atomicity of elements?
 14. Calculate the atomicity of H_2SO_4 .

VI. Answer in detail.

1. Differentiate metals and non metals.
2. Explain the characteristics of compounds
3. Describe the different ways in which we can write the symbols of elements. Give appropriate examples.
4. Differentiate between elements and compounds.
5. Write any five characteristics of compound.



6. List comparative properties of metals and non-metals. Give three examples of each.
7. Write down the properties of metalloids.

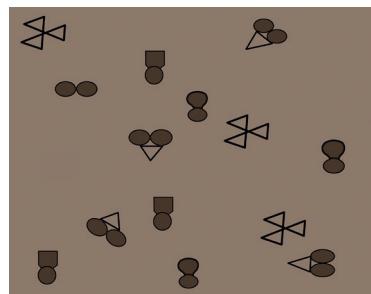
VII. Rewrite the sentence in correct form

1. Elements contains two or more kinds of atoms and compounds contains only one kinds of atoms.

VIII. Higher Order Thinking questions

1. Lists the metals, non-metals and metalloids which you used in your house, schools. Compare their properties.
2. Aakash noticed that the metal latch on gate was difficult to open during hot sunny days. However, this same latch was not difficult to open at night. Aakash observed that the latch and the gate are exposed to the sun during the day.
 - a. Formulate a hypothesis based on the information provided.
 - b. Briefly state how you would test the hypothesis stated in (a).

3. What changes take place in the movement and arrangement of particles during heating process?
4. In the diagram below, the circle, square and triangle represent the atoms of different elements.



5. In the diagram above, identify all combinations that represent
 - a. A molecule of a compound
 - b. A molecule of an element consisting of two atoms
 - c. A molecule of an element consisting of three atoms

IX. Assertion-reason questions

Directions: Please refer to the following instructions:

1 st Statement	2 nd Statement
Oxygen is a compound	Oxygen cannot be broken down into anything simpler
Hydrogen is an element	Hydrogen cannot be broken down into anything simpler
Air is a compound	Air consists of carbon dioxide
Air is a mixture of elements only	Only nitrogen, oxygen and neon gases exist in air
Mercury is solid in room temperature	Mercury is a non-metal

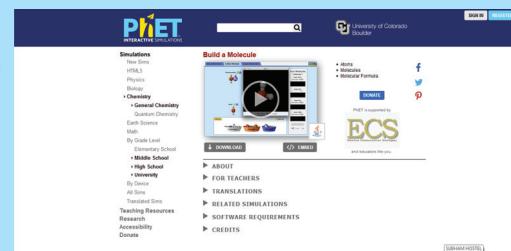
- A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
- B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
- C. The 1st statement is false while the 2nd statement is true.
- D. Both statements are false.



ICT CORNER

Matter around us

Let's build the molecules.



PROCEDURE :

- Step 1:** Use the URL to reach stimulation page. Click ‘Download’ and launch the stimulation.
- Step 2:** Drag the atoms from the kit which is at the bottom of the display to ‘make molecule’. Click on “3D” to see the molecule in 3 dimension. And drag that molecule to ‘Your molecule collection’ on the left side window.
- Step 3:** Click on the ‘collect multiple’ tab on the top of the window for more molecules.
- Step 4:** Click on the ‘Larger molecules’ tab to make larger molecules.



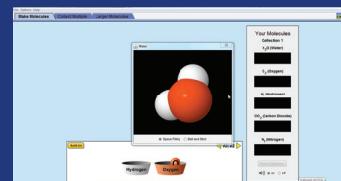
Step 1



Step 2



Step 3



Step 4

Matter around us URL:

<https://phet.colorado.edu/en/simulation/build-a-molecule>

*Pictures are indicative only

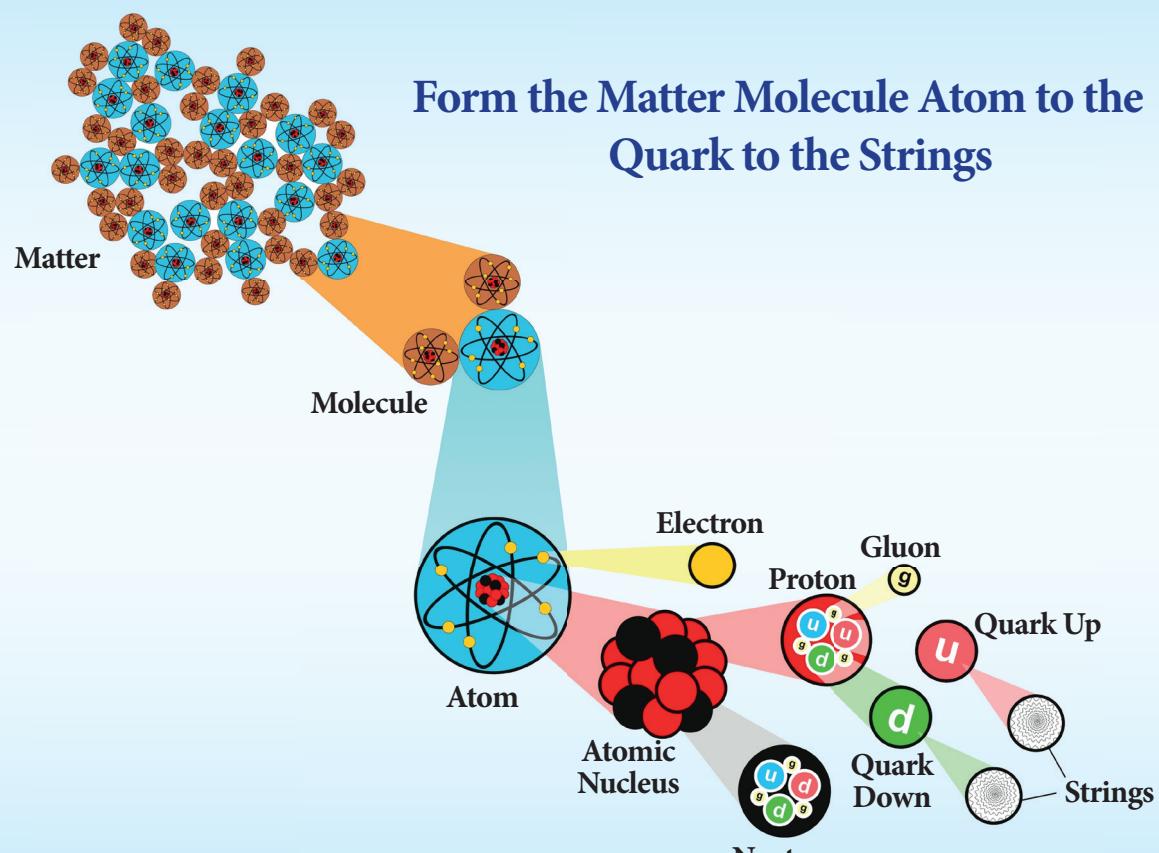
*If browser requires, allow Flash Player or Java Script to load the page.





Unit 4

Atomic Structure



Learning Objectives

- ❖ To know the structure of an atom.
- ❖ To know the position of the subatomic particle, understand and compare the properties of subatomic particles.
- ❖ To understand the term atomic number and mass number.
- ❖ To calculate the number of protons, electrons and neutrons in an atom from the symbols in the periodic table.
- ❖ To understand the term valency





Introduction

In the last chapter we have studied anything around us is matter and is made up of molecules. The molecules are combination of atoms of different elements or the same element.

ACTIVITY 1

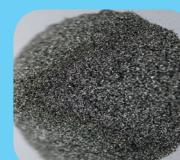
Some known objects are shown, also the broken particles of the objects are shown.

1. Name the articles or objects you see here? Also try to write What each of it made of?

1. -----



2. -----



3. -----

4. -----



Hey friends! I am atom. I am the smallest particle.



Table, chair, bag, book, chalk and blackboard, in short everything you see around are made up of atoms. I cannot be seen through a microscope. Molecule can be cut or divided into atoms that makes it up.



Hey friends! I am molecule.
I am made up of two or more atoms.

Do you guys know how small I am? When compared with the things you see daily you all will get a better idea.





4.1 How small is an atom?

An atom is one thousand times smaller than the thinnest human hair. It has an average diameter of 0.000000001m or $1\times10^{-9}\text{ m}$. To understand atom's size with the familiar things we know, now let us find what is the size of pencil, red blood cell, virus and dust particle.

$1\times10^{-2}\text{ m}$ $1\times10^{-4}\text{ m}$ $1\times10^{-6}\text{ m}$
 $1\times10^{-7}\text{ m}$ $1\times10^{-10}\text{ m}$

Now you could imagine how small an atom would be.

4.2 Evolution of idea of an atom

Many scientists have studied the structure of the atom and advanced their theories about it. The theories proposed by Dalton, Thomson and Rutherford are given below.

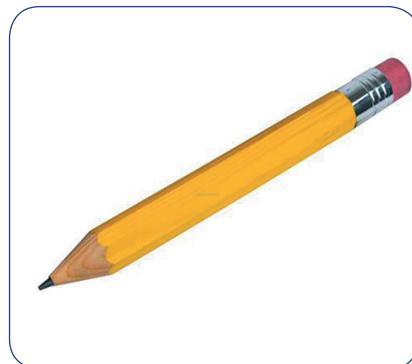
Dalton's atomic theory

John Dalton proposed the atomic theory in the year 1808. He proposed that matter

consists of very small particles which he named atoms. An atom is smallest indivisible particle, it is spherical in shape. His theory does not propose anything about the positive and negative charges of an atom.

Hence, it was not able to explain many of the properties of substances.

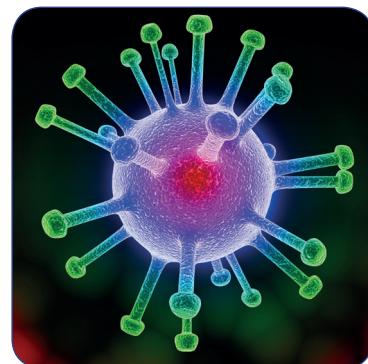
DO YOU KNOW?
Nanometer is the smallest unit used to measure small lengths. One metre is equal to $1\times10^{-9}\text{ nm}$ or one nanometer is equal to $1\times10^{-9}\text{ m}$



Pencil $1\times10^{-2}\text{ m}$



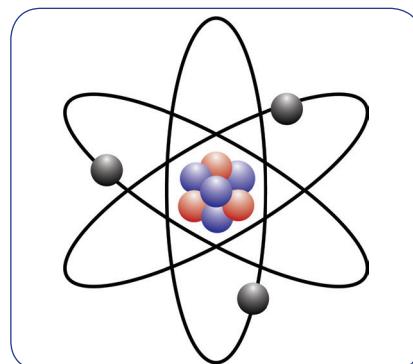
Red Blood Cell $1\times10^{-4}\text{ m}$



Virus $1\times10^{-6}\text{ m}$



Dust Particle $1\times10^{-7}\text{ m}$



Atom $1\times10^{-10}\text{ m}$



Thomson's theory



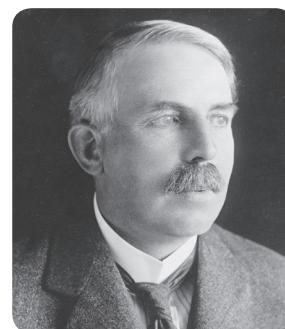
J.J. Thomson

In 1897 J.J. Thomson proposed a different theory. He compared an atom to a watermelon. His theory proposed that the atom has positively charged part like the red part of the watermelon and in it are embedded, like the seeds, negatively charged particles which he called electrons. According to this theory as the positive and negative charges are equal, the atom as a whole does not have any resultant charge.

Thomson's greatest contribution was to prove by experimentation the existence of the negatively charged particles or electrons in an atom. For this discovery, he was awarded the Nobel Prize in 1906. Although this theory explained why an atom is neutral, it was an incomplete theory in other ways.

Rutherford's theory

There were short coming in Thomson's theory, Ernest Rutherford gave a better understanding. Ernest Rutherford conducted an experiment. He bombarded a very thin layer of gold with positively charged alpha rays. He found that most of these rays which travel at a great velocity passed through the gold sheet without encountering any obstacles. A few are, however, turned back from the sheet.

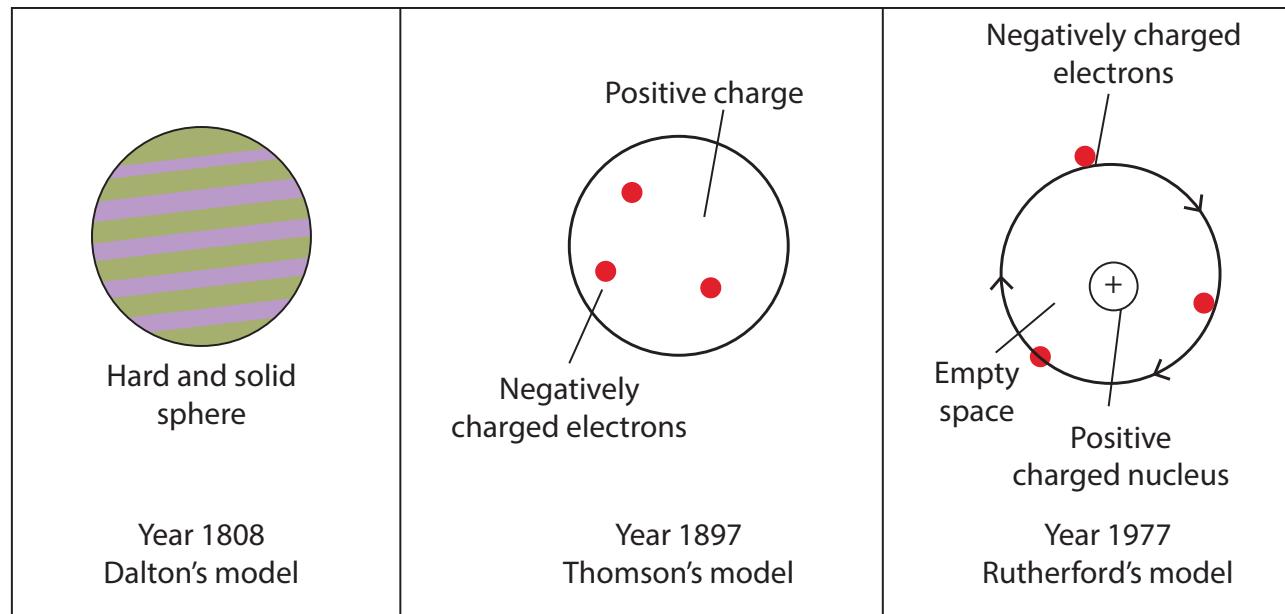


Rutherford

Rutherford considered this remarkable and miraculous as if a bullet had turned back after colliding with tissue paper.

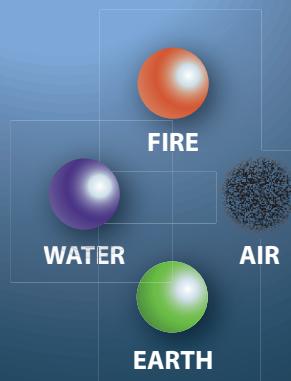
Based on this experiment, Rutherford proposed his famous theory. In his opinion, – 1. The fact that most alpha particles pass through the gold sheet means that the atom consists mainly of empty space. 2. The part from which the positively charged particles are turned back is positively charged but very small in size as compared to the empty space.

Stages of discovery of the constituents of an atom

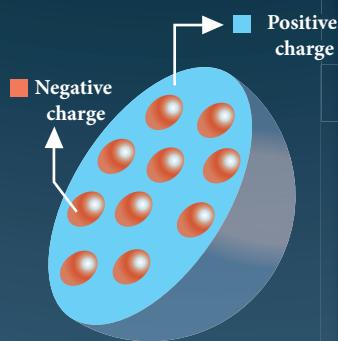




Evolution of the atomic structure from the 5 elements



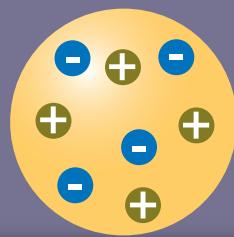
Hindu philosophers discuss atoms as ultimate pieces of the elements earth, air, fire and water. Atoms are round and differ in properties such as color, flavor and odor.



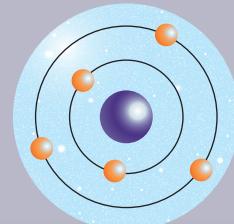
J.J. Thomson proposes the "plum pudding" model of the atom, picturing negatively charged electrons rotating in concentric rings within a sphere of positive electricity



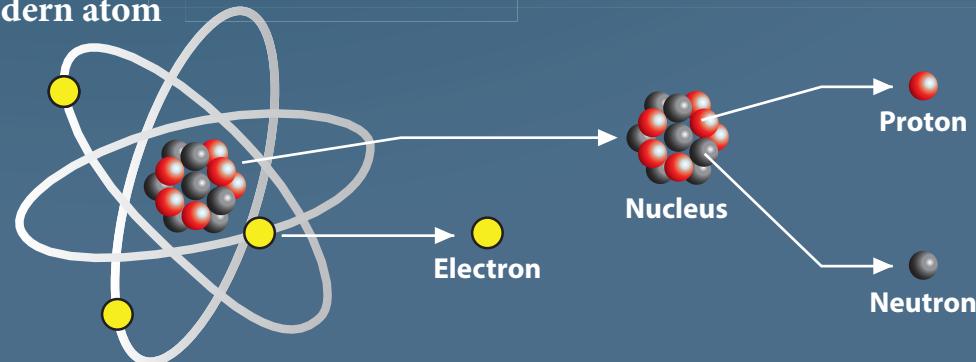
1904
J.J. THOMSON THEORY



1913
BOHR THEORY
(the energy levels)

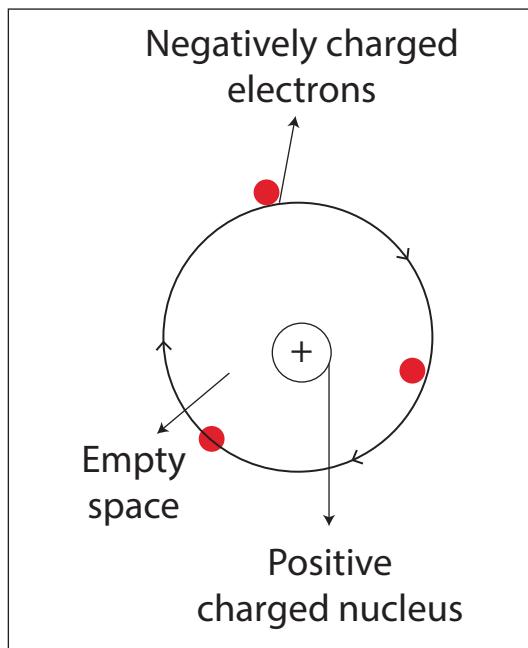


Modern atom





From these inferences, Rutherford presented his theory of the structure of atoms. For this theory, he was awarded the Nobel prize for chemistry.



Rutherford's theory proposes that

1. The nucleus at the centre of the atom has the positive charge. Most of the mass of the atom is concentrated in the nucleus.
2. The negatively charged electrons revolve around the nucleus in specific orbits.
3. In comparison with the size of the atom, the nucleus is very very small



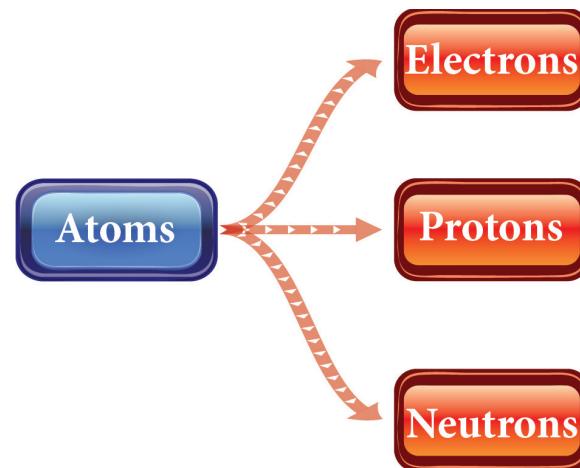
You have around 7 billion atoms in your body, yet you replace about 98% of them every year!

4.3 The subatomic particles

The discoveries made during the twentieth century proved that atoms of all elements are made up of smaller components - electron, proton and neutron. An electron from hydrogen atom is no different from electron of a carbon atom. In the same manner, protons



and neutrons of all elements also have same characteristics. These particles that make up the atom are called Subatomic Particles.



Proton (p)

The proton is the positively charged particle and its located in the nucleus. Its positive charge is of the same magnitude as that of the electron's negative charge.

Neutron (n)

Neutron is inside the nucleus. The neutron does not have any charge. Excepting hydrogen (protium), the nuclei of all atoms contain neutrons.

Electron (e)

This is a negatively charged particle. Electrons revolve around the nucleus of the atom in specific orbits. The mass of an electron is negligible as compared to that of a proton or neutron. Hence, the mass of an atom depends on the number of protons and neutrons in the nucleus.

Protons and Neutrons are the two types of particles in the nucleus of an atom. They are called nucleons. The total negative charge of all electrons outside the nucleus is equal to the total positive charge in the nucleus. That makes the atom electrically neutral.

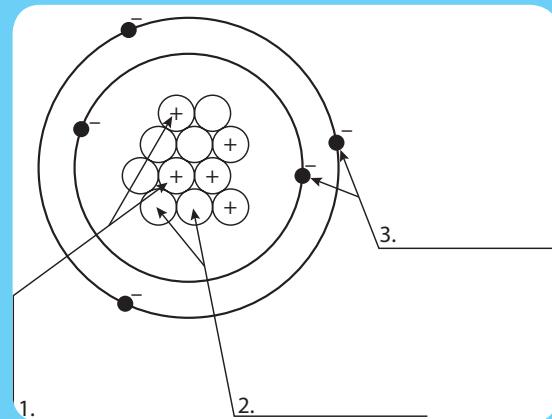


Charge and mass of the sub atomic particles:

Particle	Discoverer	Symbol	Charge	Mass (kg)
Proton	Ernest Rutherford	p	+1	1.6726×10^{-27}
Electron	Sir John Joseph Thomson	e	-1	9.1093×10^{-31}
Neutron	James Chadwick	n	0	1.6749×10^{-27}

ACTIVITY 2

Let us learn the characteristics of the subatomic particles through the following activity. Label the parts in the given diagram and answer the following.

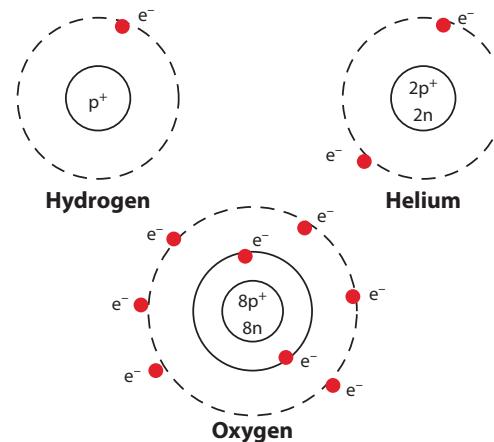


1. The positively charged particle is _____.
2. The negatively charged particle is _____.
3. _____ is neutral.

Is the structure of the atom the same as the structure of the solar system? Yes ! It is similar to the solar system. It has a core center called nucleus and it has paths called orbits around the nucleus.

Atomic number (z)

The number of electrons or protons in an atom is called the atomic number of that atom. It is represented by the letter Z. If we know the atomic number of an atom, we know the number of electrons or protons in it.



4.4 Atomic number and Mass number

If all elements are made up of same type of electrons, protons and neutrons how does a carbon atom differ from an iron atom? Further investigations led to the discovery that the number of the protons inside the nucleus of an atom determines what element it is. For example if the nucleus has only one proton, then all such atoms are hydrogen atom. If there are eight protons then that atom is oxygen.



Look at the figures. The hydrogen nucleus has one proton around which revolves one electron. It means that its atomic number $z=1$.

In the helium atom there are two protons and two electrons in orbit around the nucleus, so the atomic number of helium is $z=2$.

Look at the atomic structure of oxygen shown in the figure. What is its atomic number?



Try yourself

If the atomic number of carbon is $Z=6$, what is the number of the electrons revolving in its atom

Mass number (A) or Atomic mass :

We have seen that the mass of an atom is concentrated in its nucleus. From this, we can get the atomic mass number. mass number (A) is equal to the sum of the number of protons(p) and neutrons (n) in the nucleus.

Atomic mass or mass number = Number of Protons + Number of Neutrons

$$A = p+n$$

A lithium atom contains 3 Protons and 4 neutrons . Its atomic mass number $A = 3+4 = 7$.

In a sodium atom, there are 11 Protons and 12 neutrons. Hence , its atomic mass number $A = 11 + 12 = 23$.

Try yourself

1. Why are atomic numbers and mass numbers are always whole numbers ?
2. A sulphur atom contains 16 Protons and 16 neutrons . Give its atomic number and atomic mass number.

When writing the symbol of an element, its atomic number and atomic mass number

are also written. For example, the symbols of hydrogen, carbon and oxygen are written as ${}_1H^1$, ${}_6C^{12}$, ${}_8O^{16}$ respectively.

All the elements in the periodic table have the following combination of protons, electrons and neutrons:

Elements	Symbols	Number of proton, electron, neutron,
Carbon	${}_6C^{12}$	6p,6e,6n
Beryllium	${}_4Be^{12}$	4p,4e,5n
Nitrogen	${}_7Be^{14}$	7p,7e,7n
Boron	${}_5B^{11}$	5p,5e,6n

Isotopes:Atoms of the same element can have different number of neutrons. Such atoms will have same atomic number but different mass numbers. These atoms are called isotopes. For example Hydrogen has three isotopes --- Hydrogen (${}_1H^1$), Deuterium (${}_1H^2$), Tritium (${}_1H^3$).

Isobars: Atoms that have the same mass number but different atomic numbers. for example Calcium - 40 and Argon - 40

Elements and their symbols with their atomic number and mass number.

Element	symbol	Atomic number	Protons (p)	Neutrons(n)	Mass number(p+n)
Hydrogen	H	1	1	0	1
Helium	He	2	2	2	4
Aluminium	Al	13	13	14	27
Oxygen	O	8	8	8	16
Sodium	Na	11	11	12	23



ACTIVITY 3

H Hydrogen Atomic Number: 1 Atomic Mass: 1 Protons: 1 Neutrons: 0 Electrons: 1	He Helium Atomic Number: 2 Atomic Mass: 4 Protons: 2 Neutrons: 2 Electrons: 2	Li Lithium Atomic Number: 3 Atomic Mass: 7 Protons: 3 Neutrons: 4 Electrons: 3	Be Beryllium Atomic Number: 4 Atomic Mass: 9 Protons: 4 Neutrons: 5 Electrons: 4	B Boron Atomic Number: 5 Atomic Mass: 11 Protons: 5 Neutrons: 6 Electrons: 5
C Carbon Atomic Number: 6 Atomic Mass: 12 Protons: 6 Neutrons: 6 Electrons: 6	N Nitrogen Atomic Number: 7 Atomic Mass: 14 Protons: 7 Neutrons: 7 Electrons: 7	O Oxygen Atomic Number: 8 Atomic Mass: 16 Protons: 8 Neutrons: 8 Electrons: 8	F Fluorine Atomic Number: 9 Atomic Mass: 19 Protons: 9 Neutrons: 10 Electrons: 9	Ne Neon Atomic Number: 10 Atomic Mass: 20 Protons: 10 Neutrons: 10 Electrons: 10
Na Sodium Atomic Number: 11 Atomic Mass: 23 Protons: 11 Neutrons: 12 Electrons: 11	Mg Magnesium Atomic Number: 12 Atomic Mass: 24 Protons: 12 Neutrons: 12 Electrons: 12	Al Aluminium Atomic Number: 13 Atomic Mass: 27 Protons: 13 Neutrons: 14 Electrons: 13	Si Silicon Atomic Number: 14 Atomic Mass: 28 Protons: 14 Neutrons: 14 Electrons: 14	P Phosphorus Atomic Number: 15 Atomic Mass: 31 Protons: 15 Neutrons: 16 Electrons: 15
S Sulfur Atomic Number: 16 Atomic Mass: 32 Protons: 16 Neutrons: 16 Electrons: 16	Cl Chlorine Atomic Number: 17 Atomic Mass: 35 Protons: 17 Neutrons: 18 Electrons: 17	Ar Argon Atomic Number: 18 Atomic Mass: 39 Protons: 19 Neutrons: 20 Electrons: 19	K Potassium Atomic Number: 19 Atomic Mass: 39 Protons: 19 Neutrons: 20 Electrons: 19	Ca Calcium Atomic Mass: 20 Atomic Number: 40 Protons: 20 Neutrons: 20 Electrons: 20

Observe the table given above and answer the following questions.

- I am used for breathing, without me you cannot live. Do you know me? Write my name and symbol _____.
- It is used in filling the balloons. It is a gas, identify it. What is its mass number?
- _____.
- Name the element present in banana. What is my atomic number?
- _____.
- I am found in crackers. How many protons do I have?
- _____.
- I am the most valuable element. Find who am I? Can you say my mass number?
- _____.

4.5 Valency

Imagine there are various people having different pattern of hands. Some have no hands and some have one, some two and others three. Few have

four and no one has more than four. The person with four hands can hold hands of four others at a same time, while the one with no hands can never hold any hand. In this manner some atoms can



hold one electron, some can hold two, some can hold three, some can hold four and some cannot hold any electron. This property is called valency.



WHAT MAKES ATOMS STICK TOGETHER?

Electrons carry a negative electric charge, and protons carry a positive charge. The attraction between them holds electrons in orbits.

This combining property of an atom is called as Valency. It is a measure of how many hydrogen atoms it can combine with. For example: oxygen can combine with two hydrogen atoms and create water molecule, the valency of oxygen atom is two. In case of chlorine, it can combine with only one hydrogen to create HCl (hydrochloric acid) here the valency of chlorine is one. Methane has one carbon atom combining with four hydrogen atoms to form carbon molecule is methane (CH_4). Can you guess the valency of Carbon in methane? In ammonia molecule, Nitrogen combines with three hydrogen atoms. What is the valency of Nitrogen in ammonia?

Valency is defined as the combining capacity of an element. Atoms of different elements combine with each other to form molecules. Valency determines the number of atoms of an element that combines with atom or atoms of another type.

The element having valency one is called monovalent. For example: Hydrogen and Sodium. The elements having valency two are called divalent. For example: Oxygen and Beryllium. The elements having valency three are called trivalent. For example: Nitrogen and Aluminium. Some elements exhibits more than one valency. For example: Iron combines with oxygen to form two types ferrous oxide (exhibits valency 2) and ferric oxide (exhibits valency 3), however we will study about them later.

When atoms of different elements combine with each other then molecules of compounds are formed. In these instances, it is necessary to know the valencies of those elements. For example:



Valency 1 + 1

Here, the valancies of both sodium and chlorine are 1.

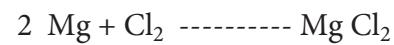
Remember The valency of element Na is 1

The valency of element Cl is 1

Then, the molecular formula will be

Symbol of Elements Na Cl Molecular Formula

Radicals and ions 1 1
NaCl



Valency 2 1

Here , the valency of magnesium is 2 and that of Cl is 1.

Elements and their symbols with their atomic number and mass number and valency.

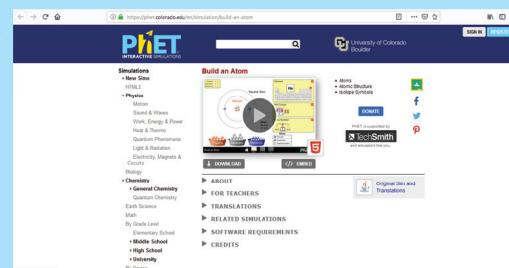
Element	Symbol	Atomic Number	Mass Number	Valency
Hydrogen	H	1	1	1
Carbon	C	6	12	4
Oxygen	O	8	16	2
Sodium	Na	11	23	1
Calcium	Ca	20	40	2



ICT CORNER

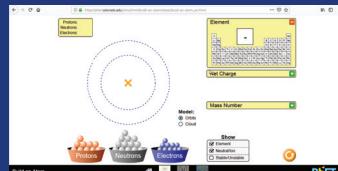
Atomic Structure

Let's build an atom.

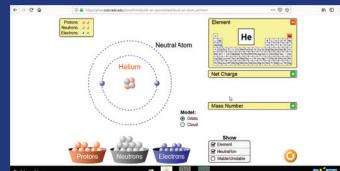


PROCEDURE :

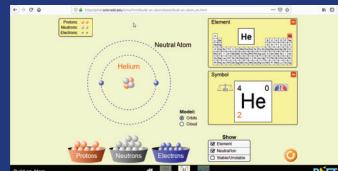
- Step 1:** Use the URL to reach stimulation page. Click play button to launch the simulation.
- Step 2:** Click on the "ATOM", a new window will be open. Drag the particles (Protons, Neutrons and Electrons) from the baskets which is at the bottom of the display.
- Step 3:** You can observe the changes in 'Elements, Net charge and Mass number' at the right side windows.
- Step 4:** Click on the 'Symbol' at the bottom. Drag the particles and get the Symbol of the element.
- Step 5:** Click on the "GAME" and play the games.



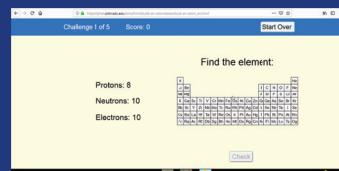
Step 1



Step 2



Step 3



Step 4

Atomic Structure URL:

<https://phet.colorado.edu/en/simulation/build-an-atom>

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.





Points to remember

- ❖ An atom is the smallest particle of a chemical element that retains its chemical properties.
- ❖ They are very tiny compared to other particles.
- ❖ Atoms are too small to be seen by the naked eye or even through microscope.
- ❖ An atom consists mostly of empty space.
- ❖ Atoms of same element are identical, and different elements differ.
- ❖ An atom consists of a dense nucleus of positively-charged protons and electrically-neutral neutrons.
- ❖ The protons and neutrons are called nucleons.
- ❖ The protons, neutrons and electrons are denoted by p,n,e respectively.
- ❖ An atom is electrically neutral. Atoms contain equal number of protons and electrons.
- ❖ Atomic number is the number of protons in an atom.
- ❖ The total number of protons and neutrons present in the nucleus of an atom is the mass number.
- ❖ Valency is defined as the combining capacity of an element.



Evaluation

I. Choose the appropriate answer.

1. The basic unit of matter is _____
a. Element
b. Atom
c. Molecule
d. Electron
2. The subatomic particle revolve around the nucleus is _____
a. Atom
b. Neutron
c. Electron
d. Proton



3. _____ is positively charged.
a. Proton
b. Electron
c. Molecule
d. Neutron
4. The atomic number of an atom is _____
a. Number of neutrons
b. Number of protons
c. Total number of protons and neutrons
d. Number of atoms
5. _____ Nucleons comprises of
a. Protons and electrons
b. Neutrons and electrons
c. Protons and neutrons
d. Neutrons and Positron

II. Fill in the blanks.

1. The smaller particles found in the atom is called _____.
2. The nucleus has _____ and _____.
3. The _____ revolve around the nucleus.
4. If the valency of carbon is 4 and that of hydrogen is 1 , then the molecular formula of methane is _____ .
5. There are two electrons in the outermost orbit of the magnesium atom. Hence, the valency of magnesium is _____ .

III. Match the following:

1. Valency	Fe
2. Neutral Particle	Proton
3. Iron	Electrons in the outermost Orbit
4. Hydrogen	Neutron
5. Positively charged Particle	Monovalent



IV. True or False. If False, give the correct statement (T/F).

1. The basic unit of an element is molecule.
2. The electrons are positively charged.
3. An atom is electrically neutral.
4. The nucleus is surrounded by protons.

V. Complete the analogy.

1. Sun: Nucleus, planets: _____.
2. Atomic number: _____, Mass number: number of protons and neutrons.
3. K: Potassium, C: _____.

VI. Assertion and reason.

1. **Assertion:** An atom is electrically neutral.
Reason: Atoms have equal number of protons and electrons.
2. **Assertion:** The mass of an atom is the mass of nucleus.
Reason: The nucleus is at the centre.
3. **Assertion:** The number of protons and neutrons is atomic number.
Reason: The mass number is sum of protons and neutrons.

VII. Give very short answer.

1. Define an atom.
2. Name the sub-atomic particles.
3. What is atomic number?
4. What is the characteristics of proton?
5. Why neutrons called neutral particles?

VIII. Give short answer.

1. Distinguish Isotopes from Isobar.
2. What are the isotones give one example.
3. Differentiate mass number from atomic number.

4. The atomic number of an element is 9, it has 10 neutrons. Find the element from the periodic table. What will be its mass number?

IX. Answer in detail.

1. Draw the atom structure and explain the position of the sub-atomic particles.
2. The atomic number and the mass number of an element is 26 and 56 respectively. Calculate the number of electrons protons and neutrons in its atom. Draw the structure.
3. What are nucleons. Why are they so called? Write the properties of the nucleons.
4. Define valency? What is the valency of the element with atomic number 8. What is the compound by the element with hydrogen.

X. Questions based on Higher Order Thinking Skills.

1. An atom of an element has no electron, will that atom have any mass or not? Can atom exist without electron? If so then give example.
2. Find what is common salt? Name the elements present in it? Write the formula of common salt. What are the atomic number and the mass number of the elements? Write the ions in the compound.

XI. Project.

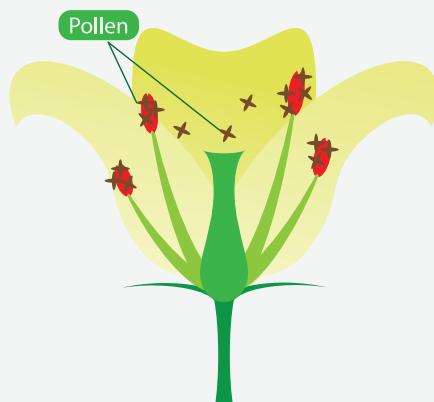
To have an idea of what atoms are, students will construct atoms using pipe cleaners (thin metal wires-electron shells), pom-poms (balls) (different colors for protons and neutrons) and beads (electrons). Students will love and enjoy putting them together and they look great hanging from the ceiling in the classroom.



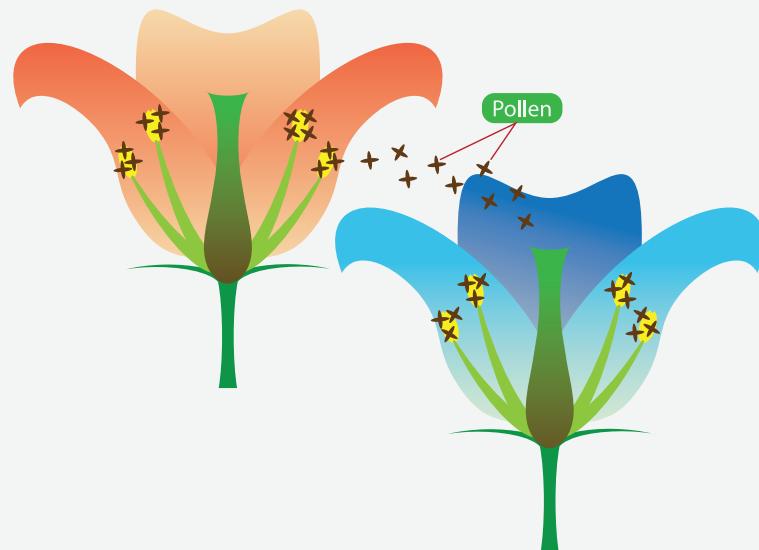
Unit 5

Reproduction and Modification in Plants

Pollination in Plant



Self Pollination



Cross Pollination

Learning Objectives

- ❖ To get a clear idea, how a flower become a fruit with seed through pollination and fertilization.
- ❖ To acquire knowledge about the pollination and pollinators
- ❖ To differentiate self pollination and cross pollination in plants.
- ❖ To know the modification of root, stem and leaves.
- ❖ To understand how these modifications are useful to animal and Human Being





Introduction

Already we know that flowering plants have root, stem and leaves. They are called vegetative organs. Flowers, fruits and seeds in a plant are called reproductive organs. In earlier classes we have seen new plants can be grown from seeds. In this lesson, we are going to know about how a flower changes itself into a fruit and the modifications of root, stem and leaves of a plant.

ACTIVITY 1

Aim:

To raise a new generation of plant from watermelon and potato.

Materials required:

Two pots with soil, potato, watermelon seeds and water.

Procedure:

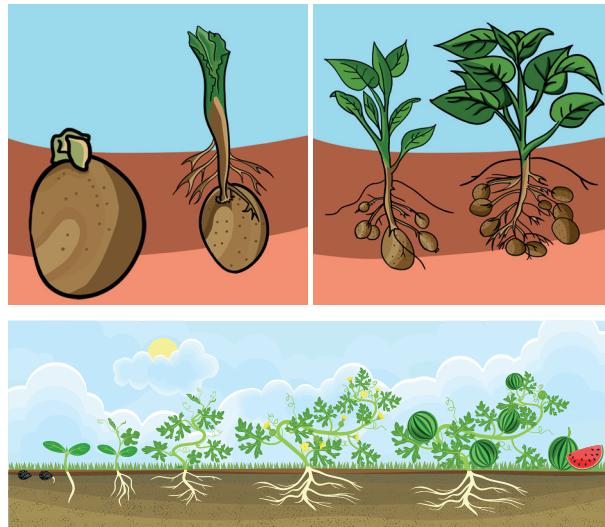
Fill both pots with soil mixed with compost or manure. Take young potato. Ensure that it is not dried up and the skin still looks fresh. Bury a potato in one part. Sow watermelon seeds in another pot. Pour water regularly and maintain the plant.

Observation:

After few days, we can see single plant arising from a buried potato. Plants arise from the pot sowed with watermelon seeds. Each seed produces a plant

Inference:

Watermelon plants were produced from seeds. Potato plant is not from seed, but from the stem tuber (vegetative part). Seed is not only the source for new generation, even vegetative part of a plant can also be used to produce a new plant.



Find out how these plants reproduce:

Sl. No.	Name of the plant	Reproductive Part			
		Seed	Stem	Cutting	Layering
1.	Mango				
2.	Potato				
3.	Banana				
4.	Tamarind				
5.	Rose				
6.	Mustard				
7.	Coriander				
8.	Moringa				
9.	Pumpkin				
10.	Radish				

5.1 Reproduction

The process by which plants and animals produce young ones and increase their number is known as 'reproduction'. Drumstick tree can be grown from both seeds and stem cuttings. When plants reproduced from seeds we call that process as **sexual reproduction**. All other ways of reproduction without seed are called as **asexual reproduction**.

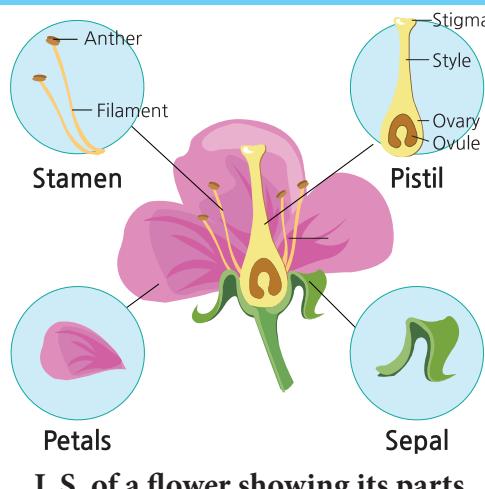


5.2 Sexual reproduction

Seed is produced from a flower by the process of pollination and fertilization. This is known as sexual reproduction. To understand how seeds are formed in a flower, first we need to understand parts of a flower.

ACTIVITY 2

Take a flower. Dissect as shown longitudinally and find parts inside the flower. Can you identify the male reproductive part, androecium (stamen, filament and pollen sac). Carefully observe the female reproductive part, gynoecium (ovary, style and stigma). If they are not seen clearly, gently pluck off the sepals and petals. Make a drawing of the parts and arrangement in your notebook.



5.1.1 Parts of flower

Collect few buds and opened flowers of **Hibiscus** and **Datura**. With the help of your teacher, perform the following steps.

- Observe and compare bud and opened flower of **Hibiscus** and **Datura**.
- Tabulate the characteristics

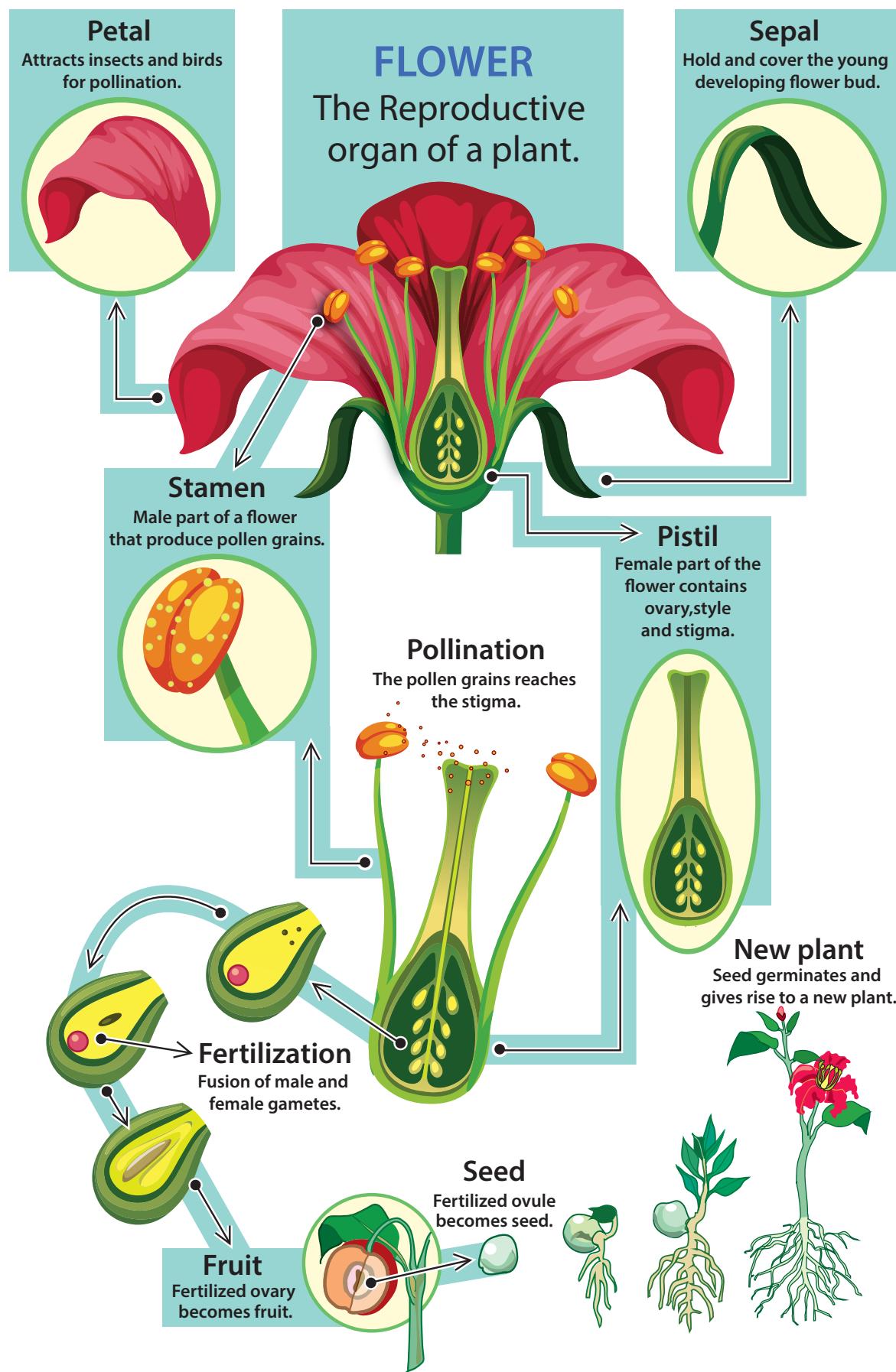
Hibiscus flower	
Bud	Opened flower
Green colour	Brightly colour
Sepals	Petals
Dissected Hibiscus flower	
Bud	Opened flower
Curled petals	Expanded petals
Small tube with yellow lobes-Anthers	Expanded tube with yellow lobes-Anthers

Datura flower	
Bud	Opened flower
Green colour	White colour
Sepals	Petals
Dissected Datura flower	
Bud	Opened flower
Curled petals	Expanded petals
Small yellow lobes-Anthers	Expanded yellow lobes-Anthers

In a bud, we can see a green colour, leaf like structure which cover the whole bud or flower. Each of these green like structure present as an outermost layer is called as **sepal**. This outer most ring of sepals is known as **calyx**.

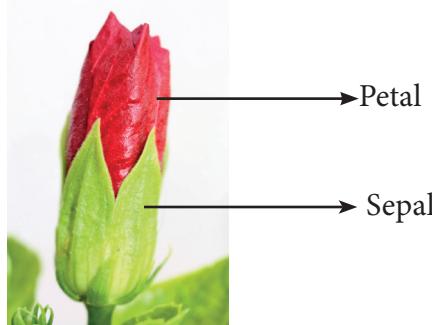


Sexual Reproduction in Plants





Petals are the largest part of flowers. They are often attractive, brightly coloured, sometimes sweet scented and attract the insects. This ring of **petals** together is called **corolla**.



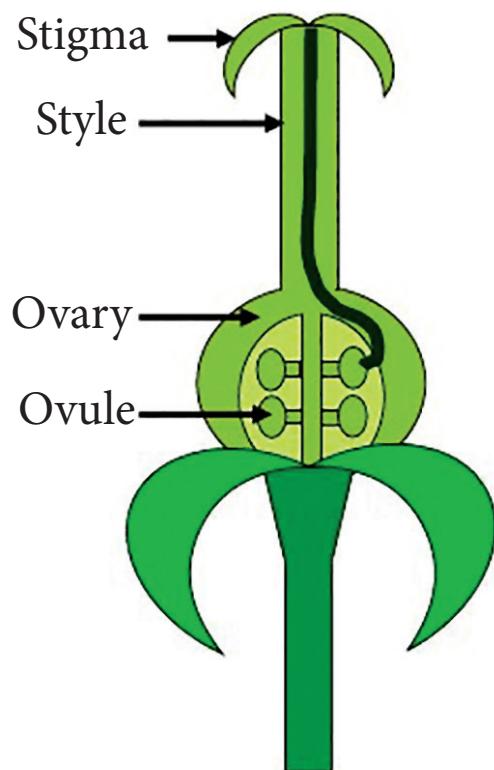
Inner to this corolla, in **Hibiscus**, we can observe a long tube on which many stamens are arranged. But in **Datura**, we can see only five stalked structures, stamens. This ring or whorl of a flower is called **androecium**. Each stamens consists of two parts – a stalk called filament and a lobe called anther. If you touch these lobes in a mature flower, we can get a powdery substance called pollen grains, male reproductive part.



Androecium -Male part of the flower

Inner to this androecium whorl, we can find a female reproductive part of the flower, called Gynoecium. You will find this part with a swollen bottom part. This is the ovary. Seeds are produced in this part. On top of the ovary there is a slender tube like structure called style. The top most sticky tip of the style is stigma. Pollen grains are received

by the stigma. This is the fourth whorl of a flower.

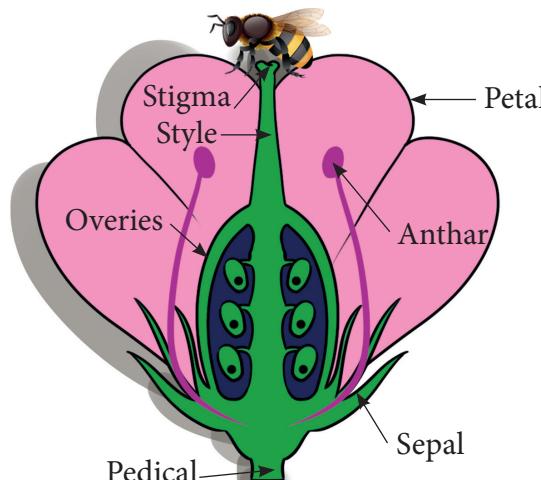


Gynoecium – Female reproductive part

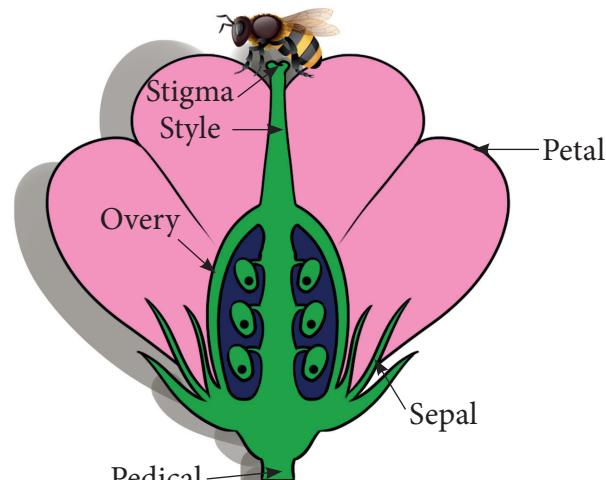
5.2.2 Types of flowers

Now we shall learn some important terms to understand flowers and their role in reproduction.

- ❖ If all the four whorls- calyx, corolla, stamens and pistil are present, then it is called as complete flower.
- ❖ Complete flowers are bisexual flowers.
- ❖ If any of these four whorls is missing, then it is called as an incomplete flower.
- ❖ Incomplete flowers are unisexual flowers. There are two types of unisexual flowers, male flower and female flower
- ❖ The one with androecium and without gynoecium is called as **male flowers** and the one with gynoecium and without androecium is known as **female flowers**.
- ❖ These are called **unisexual flowers**.



Bisexual Flower



Unisexual Flower

ACTIVITY 3

Using the information from the above complete the following table:

Sl. No.	Name of the flower	Complete / incomplete	Unisexual / bisexual	If unisexual male or female
1.	Hibiscus			
2.	Pumpkin			
3.	Rose			
4.	Coconut			
5.	Jasmine			



The sunflower is not a single flower. It is a group of flowers clustered together. A group of flowers arranged together is called inflorescence. *Tridax procumbens*, looks like a single flower, but is an inflorescence. Leaf juice of this plant is used to cure wounds and cuts.

5.2.3 Flower to fruit

To understand how a flower develops into fruit, let us perform an experiment on pumpkin plant. We know from our earlier explorations that flowers of pumpkin are unisexual- that is some of the flowers are male while many are female flowers.

ACTIVITY 4

Make a flower album

Press the collected flowers between pages of newspaper or book. Place two thick sheets and keep a heavy object, such as brick, on the top to apply pressure. Turn the sides every two to three days. Allow flowers to dry completely. Collect the dried flowers and paste them in an album. Now, your flower album ready.

We can easily identify the male and female flower buds of pumpkin, even before they bloom. Once flower buds appear, immediately identify ten female flower buds. Tie a plastic bag around each bud so that no outside material can enter.



Ensure to make small holes with a pin to allow air flow. Wait for two to three days to bloom.



Female



Male

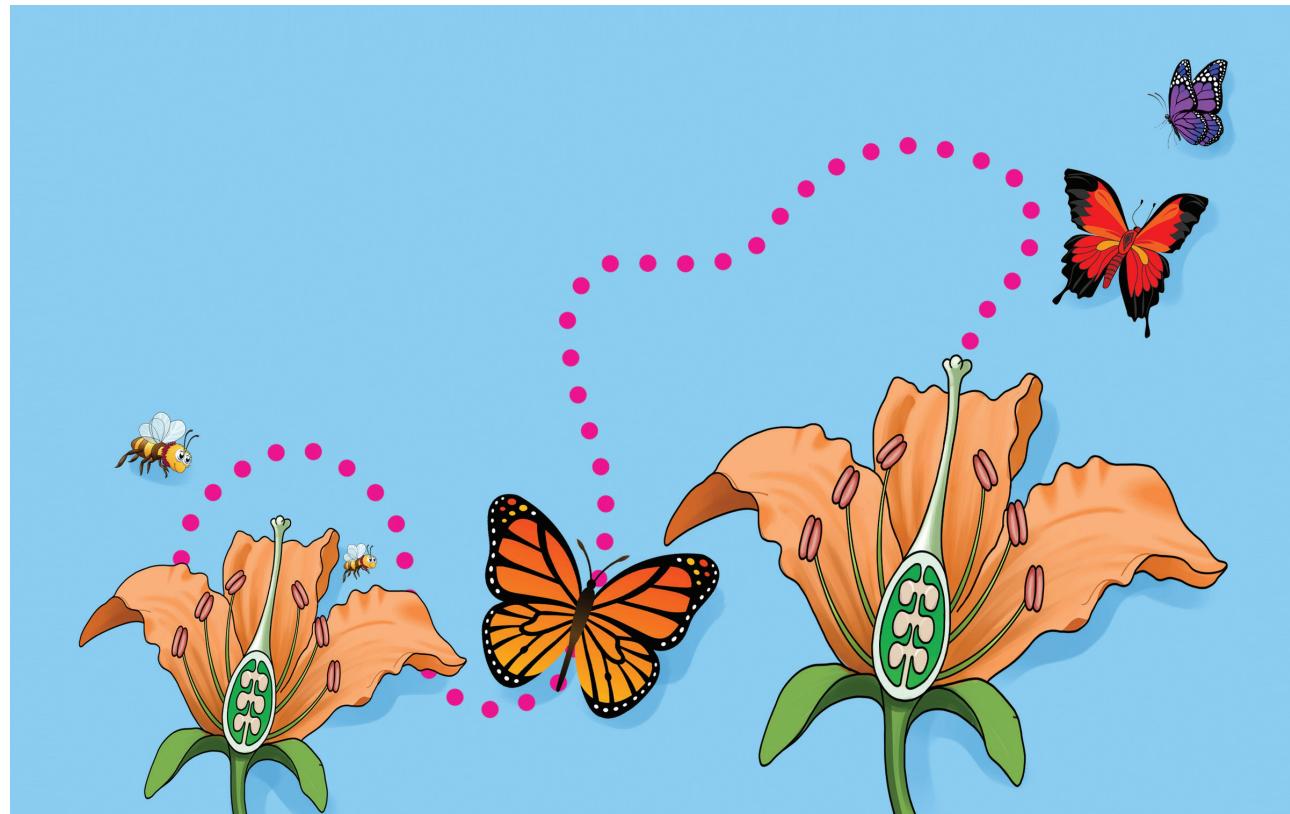
Choose three to four male flowers. Pluck the stamens of these flowers and dust the pollen grains in a sheet of paper and collect it. Open five out of ten bags containing female

flowers. Brush the collected pollen grains on the stigma with a soft paint brush. Take care not to damage the stigma. After few days we can see that flower in all bags that were not opened at all would wilt without forming a fruit, while most of the flowers to which pollens have been applied for fruits.

The process by which pollen grains reach stigma is called as **pollination**. The flower that receives pollen grains is called pollinated flower while the one that did not receive pollen grains is called as unpollinated flower.

5.2.4 Pollination

In the above experiment we transferred the pollen grains from male flower to the female flower. This is called as an **artificial pollination**. However in nature there are many ways in which pollen grains reach the stigma of the flower and is called as **natural pollination**.





In some plants like grasses, pollen grains are light. Stamens shed pollen grains, and are carried by wind to other flower. Insects, birds are also other agents of pollination. Bees, butterflies and variety of birds hover around flowers. They help to carry pollen from one flower to another. Pollen grains stick to their legs, wings or abdomen when they move from one flower to another. This is called as **Cross pollination**.

When you shake stamens, pollen grains fallout. Thus when a wind shake the flower or when a butterfly agitate the flower, pollen grains

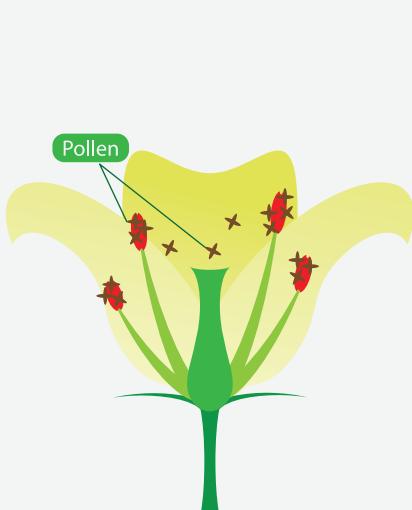
could fall onto the stigma of same flower. Some plants that have both the male and female parts within a single flowers(bisexual) pollinate by this means. This is called as **Self pollination**.

Beans (Fabaceae), tomatoes (Solanaceae) are commonly self-pollinate. Even though, for example tomato, self pollinate, they need the help of the insects to create vibrations within the flowers that will effectively loosen the pollen. Paddy is mostly self pollinating using just gentle wind as the pollinating agent. The agents that are helping in pollination are called **pollinators**.

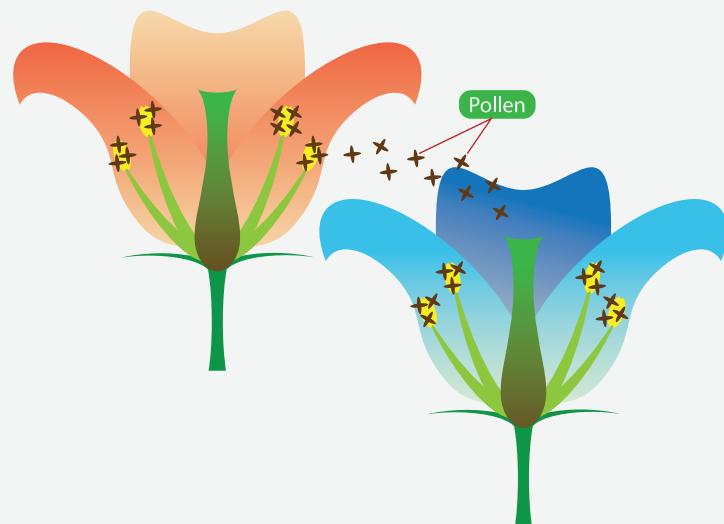
Differences between Self / Cross Pollination.

Self Pollination	Cross Pollination
Pollen grains are transferred from the anther to the stigma of the same flower or to another flower of the same plant.	Pollen grains are transferred from the anther of one flower to the stigma of another flower of the same kind or different plant.
Plants do not need to produce pollen grains in a large quantity for self pollination	Plants need to produce pollen grains in larger quantities to increase the chance of pollination.
It does not produce changes in the characteristics of new plants.	Cross pollination does introduce variations in characteristics of new plants.

Pollination in Plant



Self Pollination



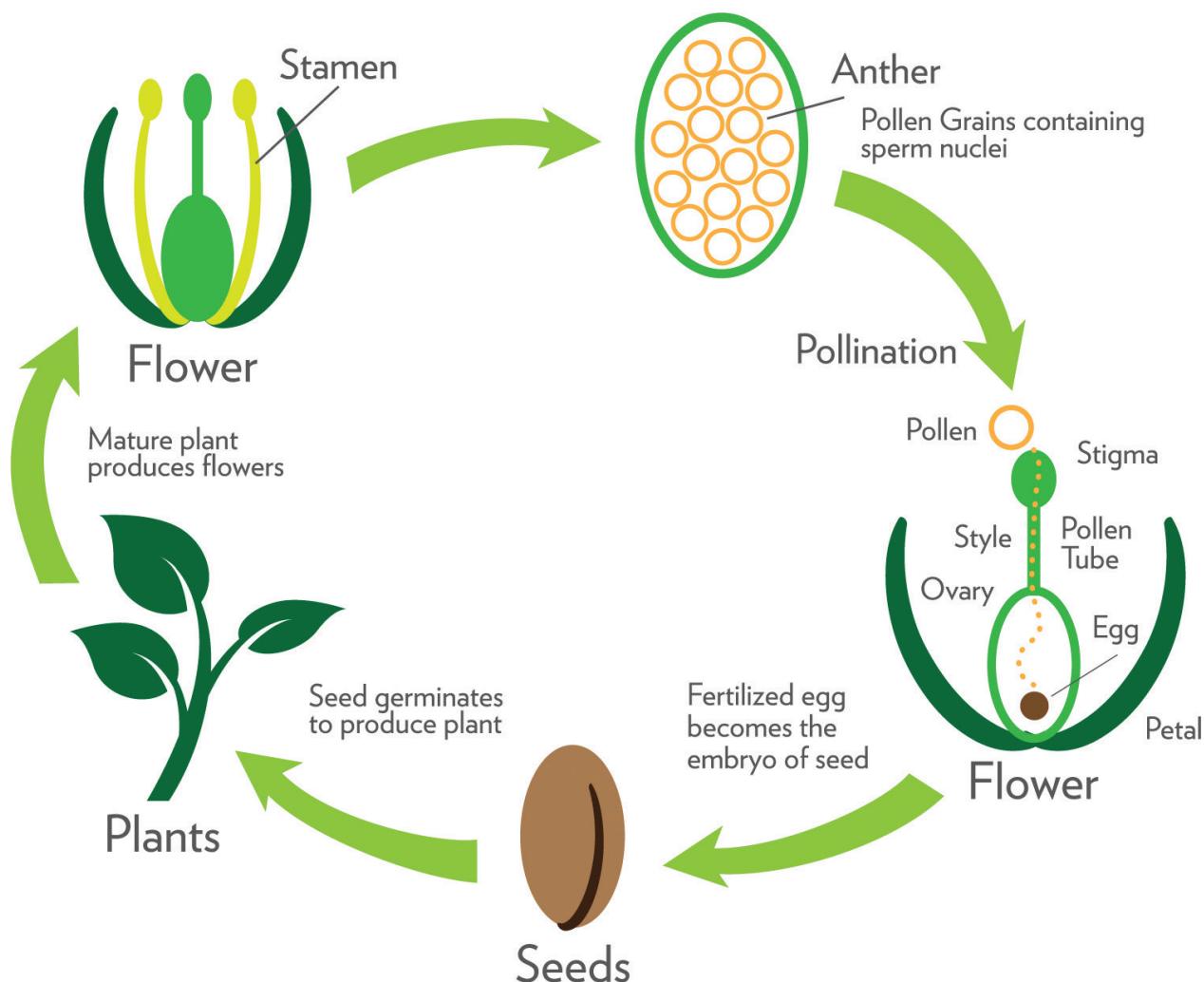
Cross Pollination



In many plants, pollens have to come from some other flowers. This is obvious in case of plants which have distinct male and female flowers like pumpkin. In some flowers the gynoecium matures first before the androecium shed pollens. Plants such as apples, plums, strawberries, pumpkins use insects for cross-pollination.

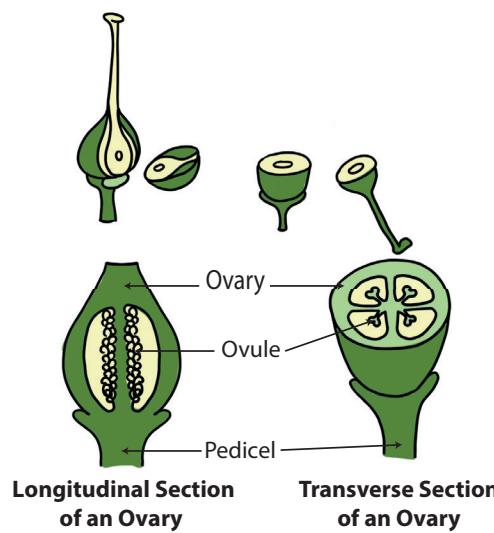
5.2.5 Fertilization

Through pollination, pollen grains reach stigma. What happens to them after this? Substances produced on the stigma causes the pollen grain to germinate. During the germination a tube develops from the pollen grain that carries male gametes that ultimately reaches female gamete inside the ovary through the style. Male gamete fuses with the female gamete to form zygote. This process is known as **fertilization**.



Life cycle of a plant

Where is this female gamete? Inside the ovary, small rounded structures, ovules are present. In these ovules, female gamete is present. To know more about this, we should cut ovary of a flower in longitudinal and transverse ways.



Cut a ovary of a flower both vertically and horizontally. Observe the ovules. Compare the ovary and ovules from few different flowers. Are there one or more ovules? Can you see any connection between the number of ovules in the ovary and number of seeds in each fruit?

Collect some fruits – Tomato, Brinjal, Lady's finger (vegetable), mango, peas and custard apple and observe. You can see some green part above brinjal and lady's finger. what are they?

Compare mango, custard apple and peas. All these are single fruits but custard apple has many small parts in it, each with a seed. Mango has a single seed and pea has many seeds. What do you understand from the above observations?

- i. A green part above fruits of **brinjal** and **lady's finger** are sepals of a flower. In some, after fertilization, sepal will not fall from fruit and remain or persist with fruit.
- ii. **Custard apple** : It is made up of many fruits, aggregated together. Each fruit part is thin, membranous with some granule like, which is edible.

iii. **Mango** : Outer skin and middle pulpy are edible and sweet. Inner most is with single seed.

iv. **Pea** : Fruit is not fleshy, but forms a covering pouch for many seeds.

In all above fruits, ovary, a lower most swollen part of pistil develops into a fleshy fruit. Ovules present inside the ovary gets transformed into a seed.

Hence, now with these observations, shall we list the changes taken place in a flower after fertilization. These are collectively said to be **post fertilization changes** and are:

- ❖ Calyx sometimes persist with fruit
- ❖ Petals wither / fall off
- ❖ Androecium fall off.
- ❖ Pistil remain and develops into a fruit.
- ❖ Style and stigma fall off
- ❖ Ovary enlarges to store food materials and develops into a fruit.
- ❖ Ovules present inside the ovary develops into seeds.

DO YOU KNOW?

1. The world's largest and heaviest seed is the double coconut. The seed looks like two coconut fused together. It only grows in two islands of the Seychelles. A single seed may be 12 inches long, nearly 3 feet in circumference and weighs about 18 kg.
2. Orchids have the smallest seeds in the plant kingdom. 35 million seeds may weight only about 25 gram.



5.3 Asexual reproduction

Earlier we saw that plants reproduce not only from seeds but by other processes as well. The production of new plants without the involvement of pollination and fertilization is known as asexual reproduction. Let us know the types of asexual reproduction.

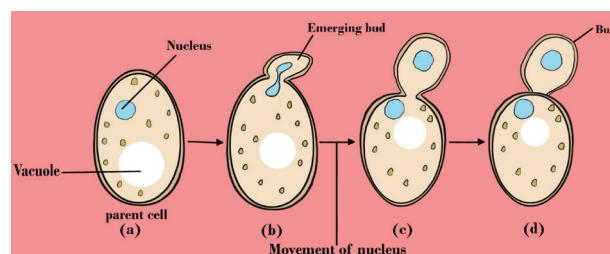
5.3.1 Vegetative Propagation

In potato, shoot arise from eyes. Sugarcane, yam are also grown like this. Vegetative parts of the plants such as root, stem and leaves can help to propagate the plant.



5.3.2 Budding

When we go to a bakery we see so many types of cakes and breads. These are very soft in nature. This is due to the presence of Yeast. Single yeast undergoes asymmetric division. It produces a small protuberance which gradually grows and detaches from the parent cell. This process is called **budding**.



5.3.4 Fragmentation

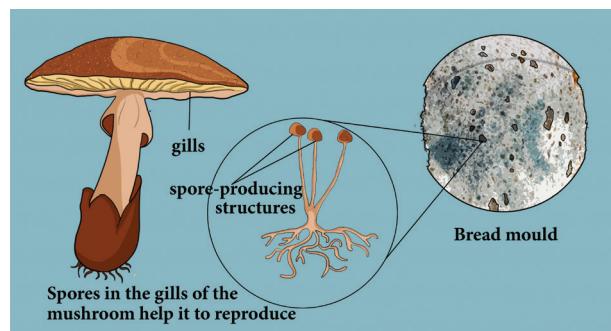
In a pond we see so many algae. **Spirogyra** is a filamentous alga, when it matures, the filament

divides into pieces. Each fragment or piece of a filament will grow into a new filament or individual. Likewise **Spirogyra** produces so many young ones and this process is known as **fragmentation**.



5.3.5 Spore Formation

What do you mean by unfavourable conditions? Scarcity of water, high temperature, nutrient deficiency in soil etc., are unfavourable conditions. During these conditions non-flowering plants like Algae, Fungi, Moss and Ferns produce spores. They germinate into a new plant when favourable conditions are returned.



5.4 Modifications of plant parts

Compare the given plants and discuss with your teacher.



Carrot Plant



Grass



Onion



Potato



Mango

Carefully remove a fresh carrot plant from the soil. Observe it. Look at the part we usually consume as 'carrot vegetable'. However it is not a unripe fruit, but the tap root of the carrot plant. We can see that the tap root of the carrot is swollen. In the case of the carrot plant, the tap root has a different characteristics than the usual

plants. Normally, each plant organ, originally evolved to meet certain needs of the plant. For example, roots evolved primarily to anchor the plant and also absorb water and mineral nutrients from soil. Leaves were adapted to optimize photosynthesis.

Stems evolved to reach out to sunlight and also served to conduct water from roots to leaves. However in certain plant species, specific parts have evolved further in unusual and surprising ways to meet certain other specific needs. In some plants root, stem, and leaves change their shape and structure to perform special functions like storage of food, mechanical support, protection and other vital functions. This is known as modification.

What appear as the 'leaf' of a cacti are actually their stem and what appear as 'spine' on them are actually leaf. Its leaves are modified into spines, an adaptation to reduce transpiration. Photosynthesis is performed by the stem part of the plant.

In this lesson let us study about the modification of root, stem and leaves.

5.5 Modification of Root



5.5.1 Roots for storage

Look at a radish, turnip, beet root, and carrot. They all grow under the soil. As soon as you pluck it from the ground if you wash them gently, you will notice small roots dangling from their surface. All these vegetables are in fact roots of the plant. Instead of thin slender roots, in case of such plants, the roots have become a place to store the food produced by them.

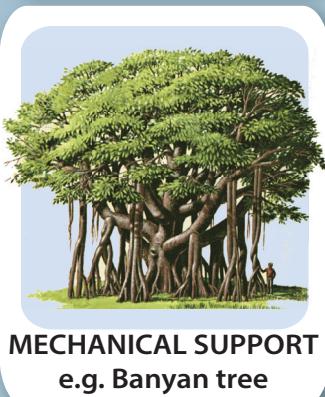


Modification of Root

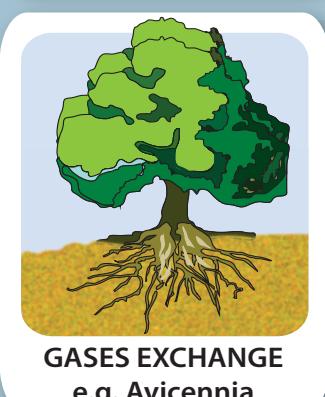
To perform special functions the roots change their size and shape.



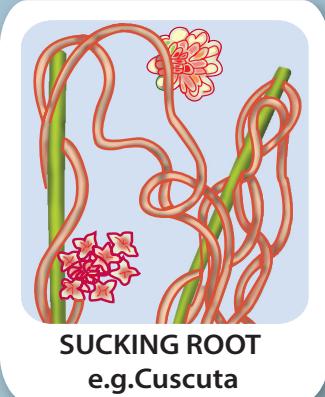
STORAGE OF FOOD
e.g. Beet root



MECHANICAL SUPPORT
e.g. Banyan tree



GASES EXCHANGE
e.g. Avicennia



SUCKING ROOT
e.g. Cuscuta



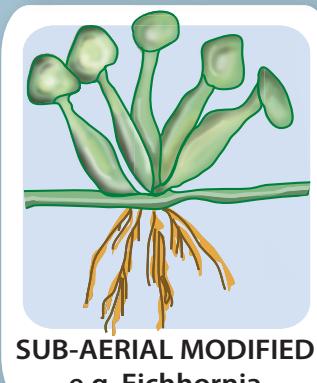
PLANT MODIFICATION

Modification of stem

Stem modified for storing the food materials and for vegetative propagation.



AERIAL MODIFIED
e.g. Cactus



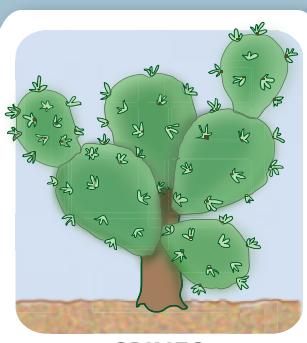
SUB-AERIAL MODIFIED
e.g. Eichhornia



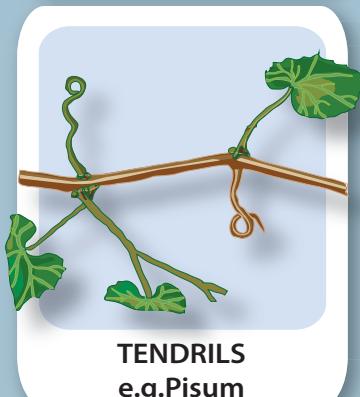
UNDERGROUND STEM
e.g. Colocasia

Modification of Leaf

Leaves have changed themselves to adapt to their environment



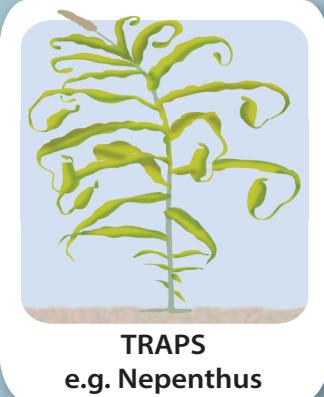
SPINES
e.g. Opuntia



TENDRILS
e.g. Pisum



PHYLLODE



TRAPS
e.g. Nepenthes



Hence they are thick and swollen. One can notice that the tap root of radish is in the shape of spindle, swollen in the middle and tapering at both ends. Such type of modified roots are called spindle shaped root. **Example : Radish**



Radish

At times, like in the case of turnip, and beet root the tap root can acquire a shape of top, that is spherical at the base and tapering shortly towards the apex. They are called as Top shaped root.



Beet Root

In case of **carrot**, the shape is conical, broad at the apex and tapering gradually towards the base and such modified roots are called Conical shaped root.



Carrot

ACTIVITY 5

Aim: To study the modification of root.

Materials Required: Sample / charts of raddish, carrot, beet root, sweet potato, stilt roots and pneumatophores.

Procedure: Carefully observe the shape of each specimen.

Observation: Draw the diagram and observe the morphological differences between the samples.

5.5.2. Mechanical Support

Look at a banyan tree. It seems to have many trunk supporting it. However many of them are actually roots. As the banyan tree is large and huge, it needs support not to tilt and fall down. Many plants require such additional support. Such plants develop roots on their aerial parts to provide mechanical support. These roots grow downward and act as supportive organs. There are three types of modified roots for support.

- i. **Prop roots:** Roots are modified to provide mechanical support as seen in Banyan tree. These roots grow vertically from horizontal branches of a tree.



Banyan



- ii. **Stilt roots** : In sugar cane, and maize adventitious roots arise from the nodes in cluster at the base of the stem. These roots are called stilt roots which gives additional support.



Sugar cane

- iii. **Climbing roots**: In betel and black pepper, nodes or internodes bear roots which help in climbing.



Betel



A root growing from a location other than the underground, such as from a stem or leaf is called as adventitious root

5.5.3. Gaseous Exchange:

Avicennia is a tree which grows in mangroves or swamps. They have roots which are seen above the ground for the purpose of gaseous exchange. These roots are erect, peg like

structures with numerous pores through which air circulates. These roots are called **breathing roots, or pneumatophores**.



Avicennia



Vanda is an epiphytic plant, which grows on trees. The velamen tissue present in the epiphytic root, absorbs moisture, to perform photosynthesis



Vanda

5.5.4. Roots for other vital function

Roots may also be perform special function. Haustoria or **Sucking roots**, are one such example. Cuscuta a parasite plant, climb the trees and other vegetation and use the haustorial roots to penetrate the tissue of the host plant and suck nutrients from them. They are usually found in parasitic plants that depend on the host plants for nutrients.



Cuscuta

5.6.2 Sub – aerial Modifications

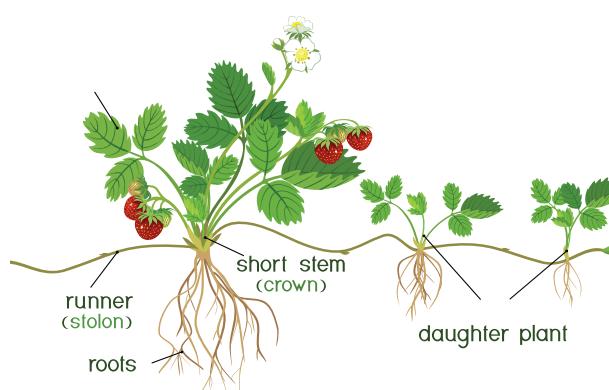
Stem of some plants remains sub – aerial which grow horizontally on the surface of the soil for the purpose of reproduction. There are four types.

- i. **Runner :** The stem grows laterally on the surface of the soil, breaks up to produce roots where it touches the ground to give rise to new plants. E.g: *Centella (Vallarai)*



Centella

- ii. **Stolon :** Stolon is a slender branch of the stem that grows upwards to some distance and then bends towards the ground. Upon touching the ground, it gives rise to a new plant. E.g:**Wild strawberry.**

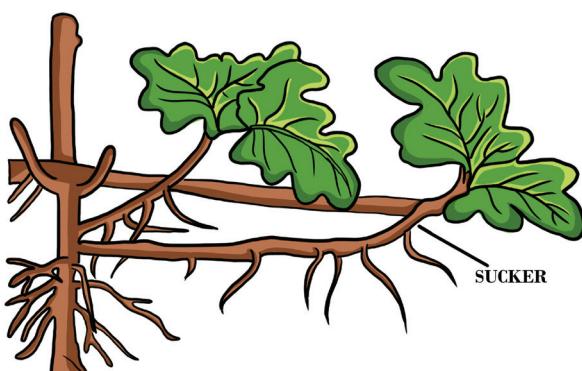


Wild strawberry

- iii **Sucker :** Sucker is a short and weak lateral branch that grows diagonally upwards and directly gives rise to a new shoot.
E.g : *Chrysanthemum.*



Cactus



Chrysanthemum

iv **Offset**: An offset is a short and thick branch that arises from the axial part of a leaf. It has thick internodes. It produces a tuft of leaves and cluster of small roots below.
E.g: Eichhornia.



Eichhornia

ACTIVITY 6

Aim: To study the modification of stem

Materials Required: Specimens of Ginger, Potato, Onion, Mint, Bougainvillea-, Acacia, Opuntia and locally available specimens.

Procedure: Observe the external morphology of each specimen.

Observation: Draw diagram and bring out the differences and their function in each type of stem modifications.

5.6.3 Underground modifications

In aerial and sub aerial modifications, stem has indefinite growth. In underground modified stem, whole stem is buried under the ground and it has definite growth. Usually stem grows above the ground, but there are some stems that grow under the ground to store food. These underground stems swell and become thick.

There are four types of underground stems:

1. Rhizome; 2. Corm; 3. Tuber; 4. Bulb

i. **Rhizome**: It is an underground thick stem with nodes and internodes with scale leaves at the node. It grows horizontally and has an irregular shape. Rhizome have buds. If give rise to new stem and leaves. E.g: Ginger and Turmeric.



Turmeric

ii. **Corm**: This underground stem is round in shape and flat at the top and bottom. It is a condensed form of rhizome and bears one or more buds in the axils of scale leaves. Daughter plants arise from their buds.

E.g: Colocasia.



Colocasia



iii. Tuber: It is an enlarged, spherical underground stem that stores food. It has many dormant buds on its surface known as “Eyes”. If we plant a part of tuber with the bud, it grows into a new plant. E.g. Potato.



Potato

iv. Bulb: It is a condensed stem which is disc like and stores food in the fleshy leaves. The bulb has two types of leaves.

1. Fleshy Leaves
2. Scaly Leaves

The upper part of the stem has a terminal bud and it is covered by many scaly leaves. The inner fleshy leaves store food as seen in Garlic and Onion.



Onion

5.7 Modifications of Leaf

Plants have changed themselves to adapt to the environment they grow. One of them is the

modification of leaves. Leaves of several plants get modified into different form based on the purpose and environment

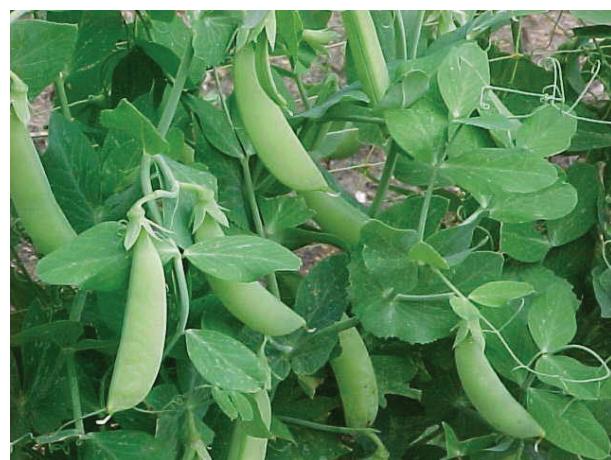
i. Spines: Leaves are reduced to spines, and the stem is modified into green succulent part to perform photosynthesis. Eg : *Opuntia*.



Opuntia

ii. Tendrils: In climbers, the leaf of plant would be modified into elongated structure to help the plants climb efficiently.

- *Gloriosa superba* – Leaf tips are modified into tendrils
- *Pisum sativum (pea)* – Terminal leaflets are modified into tendrils.



Pisum sativum

iii. Phyllode: In *Acacia auriculiformis*, petioles expand to form leaf like structure. They carry out the function of leaf (Photosynthesis)



Acacia

iv. Traps: Plants that grow in nitrogen deficient places adapt themselves well to get it. In **Nepenthes**, the leaves are modified into a flask like structure, which is used to attract insects and other tiny animals. The inner wall of the leaf secretes digestive enzymes that help to digest the insects and extract the nitrogen needed for the plant. Eg: **Nepenthes**.



Nepenthes

Points to remember

- ❖ Reproduction is an essential characteristics of living organisms. In plants there are two types of reproduction – asexual reproduction and sexual reproduction.
- ❖ In a flowering plants ,flowers are the reproductive organs. They produce fruits and seeds through pollination and fertilization.
- ❖ The male reproductive organ of a flower is androecium and the female reproductive organ of a flower is gynoecium.
- ❖ Transfer of pollen grains from the anther to stigma is called pollination. There are two types of pollination - self pollination and cross pollination.
- ❖ Agents like wind, water, insects and animals are helpful for pollination and are known as pollinators.
- ❖ After pollination, the fusion of male and female gametes takes place. It is called fertilization. After fertilization, ovary becomes the fruit and ovule becomes the seed.
- ❖ To perform the special function other than the normal function, the root, stem and leaf externally modify themselves according to the environment. So they change their size, shape and colour. These are called the modification of root, stem and leaves.



ICT CORNER

Reproduction plants

Let's label the parts of the flower.



PROCEDURE :

- Step 1:** Use the URL to reach stimulation page. Click ‘Run adobe flash’ to launch the simulation.
- Step 2:** Select ‘OK’ button to run the activity.
- Step 3:** Drag a Stamen into the labelled box. Then click ‘OK’ button.
- Step 4:** Read the instructions at the top of the screen to do the activity.
- Step 5:** Click ‘Reset’ to refresh.



Step 1



Step 2



Step 3



Step 4

Reproduction plants URL:

<http://www.sciencekids.co.nz/gamesactivities/lifecycles.html>

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.



B351_7_SCI_EM



Evaluation

I. Choose the appropriate answer.

1. Vegetative propagation by leaves takes place in
 - a. Bryophyllum
 - b. Fungi
 - c. Virus
 - d. Bacteria

2. Asexual reproduction in yeast is
 - a. Spore formation
 - b. Fragmentation
 - c. Pollination
 - d. Budding

3. Reproductive part of a plant is
 - a. Root
 - b. Stem
 - c. Leaf
 - d. Flower

4. Pollinators are
 - a. Wind
 - b. Water
 - c. Insect
 - d. All the above

5. Climbing roots are seen in
 - a. Betel
 - b. Black pepper
 - c. Both of them
 - d. None of them



II. Fill in the Blanks.

1. The male reproductive part of a flower is _____.

2. _____ is the basal swollen part of the Gynoecium.

3. After fertilization the ovule becomes _____.

4. Breathing roots are seen in _____ plants.

5. Onion and Garlic are example of _____.

III. True (or) False, write the correct answer for the false statement.

1. A complete flower has four whorls.
2. The transfer of pollen to the stigma is known as pollination.
3. Conical shaped root is carrot.
4. Ginger is an underground root.
5. Leaves of Aloe vera are fleshy and store water.

IV. Match the following:

1.	Petal	-	Opuntia
2.	Fern	-	Chrysanthemum
3.	Phylloclade	-	Attracts insect
4.	Hooks	-	Spore
5.	Sucker	-	Bignonia

V. Very short answer.

1. Write two types of reproduction in plants.
2. What are the two important parts of a flower?
3. Define – pollination.
4. What are the agents of pollination?
5. Give example for
 - a. Corm
 - b. Tuber
6. What is tendril?
7. What are thorns?

VI. Short answer.

1. Differentiate bisexual flower from unisexual flower?
2. What is cross pollination?
3. Write notes on phyllode.

VII. Answer in Details.

1. Write a brief account on pollination.
2. Explain the underground stems.



VIII. Higher Order Questions.

1. Ginger is considered to be a stem, not a root. Why?
2. What will happen if pollen grain of rose gets deposited on stigma of lily flower? Will pollen germination takes place? Why?

d. Assertion is incorrect, Reasoning is incorrect.

2. **Assertion** – The example of conical root is carrot.

Reasoning – It is an adventitious root modification.

- a. Assertion is incorrect, Reasoning is correct.
- b. Assertion is incorrect, Reasoning is incorrect.
- c. Assertion is correct, Reasoning is correct.
- d. Assertion is correct, Reasoning is incorrect.

IX. Assertion and Reasoning types of Question.

1. **Assertion** – Pollination and fertilization in flowers, produces fruits and seeds.

Reasoning – After fertilization the ovary becomes fruit and ovule becomes seed.

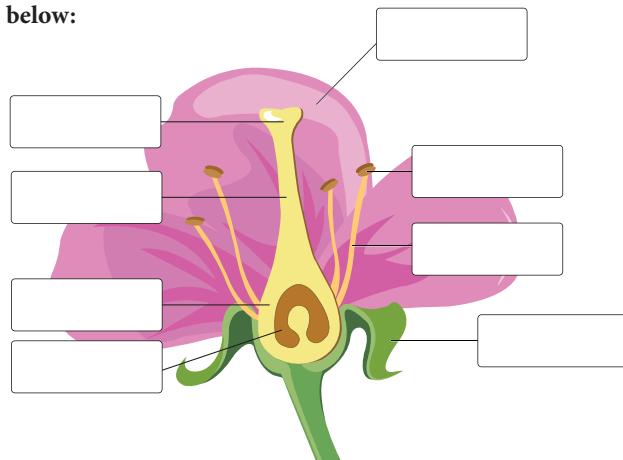
- a. Assertion is correct, Reasoning is incorrect.
- b. Assertion is incorrect, Reasoning is correct.
- c. Assertion is correct, Reasoning is correct.

X. Picture Based question.

- i. Observe the picture and draw the labels.

Parts of a Flower

Label the parts below:



Stigma Pistil Filament
Petal Style Anther
Ovary Sepal Stamen

- ii. Identify the four plants shown in the following Name the different modification in each of them.

	Name	Modification
1.	Garlic	
2.	Turnip	
3.	Rose plant	
4.	Maize	



Unit 6

Health and Hygiene



Learning Objectives

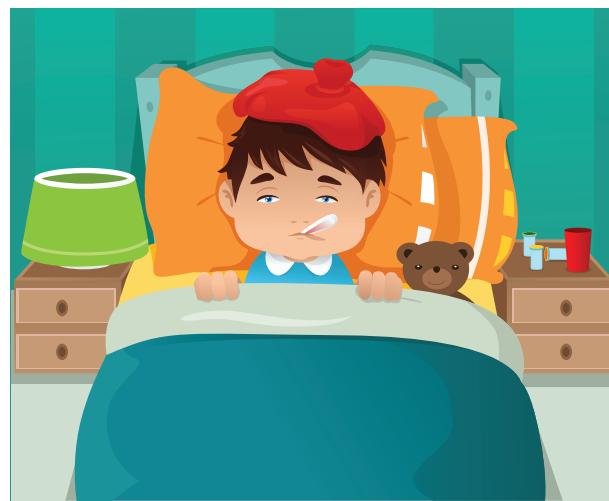
- ❖ At the end of this lesson you will learn
- ❖ How to take care of your body. (Describe ways to take care of our body)
- ❖ Take care of your teeth, eye, hair and follow the hygienic habits.
- ❖ To understand the communicable and non-communicable diseases.
- ❖ To know and understand some common ailments and their remedies.
- ❖ To know first aid and safety measures.





Introduction

1. Have you ever taken leave from the school due to sickness?
2. What happens exactly when we become sick?
3. Sometimes, we feel good even without taking any medicines and sometimes we need to consult doctor and take regular medicines in sickness. Why is it so?



What causes sickness?

Persons from different countries or backgrounds have different ways to explain what causes sickness.

A baby gets diarrhoea. Why?

Some people may say that parents did something wrong, or perhaps because they made a God or Spirit angry. A doctor may say it is because the child has an infection. A public health officer may say it is because the villagers do not have a good water system or proper sanitation. A teacher may say that they need to be educated about health and sanitation. People see the cause of sickness in terms of their own experience and point of view. Who then is right about the cause? Possibly everyone is right, or partially right.

This is because...

Each of the causes seen above may be a part of the reason why a baby gets diarrhoea. To prevent

and treat sickness successfully, it is necessary to have complete understanding of the common sicknesses in the area and the combination of things that caused them. Reading this lesson may help to understand the various causes of sickness.

Health is the best wealth. If you have good health, you will have a sound mind and you will gain good knowledge and wealth also. To maintain good health, you should follow good hygiene, eat nutritious food, do exercise, take rest and have a sound sleep.

It is also refers to a state of a sound mind and body free from any sickness or ailment, stress and problems. In simple words, health refers to the physical, emotional and psychological well-being of a person.

Hygiene refers to the good habits and their practices which is followed to prevent diseases, maintain good health, especially through cleanliness, consumption of safe drinking water and proper disposal of sewage. It refers to all those activities that are done for improving and maintaining good health and sound mind.

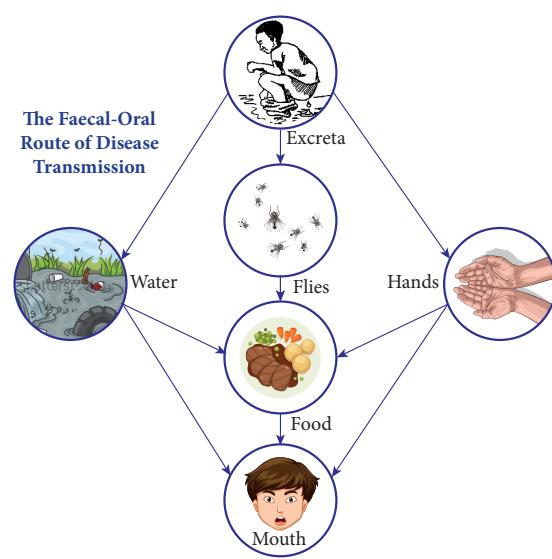
Cleanliness

Observe the following picture discuss with your teacher and write few lines about the transmission of disease producing pathogens through oral and faecal route.

Cleanliness refers to the maintenance of personal and environmental hygiene. In simple words, It refers to the state of being clean which is essential for good health. To protect us from diseases it is essential to maintain good health by taking regular bath, cleaning the clothes and surroundings and also avoiding unhygienic food consumption.



The Faecal-Oral Route of Disease Transmission



Personal hygiene

Do you follow the personal hygiene properly?



How does the above activities will keep you physically fit?

Personal hygiene is defined as “the branch of health which is concerned with the individual’s adjustment to the physiological needs of the body and mind for the attainment of the maximum level of health, it also refers to the cleaning and grooming of the body.

How do pathogens are spread ?

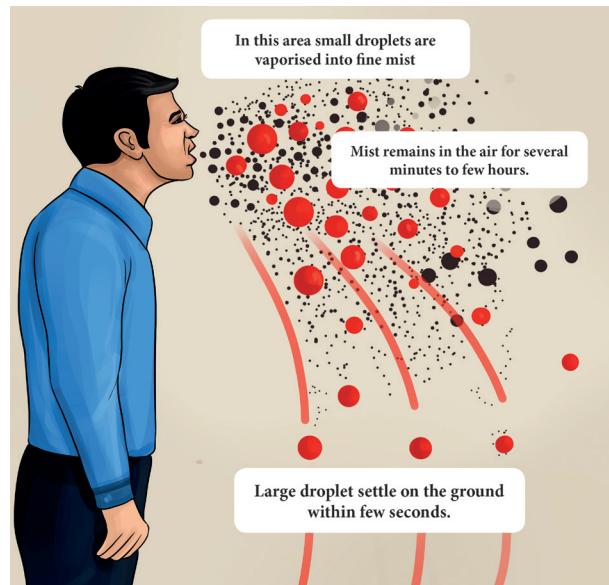
ACTIVITY 1

What is Personal Hygiene?



List out your daily activities in the given table

S.No.	Activities	Number of Times in a Day
1.	Brush teeth	
2.	Take shower	
3.	Wash hair	
4.	Wash hands and feet	
5.	Wearing Clean clothes / Uniforms	



Observe the picture and answer the question.

What will happen, if cold affected friend/classmate of you, sneezes or cough in front of you? _____

Colds and the flu are common communicable diseases. It is caused not only by bacteria but also by virus. When you have cold and flu, you may also have running nose, cough, sore throat, and sometimes fever or pain in the joints. For some, this condition may also lead to mild diarrhoea.

Secretions oozing out from the nose may contain the bacteria or virus. When the patient touch the nose and some other object or someone else the virus is transferred. When the patient sneezes or coughs the virus comes out with the droplets and become airborne. Hence it is a good practice for the patient with cold and flu to use a handkerchief to blow the noses and also wash the hands often to ensure that they do not accidentally spread the virus to others.

Community Hygiene

ACTIVITY 2



Observe the picture and write remedial measures

A community is formed by a group of people living together in a particular area. If the people in a community wish to lead a healthy life, they should maintain basic community hygiene. It can be done by adopting the following measures.

- The surroundings should be kept clean.
- Drains should be covered properly.
- The domestic wastes should be segregated and properly disposed off safely in separate dust bins provided by the Government (Green and Blue).
- Used water from houses should not be let out into open drains or open areas.



DO YOU KNOW?

Dengue is spread by mosquitoes of Aedes aegypti caused by DEN-1, 2 virus belonging to the type- flavivirus. It decrease counting of the blood platelets of human blood and it has a maximum flight range of 50–100 meters in and around the places.



Care of the body

A human body is a massive miracle. It consists of organs and systems, which functions day in and out. Our body is compared to a machine. The human body systems work well with proper maintenance and guidance. For smooth functioning, all the parts of the body should work in unison. The digestive system, circulatory and muscular system is the core systems that should be in synchronization and functioning well. So keep them well by proper care.

Dental Care

Dental care or broadly speaking oral hygiene is an important aspect of the personal health of

an individual. Good oral hygiene implies sound teeth and healthy gums with healthy surrounding tissues. The physical act of chewing food promotes saliva and gastric secretions which helps digestion. The act of chewing and tasting is called ‘mastication’. It gives pleasure and emotional satisfaction of eating food. Teeth is essential for good appearance and clear speech also.



- When you brush two times a day, it will prevent the formation of tartar and plaque on your teeth and gums.
- When you Floss, it will remove food particles, plaque, AND bacteria which build up between your teeth. When you start flossing, your gums may bleed a little bit, but after few days that will be stopped. It should be started only with proper medical guidance.

Diseases affecting the teeth

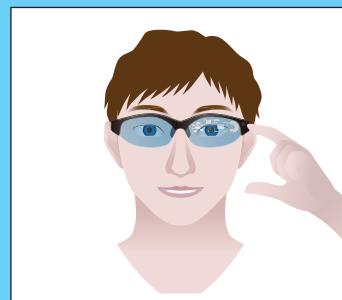
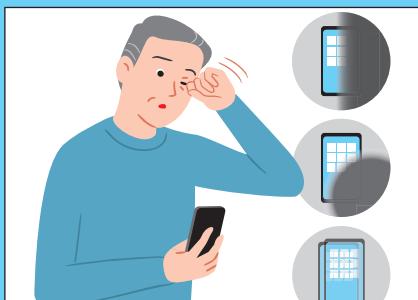
Diseases affecting the teeth and gums, their causative agents and remedial measure are given below:

Sl. No.	Name of the Diseases	Causative Agents	Impacts/Consequences	Remedial measures
1	Bleeding gums	Vitamin C deficiency	Bleeding of the gums	Eating citrus fruits
2	Tooth decay	Bacteria in plaque	Bacteria produce acids	Brushing and flossing the teeth can prevent decay.
3	Periodontitis	Tobacco chewing	Severe form of gum disease ruin the bones, gums, and other tissues	Chewing type of tobacco should be avoided. Eat a well-balanced diet.



Eye Care

ACTIVITY 3



Observe the picture and tick do's and don'ts in the given tables

Sl .No.	Practices	I Do	I Don't do
1.	Do you rub the eyes?		
2.	Do you watch TV/work on computer for a long time		
3.	Do you use cold water for cleaning your eyes?		
4.	Do you like eating carrot?		
5.	Do you regularly eat fruits like Orange, sweet lemon and lemon?		

In the above checklist what do you understand?

Eye Care

Eyes are an important organ of our body. They are considered as “windows to the world”. Eyesight is the most important sense. 80% of what we perceive comes through the sense of sight. The protection of the eyes, can reduce the odds of blindness and vision loss. We protection of our eye from the diseases, surroundings, climate condition.

Diseases affecting Eye

Diseases affecting the eye and their remedial measure are given below:

Hair Care

The condition of the hair reflects to some extent the nutritional status and general health of the body. Thin, sparse hair and the loss of hair indicates a poor nutritional status. The deficiencies in diet, physical and mental illness of various kinds may also lead to premature graying of hair.



The hair follicles from which the hair grows] produce oil which keeps the hair smooth. The sweat and the dead skin cells come off the scalp.

The oil, sweat and dead cells all add together and can make the hair greasy and look dirty unless it is washed regularly.

S.No.	Name of the Disease	Causative Agents	Impacts/Consequences	Remedial measures
1.	Night Blindness	a lack of vitamin A , a disorder of the cells in your retina	makes it hard to see well at night or in poor light..	Eat foods rich in anti-oxidant, vitamins and minerals.
2.	Conjunctivitis (Pink eye)	Caused by a virus and bacteria	One or both eyes can be affected. Highly contagious; can be spread by contamination and sneezing.	Antibiotic eye drops or ointments, home remedy
3.	Color blindness	genetic condition	<ul style="list-style-type: none"> Difficulty distinguishing between colours Inability to see shades or tones of the same colour 	There is no known cure for colour blindness. Contact lenses and glasses with filters.

To keep the hair clean and healthy:

The regular hair wash and massage of the scalp will remove the dead skin cells, excess oil and dust.

Rinsing the hair well with clear water and using good toothed comb for hair dressing is highly essential for their maintenance.

Diseases

A **disease** is the functional or physical change from a normal state that affects the health of a person by causing disability or discomfort. The following are reasons that could lead to the development of disease in an individual.

1. Infection caused by disease-causing microbes



2. Lack of balanced diet
3. Poor lifestyle and unhealthy habits
4. Malfunctioning of one or more body parts or organs

Different kinds of sickness and their causes

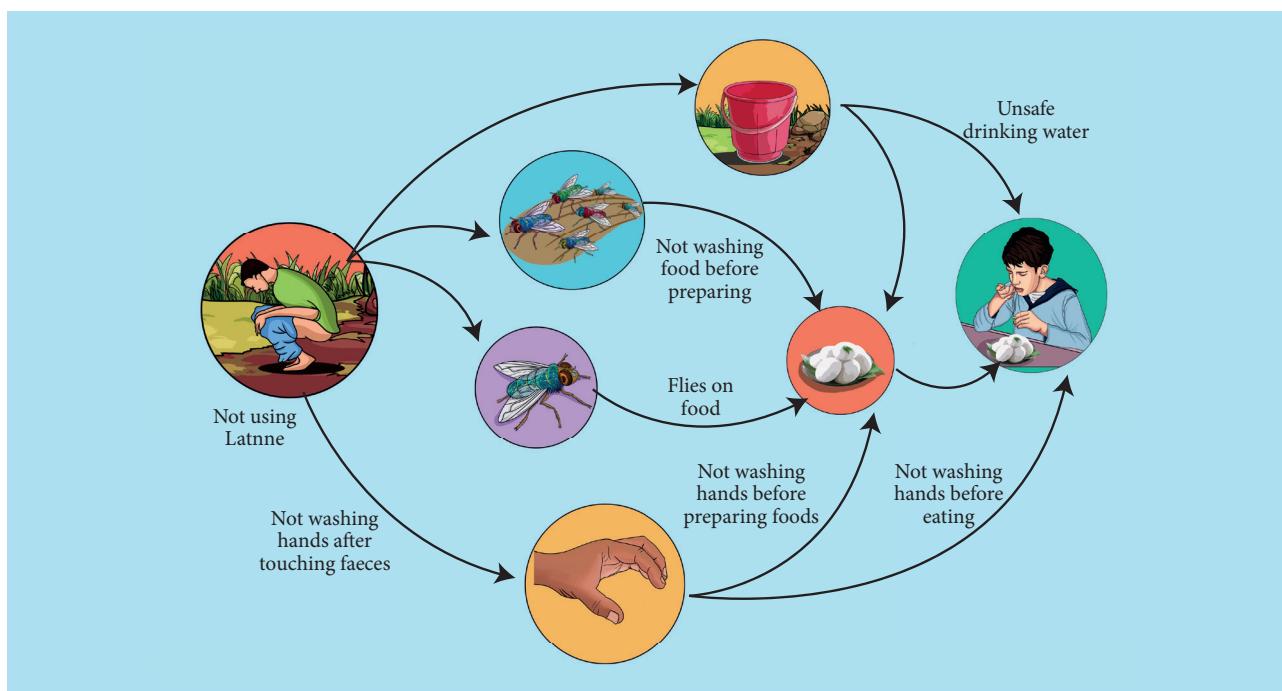
The prevention and treatment of sickness can be considered in two groups for their better understanding. They are, **communicable and non-communicable disease**.

Communicable Diseases

Communicable diseases are those that spread from one person to another. Healthy persons must be protected from people with communicable diseases. Diseases spread through contaminated air, water, food or vectors (insects and other animals)



Health Risks



Diseases Caused by Bacteria

In this lesson, you will study about some communicable disease (like tuberculosis, Cholera and Typhoid), which are caused by microbes and spread through air, water and some other organisms also.

Tuberculosis:

TB is caused by *Mycobacterium tuberculosis* and spreads from one person to another person through air by spitting and prolonged contact with sharing materials of the patient. The symptoms are fever, weight loss, chronic cough, bloody spitting and difficulty in breathing.



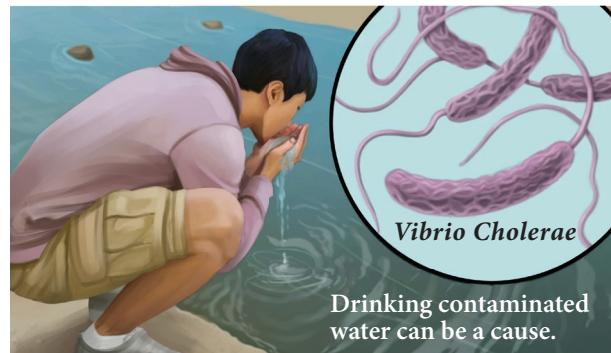
Mycobacterium tuberculosis

Prevention and treatment

- BCG vaccination,
- Giving special attention to the patient,
- Regular medication like DOT

Cholera:

Cholera is caused by *Vibrio cholera* and spread through the consumption contaminated food or water. The symptoms of Cholera is Vomiting, severe diarrhea and cramps in legs.



Vibrio cholera

Prevention and treatment

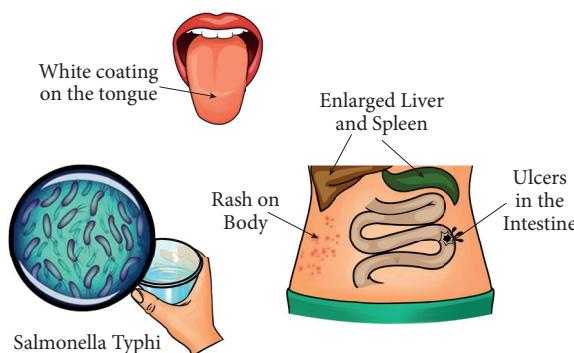
- Good hygienic practices like, washing hands before eating.
- Avoid eating uncovered food from street vendoers.
- Drinking boiled water.
- Getting Vaccination against cholera

Typhoid:

Typhoid is caused by *Salmonella typhi* and spreads by contaminated food and water. The symptoms are Anorexia, headache, rashes on abdomen, dysentery and high fever up to 104°F .



TYPHOID FEVER



Prevention and treatment

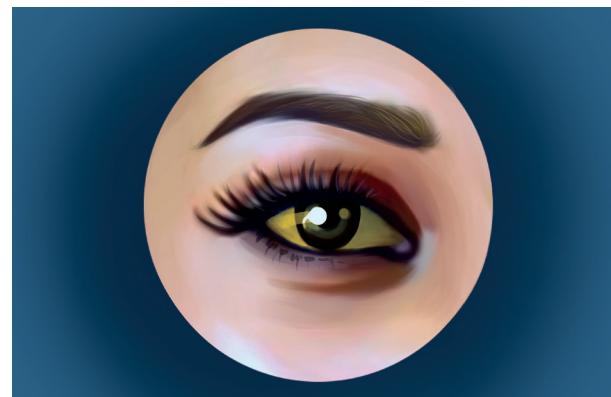
- Drinking boiled clean water
- Proper disposal of sewage
- Vaccination

Disease Caused by Virus

Viral diseases are extremely widespread infections caused by many type of viruses. In this lesson you will learn about some disease caused by viruses like, Hapatitis, Chickenpox and Rabies.

Hepatitis:

Hepatitis is one of the most dangerous and fatal diseases caused by Hepatitis virus-A, B, C, D, E. Its mode of transmission is Contaminated water, sharing of needles and blood transfusion. The symptoms of hepatitis is loss of appetite, (Anorexia), vomiting, eyes and urine in yellow color.



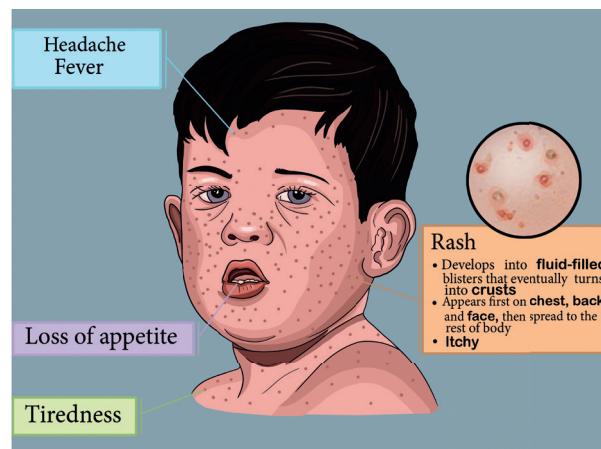
Prevention and treatment

- Drinking boiled water,
- Proper cleaning of hands



Chickenpox:

Chickenpox (chicken pox), also known as varicella, is a highly contagious infection caused by the varicella zoster virus. This disease spreads through air and contact with an infected person. Its symptoms are appearance of rashes on the whole body, fever, headache and tiredness.



Prevention and treatment

The chickenpox (varicella) vaccine is the best way to prevent chickenpox

Special attention should be given to the infected persons.

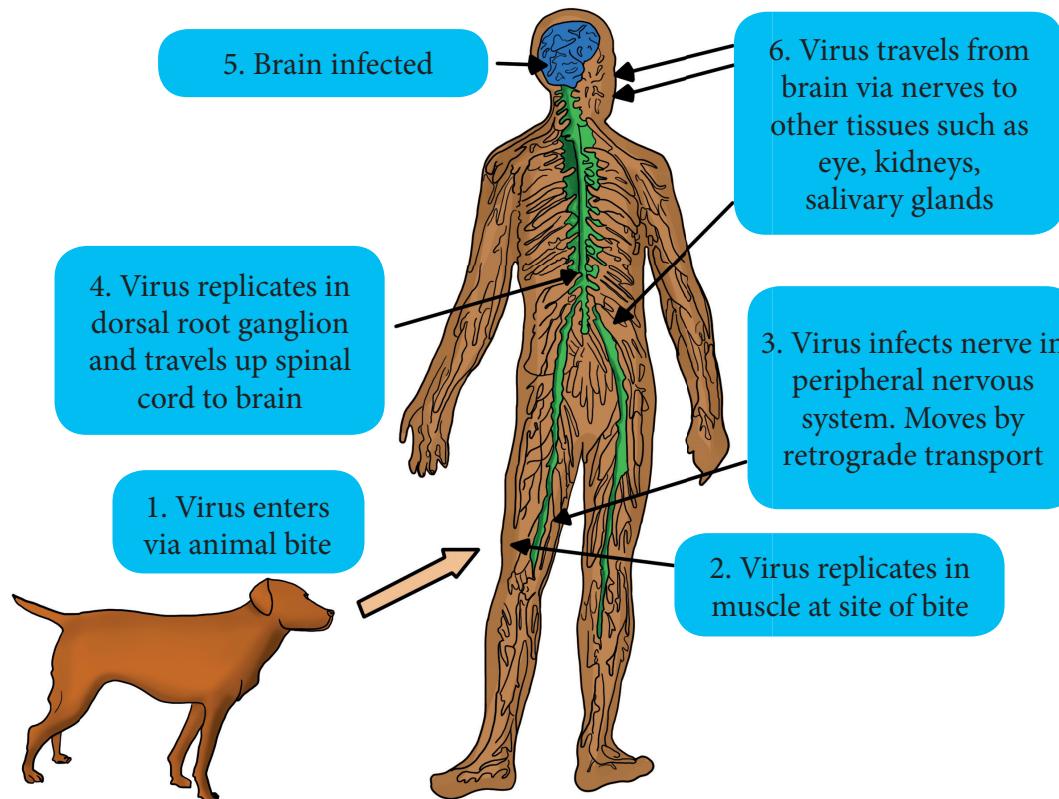
Rabies:

Rabies is a fatal disease. Which is transmitted by the bite of the infected dog, rabbit, monkey, cat etc. The virus present in the saliva of dog enters the brain via neurons. The symptoms of rabies are hydrophobia (extreme fear for water), fever for 2 – 12 weeks and exaggerations in behavior.

Prevention and treatment

- In early stages rabies is very difficult to detect
- After an animal is bitten it usually takes two to twelve weeks to show any symptoms and it may take as long as two years also.
- Fatality can be prevented by timely vaccination before the onset of symptoms.

Rabies





Vaccine

A **vaccine** is a biological preparation that provides active acquired immunity to a particular disease. Vaccines like (BCG, Polio, MMR) are given at early childhood to protect from other diseases.

ACTIVITY 4

Visit nearby Primary Health Centre and collect information about the vaccination given to the children of 0-15 years. Meet a doctor or a health worker in the hospital and enquire about the types of vaccines are available there? disease can be prevented by their usage? Collect the list about the age it should be given?

Non-Communicable diseases

Communicable diseases do not spread from person to person. They are caused by other factors. Therefore, it is important to know which sickness are communicable and which are not. They are never caused by germs, bacteria, or other living organisms that infect the body. Antibiotics, or medicines that fight against germs do not help to cure non-communicable diseases.

Problems caused by wearing out of body parts:

- ❖ Rheumatism, heart attack, epileptic seizures, stroke, migraine, headache, Cataract and cancer

Problems caused by external harmful agents entering the body:

- ❖ Allergies, asthma, poisons, snakebite, cough from smoking, stomach ulcer, alcoholism.

Problems caused by a lack of trace elements in the body:

- ❖ Anemia, pellagra, night blindness and xerophthalmia, goiter and hypothyroidism.

Problems caused by Malnutrition.

- ❖ Nutritious food is needed for a person to grow well, work hard, and stay healthy. Many common sicknesses are caused by malnutrition.



Leucoderma is a non-communicable disease caused by partial or total loss of pigmentation in the skin. (**melanin pigment**). This condition affects any age, gender and ethnicity. There is no cure. It does not spread by touching, sharing food and sitting together.

Specific health problems of children

Anaemia

It is caused by eating food with less iron content and can also be caused due to feeding some other foods instead of breast milk. Severe anemia in children may lead to hookworm infection, chronic diarrhoea and dysentery. In recent day school going children, especially the girls are affected by anemia. The Government of Tamil Nadu provides weekly iron folic tablets to all the girls in the schools of all areas.



The signs of anemia are:

- ❖ Pale or transparent skin, The inner surface of eye lids are pale, white fingernails, pale gums, weakness and fatigue.
- ❖ In severe cases, face and feet may be swollen, the heartbeat is rapid and with shortness of breath.
- ❖ Children and women who eats mud are usually anemic.



Treatment and prevention of anemia:

The signs of anemia are:

- pale or transparent skin
- pale insides of eyelids
- white fingernails
- pale gums
- weakness and fatigue



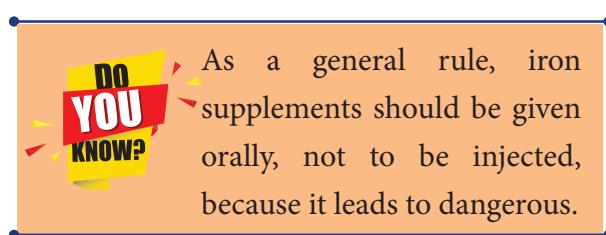
- If the anemia is very severe, face and feet may be swollen, the heartbeat rapid, and the person may have shortness of breath.
- Children and women who like to eat dirt are usually anemic.



Consuming iron containing food

Sources

- ❖ **Food** – Moringa leaves, Dates, Liver (Sheep and Chicken), Green, green leafy vegetables like beans, peas, lentils and Greed banana.
- ❖ **Pills** - Cod liver oil tablet, Ferrous sulfate.



Safety and First Aid

First aid is the immediate treatment given to the victim of trauma or sudden illness before medical help is made available.

The first aid is

- ❖ To save the life
- ❖ To prevent further bleeding and determine the condition of the patient
- ❖ To relieve the pain
- ❖ To provide a medical care available at the earliest



3.4.1 Burns

The tissue damage caused by heat, chemical, electricity, sunlight or nuclear radiation is known as Burns. Mostly burns are caused by scalds, building fires, flammable liquid and gases. There are three types of burns, according to degree of burning.

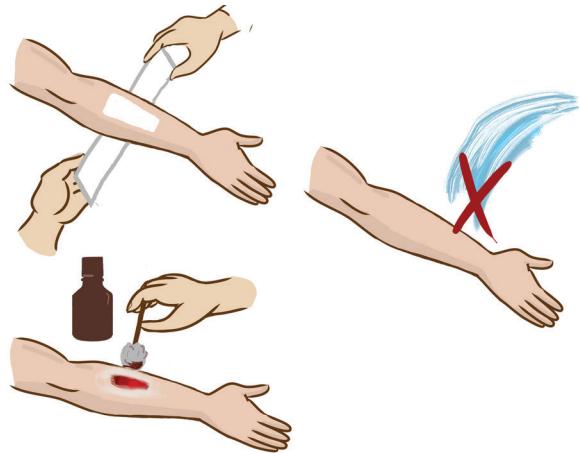


- First-degree burns affect only the outer layer (called the epidermis) of the skin
- Second-degree burns damage the epidermis and the layer beneath it (called the dermis)
- Third-degree burns involve damage or complete destruction of the skin to its full depth and damage to underlying tissues also. People who experience such burns often require skin grafting.



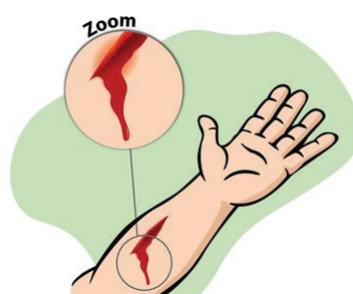
First Aid for Burning

In case of minor burns, the affected area should be washed with cold water and an antiseptic cream should be applied. In case of severe burns, where deeper layers of tissues get destroyed and blisters appear, use of water should be avoided. The burnt area should be covered with a clean non-sticking cloth or bandages. Larger burns need immediate medical attention.



It is very important to keep a fire extinguisher readily available.

3.4.2 Cut and Scratches



Cuts and scratches are areas of damage on the surface of the skin. A cut is a line of damage that can go through the skin and into the muscle tissues below, whereas a scratch is surface damage that does not penetrate the lower tissues.

Cuts and scratches may bleed or turn red, become infected and leave scars.

First aid for cuts



For minor cuts, the affected area should be washed with cold running water and cleaned with an antiseptic liquid. Then apply an antiseptic cream on the wound and sterilized bandage should be tied to prevent infection. If the cut is deep, a clean cotton pad should be placed on the cut and pressed, and the injured person should be taken to a doctor immediately.

Basic cleanliness and protection.

1. The most important thing is to help anybody, but you must also protect yourself from HIV and other blood-borne diseases when you help someone who is bleeding. You should wear gloves or a clean plastic bag on your hands.
2. Be careful not to prick yourself with needles or other sharp objects around the person you are helping.



Queen of Medicines – Penicillin



Alexander Fleming



Alexander Fleming
(1881 - 1955)



Alexander Fleming did his school education at St. Mary's school in London



As he was very much interested in studying medicine at the age of 20, he joined medical course at St. Mary's Medical College and Hospital with the help of his uncle

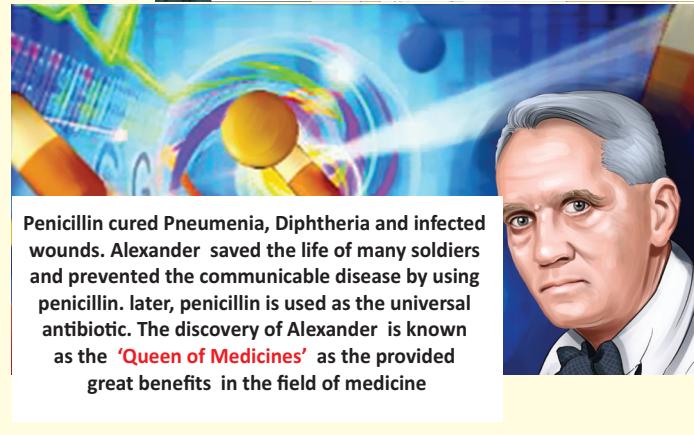
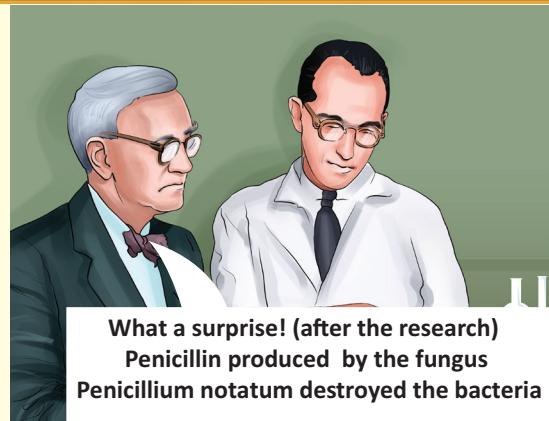
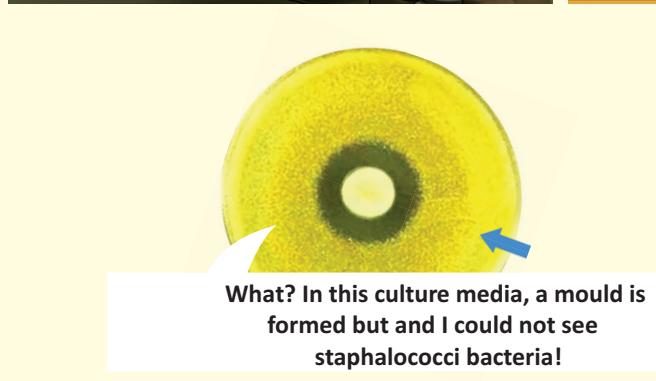
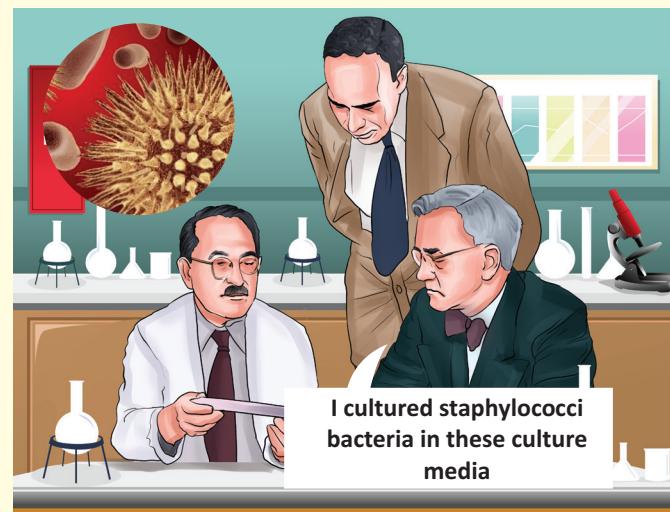


In the first world war, soldiers were wounded heavily and hence many were infected with contagious diseases



He was appointed the Chairman of the Medical Board for military soldiers







Points to remember

Health

A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Communicable diseases

Diseases that are caused by pathogens and can be transmitted from an infected person to a healthy person directly or indirectly.



Evaluation

I. Choose the appropriate answer.

1. Ravi has sound mind and physically fit body. Which refers to
 - a. Hygiene
 - b. Health
 - c. Cleanliness
 - d. wealth

2. Sleep is not only good for body, but it is also good for
 - a. Enjoyment
 - b. Relaxation
 - c. Mind
 - d. Environment

3. Our living place should be
 - a. Open
 - b. Closed
 - c. Clean
 - d. Unclean / Untidy

4. The tobacco chewing causes
 - a. Anamia
 - b. Periodontitis
 - c. Tuberculosis
 - d. Pneumonia

5. The first aid is to
 - a. To save money
 - b. To prevent scars
 - c. To prevent the medical care
 - d. To relieve the pain



Non – Communicable diseases

Diseases that are not caused by pathogens and cannot be passed on by a sick person to a healthy person.

First aid

The immediate care given to a patient before a medical person arrives.

2. I am green colour box with garbage. Who am I? _____
3. Eyes are considered as _____ to the world.
4. The hair follicles produce _____ which keeps the hair smooth.
5. Tuberculosis is caused by the bacterium _____.

III. True or False – If false give the correct statement.

1. All food should be covered.
2. Chicken pox also known as Leucoderma.
3. Stomach ulcer is a non- communicable disease.
4. Rabies is a fatal disease.
5. First – degree burns damage the whole skin.

IV. Match the following:

1.	Rabie	Salmonella
2.	Cholera	Yellow Urine
3.	Tuberculosis	Cramps in legs
4.	Hepatitis	Hydrophobia
5.	Typhoid	Mycobacterium

V. Analogy.

1. First degree burn: epidermis :: second degree burn: _____
2. Typhoid : Bacteria :: Hepatitis : _____
3. Tuberculosis : air :: Cholera : _____

II. Fill in the Blanks.

1. A group of people living together in a particular area is called _____



VI. Choose the correct alternative from the following.

1. Assertion (A) : Oral hygiene is good.

Reason (R) : Sound teeth and healthy gums with healthy surrounding tissues.

- a) Both A and R are true
- b) Both A and R are false
- c) A is true but R is false.
- d) A is false but R is true.

2. Assertion (A) : Chicken pox is a viral communicable disease.

Reason (R) : Characterized by rashes on the whole body, fever, head ache and tiredness.

- a) Both A and R are true
- b) Both A and R are false
- c) A is true but R is false.
- d) A is false but R is true.

VII. Very Short Answer.

1. What is hygiene?
2. Write about the right way of protect the eyes?
3. How to keep your hair clean and healthy?
4. Sobi frequently playing with her mobile. Suggest your ideas to protect his eye from irritation?
5. Give any two communicable disease, which spreads in your locality during monsoon?
6. What first aid will you provide in the case of bruises?
7. Ravi said "Ganga had minor burn, so I washed with water" Do you agree with his statement or not? Explain Why?

VIII. Short Answer.

1. Why the first aid is essential?

2. What this picture Explains?



3. Distinguish between the following pairs
Communicable diseases and **Non-communicable diseases**

4. What steps you will follow to keep the Teeth healthy?
5. Name the mode of transmission of **communicable** disease.
6. The hair is thin, spares and lost very often. Suggested your ideas to reduce this problem?

IX. Answer in detail.

1. Write about any three Communicable diseases in details.
2. List the situations in which first aid is given. What would you do if a person suffers from skin burns?
3. How the disease are transmitted from one person to the other person?

X. Higher order thinking question.

A person is sleeping during day time. Why does this happen with some people that they feel sleepy during day time in office or in the classroom. Have you ever come across such situation? Explain.





Unit 7

Visual Communication



Learning Objectives

After learning the lesson, students will be able to.

- ❖ Differentiate a file from a folder
- ❖ Know how to create a file and a folder
- ❖ Use the system application like *PAINT* to create images.
- ❖ Use the system application like *photo story* to create video from images.





In general, whenever we think of computers, the things that come to our mind is computer screen, keyboard , mouse and CPU. We learnt about computer and parts of a computer as introductory part in standard VI. Apart from that, software and hardware also plays vital role in the working of computer. Now , shall we learn how to operate the computer?

The reason we prefer computer is its speed and the ability to store data. How can we save data and information in computer? We can save them in folders which accommodate multiple files or a single file. Let us understand the terminologies like file and folder before moving further.



File: The output we get from any application is commonly referred as ‘file’. Therefore the application for the specific purposes determines the nature of the file.

7.1 Folder:

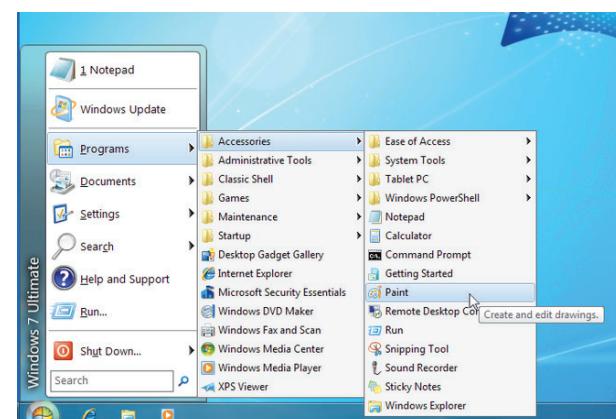
A folder is a storage space that contains multiple files. We can create files as per the user’s need. For clear understanding, we can take the example of a bookshelf in a library. The individual book can be considered as a ‘file’ and the whole set of books in a shelf can

be considered as folders. When we right click on the mouse, the popup menu appears on the screen with multiple options .Select ‘NEW’ option and a secondary menu comes up with another set of options. Select ‘**Folder**’ option in the menu. You can now save your file(s) in the newly created folder.]



More people are using Windows and LINUX operating systems in their computers. We can do many activities like collect notes, draw/paint, create animations /spreadsheets/ word docs/PPTs etc.

We use ‘**Guide Board**’ to go to the unknown places like that when we ‘On’ the computer click the ‘START’ button at the left corner of the computer, it shows the list of all programs in the computer. Now select the required program and create the required files.



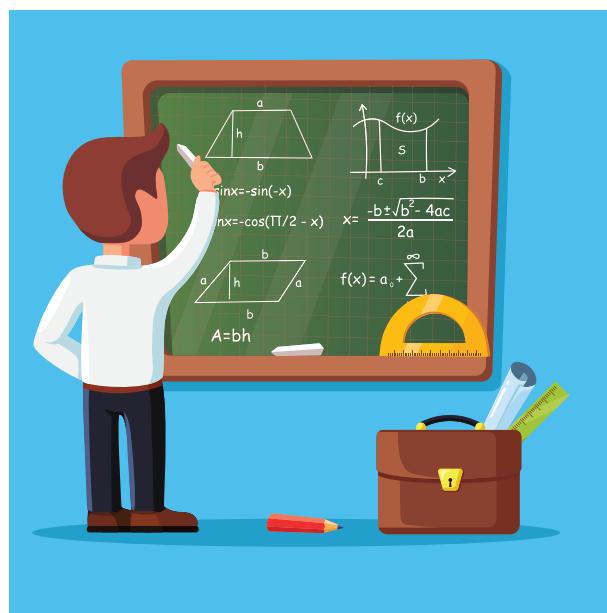
How can we create Files?

For example if the computer is operating on the Windows OS, we can collect our notes in



‘Notepad’ application and draw pictures in ‘Paint’ application.

As per its name we can type notes in ‘Notepad’ and save the created files in a folder. Likewise in the ‘Paint’ app we can draw and edit pictures. With these pictures, let us see how we can create image gallery, animations and graphics easily.



Pictures and audio-visuals gives us more understanding than teaching and writing on the black board. Is it right?



Instead of saying a story like ‘once upon a time there was a king’ we can understand the concept easily by seeing the video and also it registers firmly in the minds of the students. The device which helps in explaining the

concepts easily through pictures is known as ‘Visual Communication Device’. For example photos, audio –visuals, drawings, animations all these can be created easily with the help of computer. Cinema is a good example for ‘Visual Communication Device’.

7.2 Photo Gallery and Photostory:

You all must have admired the photos in the albums.



To beautify photos and edit the photos photographers are using a software known as ‘Photoshop’. Can we make photo gallery only with the help of photos or is there anything more to do with a bunch of photos? We can make photostory. Yes, with the photos we can make a story.

In first standard we have studied photo stories like this. Children learn concepts easily through photo stories than by reading words. This type of photo stories can be converted easily into videos with the help of the software ‘Microsoft Photo story’.



Microsoft Photostory

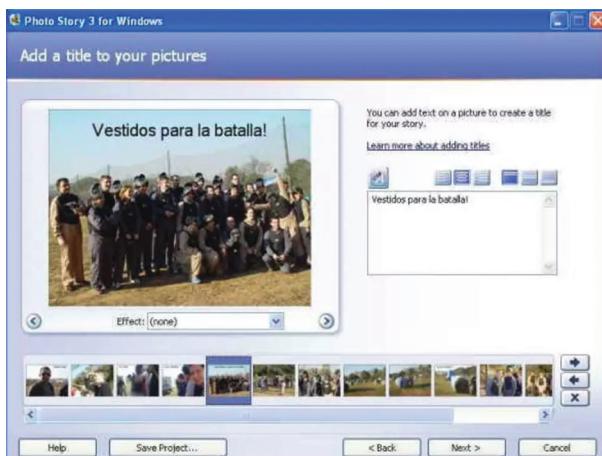
To make videos with the help of this software we have to order the photos first, then we have select a music and keep in a file.



Step 1: Open the application of ‘Microsoft Photostory’. In that select ‘**Begin A New Story**’ and click on Next.

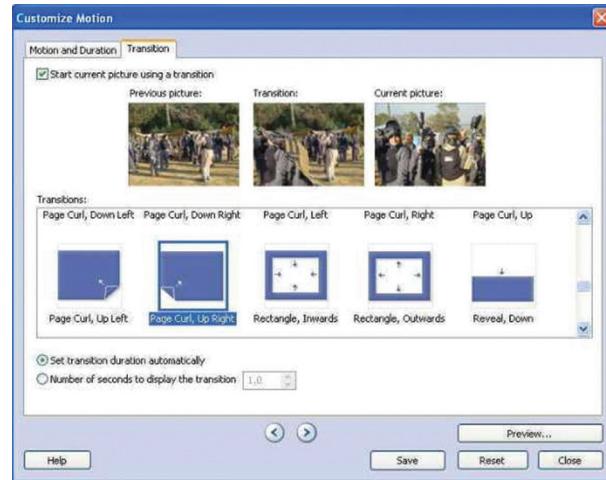


Step 2: Click ‘**Import Picture**’ in the next screen. Now, the files in our computer will appear. Select Saved pictures for video. There is a provision for editing the picture. If required, we can edit the image and click on ‘Next’.

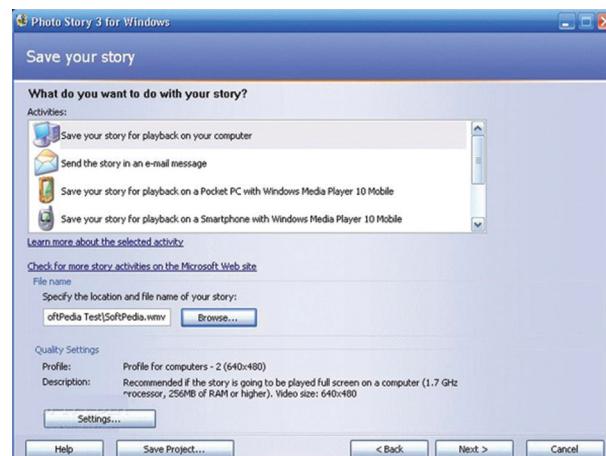


Step 3: Now we can input small text which is apt to the pictures. Then click on ‘Next’ and give animation to the videos. We can give audio effect also to these images. After finishing this click on ‘Next’.

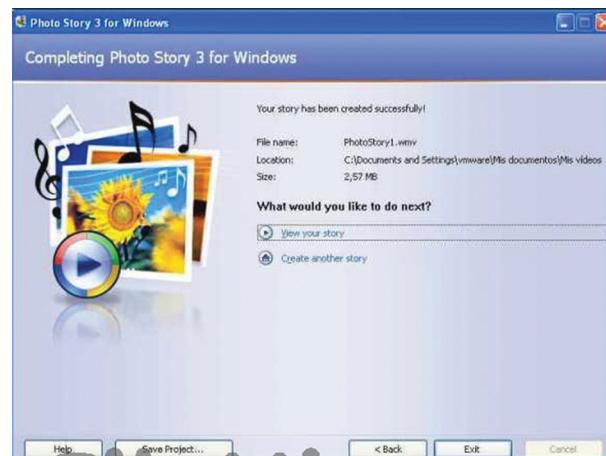
Step 4: To provide background music, we can select a music file through “Select Music” and click on “Next”.



Step 5: Next select a title for the story and select the place where it has to be saved in your computer. Then, through SETTINGS, change the format of the video.



Step 6: Now our video is ready to view. Click ‘VIEW YOUR STORY’. You can see your video now.





GRAPHICS AND ANIMATION:

Raster Graphics

The picture or image which is created by Raster Graphics is entered as it is 'as file and data'. Pictures are of two types one is Vector another one is Raster.



Raster Graphics are created on the basis of **PIXELS**. The photos taken by camera and the photos scanned by a scanner are of the Raster type. When we enlarge this type of photos we could see the pictures as rectangular layers or grids.

Raster File Types:

- .png (Portable Network Graphics)
- .jpg or .jpeg (Joint Photographic Experts Group)
- .gif (Graphics interchange Format)
- .tiff (Tagged Image File Format)
- .psd (Photoshop Document)

The Software which edit the Raster Graphics:

- Adobe Photoshop
- Vector Graphics

As the Vector Pictures are created on the basis of Mathematics, even when we enlarge the picture its accuracy won't change.

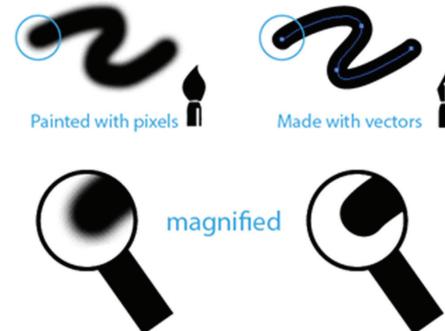
Types of Vector Graphics Files

- .eps (Encapsulated Post Script)
- .ai (Adobe Illustrator Artwork)
- .pdf (Portable Document Format)
- .svg (Scalable Vector Graphics)
- .sketch

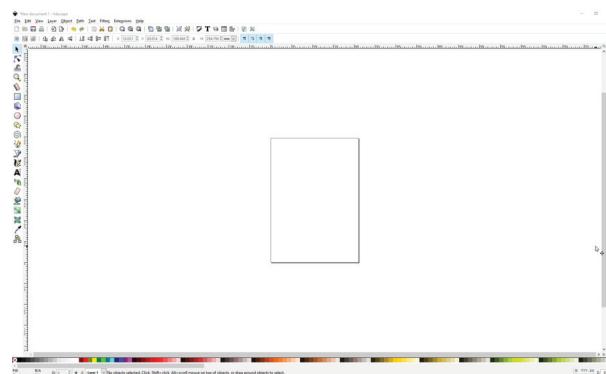
The Softwares which edit the Vector Graphic Images

- Adobe Illustrator
- Sketch
- Inkscape

Inkscape



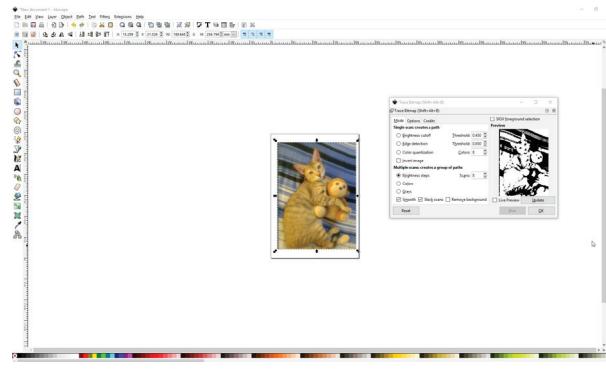
Step 1: First we have to scan the picture we have drawn in the COMPUTER.



Step 2: Then we have to open this picture in the 'INKSCAPE' software. Select the entire picture.



Step 3: Select PATH option. From the submenu, select 'TRACE BITMAP' option.





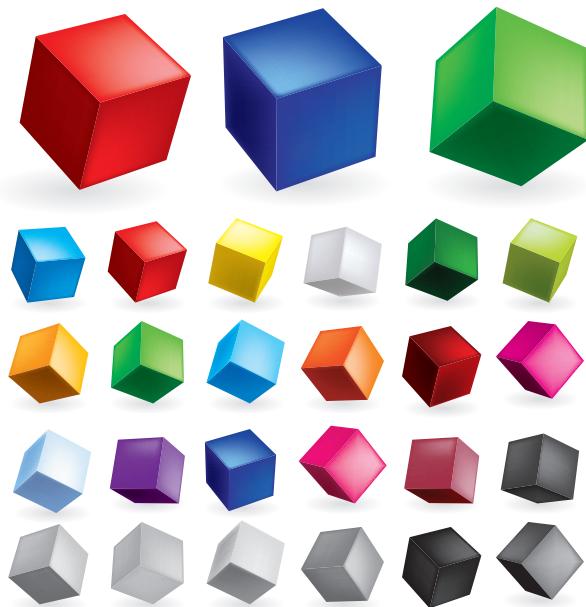
Step 4: Do corrections in the small screen which appears. Now UPLOAD this edited image and click on OK.



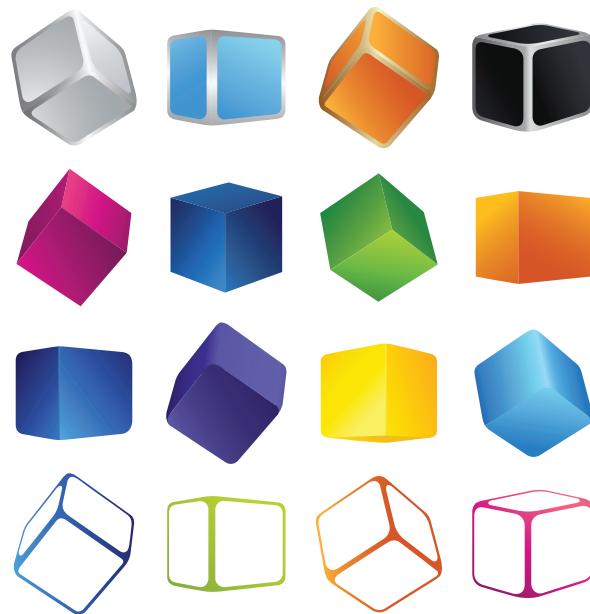
Step 5: Now close the screen of TRACE BITMAP. Now click the picture that appears on the present screen and drag it. You will get the vector graphics of the drawn picture. SAVE it by clicking the 'save button' and save it in your choice of file format.



2 Dimensional and 3 Dimensional Images:



As soon as we see the above picture we know the difference between the two. The first is TWO DIMENSIONAL (2D) another one is THREE DIMENSIONAL (3D). The two dimensional 2D images have only the two dimensions - length and height. But three dimensional images (3D) have length, height and width. 3D images appear in front of our eyes like it happens in the real world.



Three dimensional videos will bring the scenes alive before our eyes. Already there are three dimensional films. Now three dimensional games have also got released.

Now there is another new technology - VIRTUAL REALITY in 3D. VIRTUAL REALITY is a technology which shows the computer image as real image. When we see games through this technology we can feel/ perceive the setting of the game as real. Now this technology has been introduced in Smart Phones too.



Evaluation

I. Choose the correct answer.

1. Which is the example for an Wimation ?
a) sound communication
b) visual communication
c) vector communication
d) raster communication
2. Who uses the Photoshop software more ?
a) Teacher b) Doctor
c) Painter d) Photographer
3. Which option is used in the Microsoft Photostory to upload the photos?
a) Begin a Story b) Import Pictures
c) Settings d) View your Story
4. Which technology shows the computer-drawn pictures as real picture.
a) Inkscape b) Photo Story
c) Virtual Reality d) Adobe Illustrator



5. Which technology uses pixels to create pictures
a) Vector b) Raster
c) both d) None
6. Which software is used to create symbols
a) Photoshop b) Illustrator
c) Vector Graphics d) Photostory

II. Match the Following:

1. Animations	3D
2. Raster	Visual Communication
3. Vector	Pixles
4. Virtual Reality	Microsoft Photostory
5. Video Story	Illustrator

III. Answer the following Questions.

1. What is Raster Graphics?
2. Write notes on 2D and 3D pictures
3. Differentiate between Raster and Vector
4. With the help of Microsoft Photostory how will you create a video on a photostory?

A-Z GLOSSARY

Atoms	-	அணுக்கள்
Anion	-	எதிர்மின் அயனி
Asexual Reproduction	-	பாலிலா இனப்பெருக்கம்
Androecium	-	மகரந்தத்தான் வட்டம்
Anemia	-	இரத்த சோகை
Antiseptic	-	கிருமிநாசினி / நச்சுத்தடை பொருள்
Acceleration	-	முடுக்கம்
Aphelion	-	தூரியனுக்கு, தொலைவில் இருக்கும் பூமியின் நிலை (portion)
Astronomy	-	வானியல் பொருட்களைப் பற்றி படிக்கும் இயற்பியலின் ஒரு பிரிவு
Anion	-	எதிர்மின் அயனி



Budding	-	மொட்டு விடுதல்
Burn	-	தீக்காயம்
Bruise	-	கன்றிப்போன காயம்
Compound	-	இரண்டு அல்லது அதற்கு மேலான, வேறுபட்ட மூலக்கூறுகளிலான சேர்மம்
Chemical formula	-	அணுக்கள் மற்றும் மூலக்கூறுகளைக் குறிக்கக்கூடிய குறியீடு
Cation	-	நேர்மின் அயனி
Coloumb	-	மின்னுட்டத்தின் அலகு
Calyx	-	புல்லி வட்டம்
Corolla	-	அல்லி வட்டம்
Communicable disease	-	தொற்று நோய்கள்
Cross Pollination	-	அயல் மகரந்தச் சேர்க்கை
Centre of gravity	-	ஸ்ரப்பு மையம்
Celestial bodies	-	வானியல் பொருள்கள்
Ductile	-	கம்பியாக மாற்றக்கூடிய தன்மைவாய்ந்த உலோகம்
Density	-	ஓரலகு பருமனில் அடங்கியுள்ள மொத்த பொருளின் நிறை
Distance	-	தொலைவு
Displacement	-	இடப்பெயர்ச்சி
Derived quantities	-	அடிப்படை அளவுகளிலிருந்து தருவிக்கப்பட்ட அளவுகள்
Element	-	ஒரே வகை அணுக்களினால் ஆன தனிமம்
Equilibrium	-	சமநிலை
Free radical	-	முடிவுறாமூலக்கூறு
Fragmentation	-	துண்டாதல்
Fertilization	-	கருவறுதல்
First Aid	-	முதலுதவி
Gynoecium	-	தூலக வட்டம்
Gingivitis	-	பல்ஸறு வீக்கம்
Ion	-	அயனி
Inter atomic Distance	-	இரு அணுக்களுக்கு இடையே உள்ள தொலைவு
Matter	-	அணு மற்றும் மூலக்கூறுகளினால் ஆன பருப்பொருள்
Malleable	-	தகடாக மாற்றக்கூடிய தன்மைவாய்ந்த உலோகம்
Mass	-	பருப்பொருள்களில் அடங்கியுள்ள பொருளின் அளவு
Melting	-	திடப்பொருள் திரவமாக மாறக்கூடிய நிகழ்வு
Matter	-	பருப்பொருள்
Molecules	-	மூலக்கூறுகள்



Meditation	-	தியானம்
Measuring container	-	அளவுகள் குறிக்கப்பட்ட கொள்கலன்
Non- Uniform Acceleration	-	சீரற்ற முடுக்கம்
Negative Acceleration	-	எதிர் முடுக்கம்
Neptune	-	தூரிய குடும்பத்தில் உள்ள ஒரு கோளின் பெயர்
Orbit	-	ஆற்றல் மட்டம்
Particles	-	சிறிய துகள்கள்
Pollination	-	மகரந்தச் சேர்க்கை
Plaque	-	பல் சொத்தை / பல்தட்டை
Pustules	-	கொப்பளங்கள்
Positive Acceleration	-	நேர் முடுக்கம்
Perihelion	-	தூரியனுக்கு அருகில் இருக்கும் பூமியின் நிலை (position)
Physical quantity	-	ஒரு பொருளின் இயற்பியல் பண்புகளின் அளவுகள்
Sexual Reproduction	-	பாலினப் பெருக்கம்
Subatomic particles	-	அணுவகத் துகள்கள்
Self Pollination	-	தன் மகரந்தச் சேர்க்கை
Speed	-	வேகம்
SI – System of international unit	-	பன்னாட்டு அலகு முறை
Tuberculosis	-	காச நோய்
Uniform Acceleration	-	சீரான முடுக்கம்
Valency	-	இணைத்திறன்
Vegetative propagation	-	உடல் வழி இனப்பெருக்கம்
Velocity	-	திசைவேகம்
Vacuum	-	வெற்றிடம் (காற்று இல்லாத இடம்)



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STANDARD SEVEN

TERM - I

VOLUME - 3

HISTORY





CONTENTS

History

Unit	Titles	Page No.
1.	Sources of Medieval India	110
2.	Emergence of New Kingdoms in North India	119
3.	Emergence of New Kingdoms in South India: Later Cholas and Pandiyas	131
4.	The Delhi Sultanate	143

Geography

1.	Interior of the Earth	155
2.	Landforms	167
3.	Population and Settlement	176

Civics

1.	Equality	186
2.	Political Parties	192

Economics

1.	Production	201
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E - Book



Assessment



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Unit -1

Sources of Medieval India



Inscriptions: Temple Wall, Copper Plate & Palm Leaf

Learning Objectives

To acquaint ourselves with

- ❖ Sources of the study of medieval India
- ❖ Temples, mosques, tombs, palaces and forts as important sources
- ❖ Literary and inscriptional texts
- ❖ Accounts of Arab and Turkish travellers



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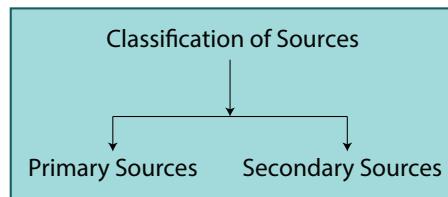
Introduction:

The periods from A.D. (CE) 700 to 1200 and from A.D. (CE) 1200 to 1700 are classified as Early Medieval and Later Medieval periods, respectively, in Indian history. Numerous and varied sources are fortunately available to the historians engaging in the study of Medieval India. Added to the information that can be gleaned from inscriptions, monuments and coins are the accounts left by Arab, Persian and Turkish chroniclers. These accounts are rich in detail and have given first-hand information on the life of kings, though they provide very little information on the life of the common people. The opinions of the courtiers and chroniclers are often one-sided, written in a hyperbolic language, exaggerating the king's achievements. Let us now explore the various sources available for the study of the history of Medieval India.

Do you know the famous words of Khafi Khan, a courtier of Emperor Aurangzeb? He says, 'It is the duty of an historian to be faithful, to have no hope of profit, no fear of injury, to show no partiality on one side, or animosity on the other, to know no difference between friend and stranger, and to write nothing but with sincerity.'

Sources

Sources are the supporting materials, documents or records in the form of evidence that help to reconstruct the past.



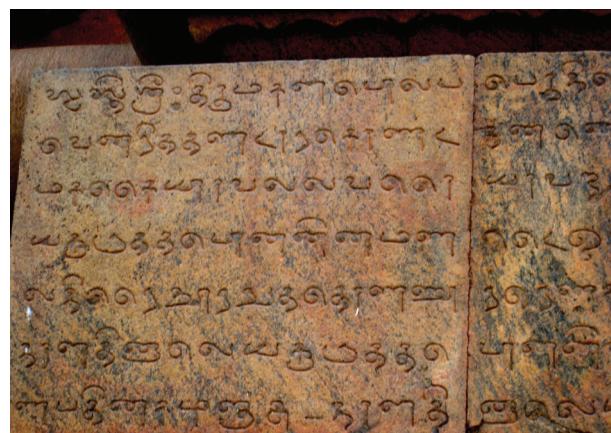


We examine the details of political, economic and socio-cultural developments with the aid of sources.

Primary Sources: Inscriptions, monuments and coins, and the information available in them.

Secondary Sources: Literary works, chronicles, travelogues, biographies and autobiographies.

Inscriptions



Rock Inscription

Inscriptions are writings engraved on solid surfaces such as rocks, stones, temple walls and metals. The king's royal decrees, dedications and donations, monuments raised in commemoration of victories in wars, those built in memory of deceased warriors, contain rich information about the concerned era.

Various types of lands gifted by the Chola kings are known from the inscriptions and copper plates. They are:

Vellanvagai	-	land of non-brahmin proprietors
Brahmadeya	-	land gifted to Brahmins
Shalabhoga	-	land for the maintenance of a school
Devadana	-	land gifted to temples
Pallichandam	-	land donated to Jaina institutions

Copper-plate grants, which were treated as legal documents, have significant source value. The Islamic-Persian practices and the relatively high cost of copper plates made palm leaf and paper cheaper alternatives from 13th century onwards.

Several copper-plate grants issued during the later Chola period (10th to 13th century) record gifts to individual priests or teachers who were Hindu, Buddhist, or Jaina, or to persons of eminence. Both the giver and the receiver are very elaborately described. By contrast, most stone inscriptions differ in their content. In stone inscriptions, the beneficence of a donor is recorded. The major focus is upon the giver. Tiruvalangadu plates of Rajendra Chola I and the Anbil plates of Sundara Chola are notable examples. Uttiramerur inscriptions in Kanchipuram district provide details of the way in which the village administration was conducted.



Copper plate Inscription

Monuments

Temples, palaces, mosques, tombs, forts, minars and minarets are called by the collective name monuments.

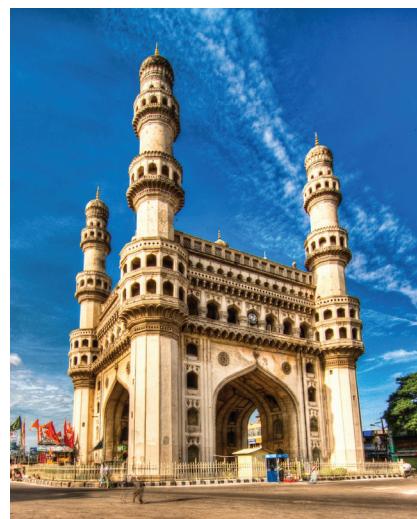


The Sultans of Delhi introduced a new type of architecture. The monuments they built had arches, domes and minarets as the main features. The inscriptions in these monuments contain



Dilwara Temple Mt. Abu

rich information, which can be used to construct history. The medieval Khajuraho monuments (Madhya Pradesh) and temples in Konark (Odisha) and Dilwara (Mt. Abu, Rajasthan) constitute valuable sources to understand the religion-centered cultural evolution in northern India. Temples in Thanjavur (Brihadeeshwara), Gangaikonda Cholapuram and Darasuram symbolise the magnificent structures the Later Cholas built in Tamil Nadu. Vitala and Virupaksha temples at Hampi similarly speak of the contribution of Vijayanagara rulers (15th century).



Charminar

Quwwat-ul Islam Masjid, Moth-ki-Masjid, Jama Masjid, Fatehpur Sikri Dargah



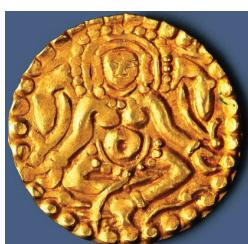
Hampi - Vijayanagar

(all in and around Delhi) and Charminar (Hyderabad) are the important mosques belonging to the medieval times.

The forts of historical importance are Agra Fort, Chittor Fort, Gwalior Fort and Delhi Red Fort as well as the forts of Daulatabad (Aurangabad) and Firoz Shah Kotla (Delhi). Palaces in Jaipur, Jaisalmer and Jodhpur signify the greatness of the Rajput dynasty that wielded enormous power from these places. Qutb Minar and Alai-Darwaza, the tombs of Iltutmish, Balban and all the Mughal rulers are the other prominent structures recognised as valuable sources of information. Cities in ruin such as Firozabad and Tughlaqabad in north India and Hampi in south India remain rich repositories of the history of medieval India.

Coins

The picture and the legend on the coins convey the names of kings with their titles and portraits, events, places, dates, dynasties and logos. The composition of metals in the coins gives us information on the economic condition of the empire. Mention of king's achievements like military conquests, territorial expansion, trade links and religious faith can also be found in the coins.



Lakshmi Coin of Ghori



Coins of Khalji

Muhammad Ghori had stamped the figure of Goddess Lakshmi on his gold coins and had his name inscribed on it. This coin tells us that this early Turkish invader was in all likelihood liberal in religious outlook.

Copper Jitals are available for the study of the period of the Delhi Sultans. Silver Tanka introduced by Iltutmish, Ala-ud-din Khalji's gold coins, Muhammad-bin-Tughluq's copper *token currency* are indicative of coinage as well as the economic prosperity or otherwise of the country of the time.

A jital contained 3.6 grains of silver. Forty-eight jitals were equal to 1 silver tanka.



Religious Literature

Devotional movement in South India and later in North resulted in the development of bhakti or devotional literature. The Chola period was known as the period of devotional literature and works such as *Kamba Ramayanam*, Sekkizhar's *Periyapuranam*, *Nalayira Divyaprabhandham*, composed by 12 Azhwars and compiled by Nathamuni,

Devaram composed by Appar, Sambandar and Sundarar and compiled by Nambiyandar Nambi, Manikkavasagar's *Thiruvatasagam*, all were scripted during the Chola times. Jayadeva's *Gita Govindam* (12th century) was a follow-up of the Bhakti Movement in South India. Kabir Das, a 15th century mystic poet, also had an influence on the Bhakti Movement in India.

Secular Literature

Madura Vijayam and *Amuktamalyatha* were poems composed by Gangadevi and Krishnadevaraya respectively that help us gain insight into the events and individuals associated with the Vijayanagara Empire. Chand Bardai's *Prithviraj Raso* portrays the Rajput king's valour. We have no Indian accounts about what happened during the Turkish invasion of India. For pre-Islamic periods, the only exception was Kalhana's *Rajtarangini* (11th century).

Books, Biographies and Autobiographies

Minhaj-us-Siraj, patronised by Sultan Nazir-ud-din Mahmud of Slave Dynasty, wrote *Tabakat-i-Nasiri*. The compendium deals with the period from the conquest of Muhammad Ghori to A.D. (CE) 1260. The compendium was named after his patron. In the 13th century, Hasan Nizami, a migrant from Ghazni wrote, *Taj-ul-Ma'sir* towards the end of Iltutmish's rule. It provides information about Qutb-ud-din Aibak and is considered the first official history of the Delhi Sultanate. Zia-ud-Barni, a courtier of Muhammad Tughluq, wrote *Tarikh-i-Firoz Shahi*, in which he dealt with the history of Delhi Sultanate from Ghiyas-ud-din Balban to the early years of the reign of Firoz Shah Tughluq. Ferishta's *Tarikh-i-Frishta* (16th century) deals with the history of the rise of the Mughal power in India.



DO YOU KNOW?

Tabakat is an Arabic word meaning generations or centuries.

Tuzk is a Persian word meaning autobiography.

Tarikh or *Tahquiq* are Arabic words meaning history.

stayed in India for 10 years. The most accurate account of Mahmud's Somnath expedition is that of Alberuni. As learned man and a scholar, he travelled all over India trying to understand India and her people. He learnt Sanskrit and studied the philosophy of India. In his book *Tahquiq-i-Hind*, Alberuni discussed the Indian conditions, systems of knowledge, social norms and religion.

In the 16th century, emperor Babur's *Babur Nama* and Abul Fazal's *Ain-i-Akbari* and Akbar Nama provided detailed information about these two emperors. In the 17th century, Jahangir wrote his memoir, *Tuzk-i-Jahangiri*, throwing a lot of light on the period. Apart from autobiographies of emperors, *Tabakat-i-Akbari*, authored by Nizam-ud-din Ahmad, is considered reliable than the exaggerated account of Abul Fazal. Similarly, Badauni's outstanding work, *Tarikh-i-Badauni* (Badauni's History), was published in 1595. This work spans three volumes. The volume on Akbar's reign is a frank and critical account of Akbar's administration, particularly of his religious policy.

Travellers and Travelogues

Marco Polo, a Venetian traveller, visited when the Pandya kingdom was becoming the leading Tamil power in the 13th century. Marco Polo was twice in Kayal, which was a port city (presently in Thoothukudi district of Tamilnadu). It was full of ships from Arabia and China. Marco Polo tells us that he himself came by a ship from China. According to Marco Polo, thousands of horses were imported into southern India by sea from Arabia and Persia.

Al-Beruni (11th century) accompanied Mahmud of Ghazni in one of his campaigns, and

Ibn Battuta (14th century), an Arab-born Morocco scholar, travelled from Morocco right across North Africa to Egypt and then to Central Asia and India. His travelogue (*Rihla [The Travels]*) contains rich details about the people and the countries he visited. According to him, Egypt was rich then, because of the whole of the Indian trade with the West passed through it. Ibn Battuta tells us of caste in India and the practice of *sati*. We learn from him that Indian merchants were carrying on a brisk trade in foreign ports and Indian ships in the seas. He describes the city of Delhi a vast and magnificent city. Those were the days when Sultan Muhammad bin Tughluq transferred his capital from Delhi to Devagiri (Daulatabad) in the south, converting this city into a desert.



Ibn Battuta



In the South, Vijayanagar had many foreign visitors who left behind their detailed accounts of the state. An Italian named Nicolo Conti came in 1420. Abdur-Razzaq came from Heart (the court of Great Khan in Central Asia) in 1443. Domingo Paes, a Portuguese traveller, visited the city in 1522. All of them recorded their observations, which are very useful for us today to know the glory of the Vijayanagar Empire.

Summary

- ❖ The period from A.D. (CE) 700 to 1200 and from A.D. (CE) 1200 to 1700 are classified as Early Medieval and Later Medieval periods in Indian history.
- ❖ Sources are classified as primary and secondary sources.
- ❖ Inscriptions on stones, rocks and temple

walls and copper-plate grants with royal orders and events in the courts, which have evidentiary value are dealt with.

- ❖ Temples, palaces, mosques, tombs, forts, minars and minarets, collectively known as monuments, belonging to early Medieval and Mughal periods, are highlighted.
- ❖ The coins of Iltutmish, Ala-ud-din Khalji and copper coins of the later Islamic rulers are discussed.
- ❖ Devotional literature belonging to the era of Bhakthi Movement is provided.
- ❖ Books, biographies and autobiographies that provide information about the political, social and economic conditions of the medieval times are detailed.
- ❖ Travellers' accounts mostly by the visiting Arab and Persian scholars are given in the end.

Glossary			
1.	chronicler	a person who writes accounts of important historical events	வரலாற்றுப் பதிவாளர்
2.	animosity	hostility, antagonism	விரோதம், பக்கமை
3.	travelogue	a book or illustrated account of the places visited and experiences encountered by a traveller	பயணக்குறிப்புகள்
4.	commemoration	in remembrance of	நினைவாக
5.	elaborately	in detail	விரிவாக
6.	minarets	a tall tower, typically part of a mosque	தூபிகள்
7.	repositories	the places, buildings where materials are stored or kept	களஞ்சியங்கள்
8.	portraits	pictures , images in drawing or painting	உருவப்படங்கள்
9.	compendium	a collection of detailed information about a particular subject , especially in a book	தொகுப்பு
10.	substantiate	to prove with evidence	சான்றுகளுடன் நிருபித்தல்



Evaluation

I. Choose the correct answer

1. _____ are the writings engraved on solid surfaces such as rocks, stones, temple walls and metals.
 - a) Chronicles
 - b) Travelogues
 - c) Coins
 - d) Inscriptions
2. _____ was the land gifted to temples.
 - a) Vellanvagai
 - b) Shalabhoga
 - c) Brahmadeya
 - d) Devadana
3. _____ period was known as the period of devotional literature.
 - a) Chola
 - b) Pandya
 - c) Rajput
 - d) Vijayanagara
4. _____ provides information about the first Sultan of Delhi.
 - a) Ain-i-Akbari
 - b) Taj-ul-Ma'sir
 - c) Tuzk-i-Jahangiri
 - d) Tarikh-i-Frishta
5. _____, an Arab-born Morocco scholar, travelled from Morocco to India.
 - a) Marco Polo
 - b) Al Beruni
 - c) Domingo Paes
 - d) Ibn Battuta



2. _____ had stamped the figure of Goddess Lakshmi on his gold coins and had his name inscribed on it.
3. 3.6 grains of silver amounted to a _____.
4. _____ was patronised by Sultan Nazir-ud-din Mahmud of Slave Dynasty.
5. An Italian traveller _____ visited Vijayanagar Empire in 1420.

III Match the following

A	B
1. Khajuraho	Odisha
2. Konark	Hampi
3. Dilwara	Madhya Pradesh
4. Virupaksha	Rajasthan

IV State true or false

1. Pallichandam was the land donated to Jaina institution.
2. The composition of metal coins gives us information on the political condition of the empire.
3. The high cost of copper made palm leaf and paper cheaper alternatives for recording royal orders and events in royal courts.
4. Domingo Paes, a Portuguese traveller, visited the Chola Empire in 1522.

V Match the statement with the reason

Tick (✓) the appropriate answer.

Assertion(A) :- Muhammad Ghori's gold coins carried the figure of Goddess Lakshmi.

Reason (R) :- The Turkish invader was liberal in his religious outlook.

- a) R is the correct explanation of A.
- b) R is not the correct explanation of A.
- c) A is wrong and R is correct.
- d) A and R are wrong.

II Fill in the Blanks

1. _____ inscriptions provide details about administration in a Brahmadeya village.



b) Find out the wrong pair

- | | |
|--------------------------|------------------------|
| 1. <i>Madura Vijayam</i> | - Gangadevi |
| 2. Abul Fazal | - <i>Ain-i-Akbari</i> |
| 3. Ibn Battuta | - <i>Tahqiq-i-Hind</i> |
| 4. <i>Amuktamalyatha</i> | - Krishnadevaraya |

c) Find out the odd one

Inscriptions, Travelogues, Monuments, Coins,

VI Answer the following in one or two sentences

1. Who compiled *Nalayira Divyaprabhandham*?
2. What does the word *Tuzk* mean?
3. Name Jahangir's memoir.
4. Name the two different types of sources for the study of history.
5. List out the important mosques and forts constructed during the medieval times.
6. Mention the important foreign travellers who visited India during the medieval period.

VII Answer the following

1. Describe the different types of coins introduced by the rulers of Delhi Sultanate.

IX HOTs

1. The composition of metals in coins is indicative of the economic prosperity of the empire – Substantiate.

X Student Activity

Prepare an album collecting pictures of palaces, tombs, mosques and forts of Medieval India.

XI Life skill

1. Find out from the libraries in your town or village and prepare a report about the primary and secondary sources available there.

References

1. Abraham Eraly, *The Age of Wrath*, New Delhi:Penguin Group, 2014.
2. Burton Stein, *A History of India*, New Delhi: Oxford University Press, 2004 (Reprint).
3. K.A. Neelankanta Shastri, *Cholas*. Madras: University of Madras (Reprint).
4. S.K. Singh, *History of Medieval India*. New Delhi: Axis Books Private Ltd, 2013.

VIII Answer Grid

1. _____ was a courtier of Emperor Aurangazeb. Ans:	2. Tiruvalangadu copper plates belong to _____. Ans:
3. _____ was the land for the maintenance of the school. Ans:	4. _____ compiled Periyapuramam. Ans:
5. _____ is an Arabic word meaning history. Ans:	6. Muhammed bin Tughluq transferred his capital from Delhi to _____ in the south. Ans:



ICT CORNER

Sources of Medieval India

This activity helps you to know about the rare collection of coins.



PROCEDURE :

- Step 1:** Open the Browser and type the given URL (or) Scan the QR Code.
- Step 2:** Click “India” Option and then select any period (Ex. Medieval)
- Step 3:** Select any dynasty and then select any Kingdom (Ex. Sultanate)
- Step 4:** Explore the coins with pictorial descriptions.

Step 1

Step 2

Step 3

Step 4

Sources of Medieval India URL:

<https://www.mintageworld.com/> (or) scan the QR Code

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.





Unit -II

Emergence of New Kingdoms in North India



Khandarya Temple

Learning Objectives

- ❖ To acquire knowledge about the kingdoms of Rajputs and their counterparts in North India
- ❖ To assess the contributions of Rajputs and Palas to Indian culture
- ❖ To know about the early military expeditions of Arabs and Turks



YUX5T4

Introduction:

There are plenty of stories that speak of the valour and chivalry of Rajputs. Rajput states formed a collective entity that was called Rajputana. Chittor was prominent and had become the rallying point for all Rajput clans. It was small compared to Malwa and Gujarat. Yet the Rajputs ruled over these states. In commemoration of the victory of Rana of Chittor over Malwa, the *Jaya Stambha*, the tower of victory, was built in Chittor. The Pratiharas and the Palas had established their powerful kingdoms in western India and in eastern India respectively. By the 9th century, the Pratihara dynasty had progressed to such an extent that it called itself the sovereigns of Rajasthan and Kanauj. The decline of Pratihara kingdom led to the rise of Palas in Bengal and Chauhans in north-western India. India's Islamic period might have begun

in the immediate context of Arabs' conquest of Sind (A.D. (CE)712) rather than in A.D. (CE)1200. But the resistance shown by the kings of Kanauj, especially of Yasovarman (A.D. (CE)736) and later by the Rajput chiefs and kings who held Kanauj and most of northern India until the middle of the 10th century made it impossible.



Jaya Stambha

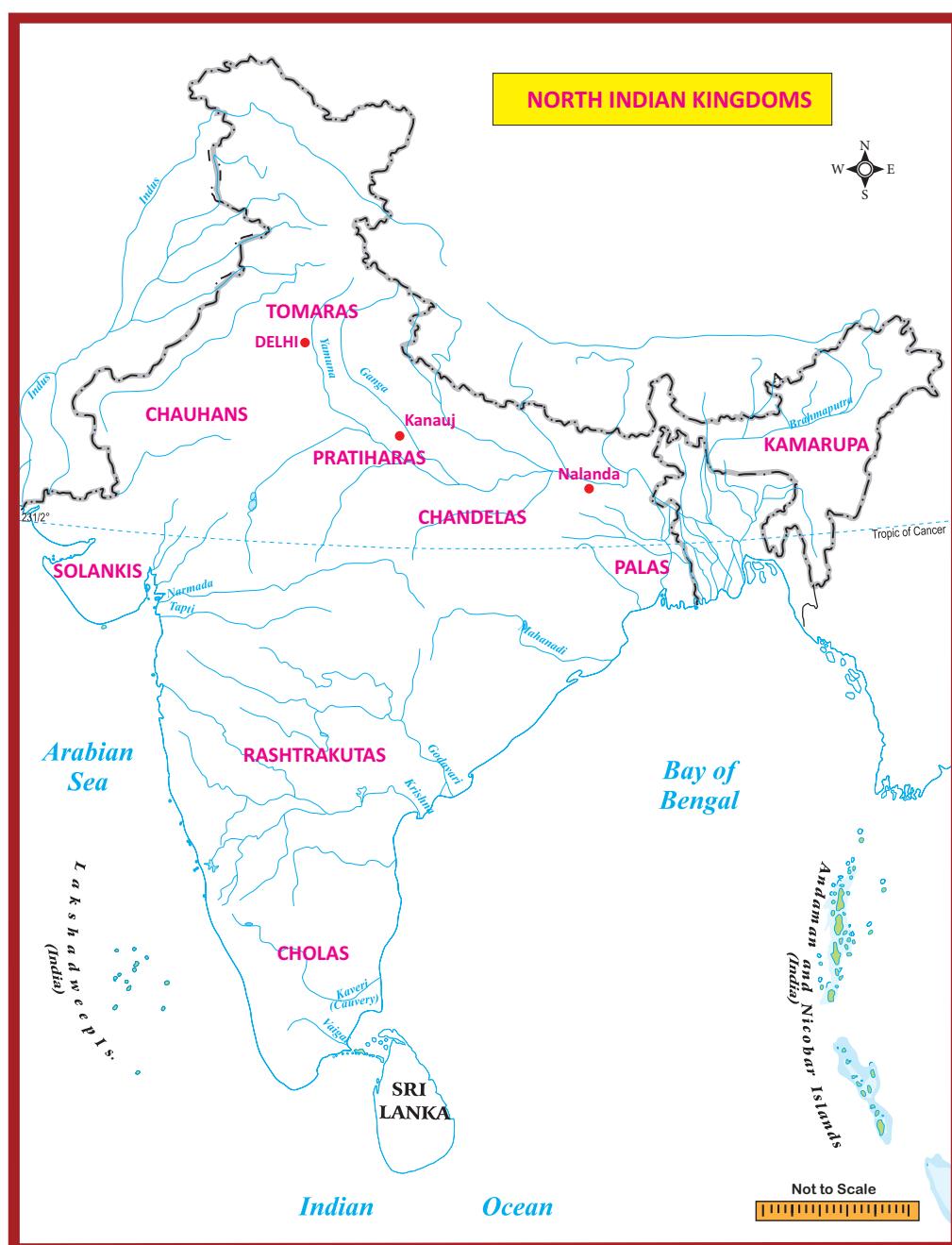


Origin of the Rajputs

The word 'Rajput' is derived from the Sanskrit word Rajputra, which means 'scion of the royal blood'. After the death of Harsha in A.D. (CE) 647, various Rajput clans established kingdoms in different parts of northern and central India. The Rajputs trace their pedigree far back into the past. Their three principal houses are the *Suryavanshi* or the Race of the Sun, the *Chandrvanshi* or the Race of the Moon and the *Agnikula* or the Race of Fire God. Among those

who claimed descent from solar and lunar lines, Chandelas of Bundelkhand were prominent. Tomaras were ruling in the Haryana region. But they were overthrown by the Chauhans in the 12th century.

Thirty-six royal Rajput clans were listed by the Oriental scholar James Tod in A.D. (CE) 1829. Among them four claimed a special status: the Pratiharas, the Chauhans, the Chalukyas (different from the Deccan Chalukyas), known





as Solankis, and the Paramaras of Pawars. All the four clans were of the Agnikula origin.

Pratiharas

The Pratiharas or Gurjara Pratiharas, one of the four prominent clans of the Rajputs, ruled from Gurjaratra (in Jodhpur). In the 6th century A.D. (CE), Harichandra laid the foundation of the Gurjara dynasty. Nagabhatta I was the first and prominent ruler of Pratiharas. In the 8th century, he ruled over Broach and Jodhpur and extended his dominion upto Gwalior. He repulsed the invasion of the Arabs of Sind from the east and checked their expansion. He was succeeded by Vatsaraja, who desired to dominate the whole of North India. His attempt to control over Kanauj brought him into conflict with the Pala ruler Dharmapala.

There was a prolonged tripartite struggle between the Gurjara Pratiharas of Malwa, the Rashtrakutas of Deccan and the Palas of Bengal, as each one of them wanted to establish their supremacy over the fertile region of Kanauj. In the process, all the three powers were weakened.

Vatsaraja's successors Nagabhatta-II and Rambhadra did not do anything impressively. Mihirabhoja or Bhoja, son of Rambhadra, within a few years of his accession, succeeded in consolidating the power of the Pratiharas. As a strong ruler, Bhoja was able to maintain peace in his kingdom. The Arab menace was firmly tackled by him. After Bhoja, the Pratihara Empire continued its full glory for nearly a century.

Having successfully resisted the Arabs, the Pratiharas turned their attention towards the east and by the end of millennium, they ruled over a large part of Rajasthan and Malwa. They also held Kanauj for some time. The Rajputs fought each other endlessly in the 11th and 12th centuries. Taking advantage of these interneccine quarrels, many local kings succeeded in making themselves independent.

Palas

Dharmapala (A.D. (CE) 770 - 810)

Gopala, who founded the Pala dynasty, did not have royal antecedents. He was elected by the people for his superior capabilities. During his reign from 750 to 770, Gopala laid the foundations for the future greatness of this dynasty in Bengal. Dharmapala, his son, made the Pala kingdom a powerful force in northern Indian politics. He led a successful campaign against Kanauj. He was a great patron of Buddhism. He founded Vikramashila Monastery, which became a great centre of Buddhist learning.



Vikramashila Monastery

Dharmapala was succeeded by his son, Devapala, who extended Pala control eastwards into Kamarupa (Assam). Devapala was also a great patron of Buddhism. He gifted five villages to Buddhists. He also constructed many temples along with monasteries in Magadha. According to the historian R.C. Majumdar, 'The reigns of Dharmapala and Devapala constitute the most brilliant chapter in the history of Bengal.'



After Devapala, five rulers ruled the region insignificantly. The kingdom attained unprecedented glory when Mahipala ascended the throne in 988.

Mahipala I (988 - 1038)

Mahipala I was the most powerful ruler of the Pala dynasty. He is called the founder of the second Pala dynasty. The decline of Pratiharas gave the Palas an opportunity to take a leading role in north Indian affairs. But he could not extend his domain beyond Banaras because of the impressive campaigns of the Chola king from the South, Rajendra Chola. Mahipala restored the old glory of the Palas. He constructed and repaired a large number of religious buildings at Banaras, Sarnath and Nalanda.

The Pala dynasty declined soon after the death of Mahipala and gave way to the Sena dynasty.

The Chauhans

The Chauhans ruled between A.D. (CE) 956 and 1192 over the eastern parts of the present-day Rajasthan, establishing their capital at Sakambari. This Rajput dynasty was founded by Simharaji, who was popularly known as the founder of the city of Ajmer.

The Chauhans were the feudatories of the Pratiharas and staunchly stood by them to check the Arab invasions. The last of Chauhan kings, Prithiviraj Chauhan, was considered the greatest of all Chauhan rulers. He defeated Muhammad Ghori in the first battle of Tarain fought in 1191. However, he was defeated and killed in the second battle of Tarain in 1192.



There is a long epic poem *Prithvirajraso*, composed by the bard Chand Bardai, a few centuries later. The story goes like this: The daughter of the King of Kanauj was to marry. A *suyamwara* (the bride choosing the bridegroom of her choice) was held to enable her to choose her husband. But she was in love with Prithiviraj and desired to marry him. Prithiviraj was the enemy of her father. In order to insult him, the King of Kanauj had not only denied him an invitation but had placed a statue of Prithiviraj as door keeper at the entrance to his court. To the shock of everyone assembled, the princess rejected the princes present and garlanded the statue of Prithiviraj, indicating her choice. Prithiviraj, who had been hiding in the vicinity, jumped in and rode away with the princess in a horse. Later both of them were married.

Contribution of Rajputs to Art and Architecture

Art



Rajasthani Painting



Rajput courts were centres of culture where literature, music, dance, paintings, fine arts and sculpture flourished. A specific style of Rajput painting—often focusing on religious themes emerged at Rajput courts. Their style of painting is called ‘Rajasthani’. The Rajasthani style of painting can be seen at Bikaner, Jodhpur, Mewar, Jaisalmer (all in Rajasthan).

Architecture

The Rajputs were great builders. Some of the important examples of the Rajput buildings are the strong fortresses of Chittorgarh, Ranathambhor and Kumbhalgarh (all in Rajasthan), Mandu, Gwalior, Chanderi and Asirgarh (all in Madhya Pradesh).

The examples of domestic architecture of the Rajputs are the palaces of Mansingh at Gwalior, the buildings at Amber (Jaipur) and lake palaces at Udaipur. Many of the Rajput cities and palaces stand among the hills in forts or by the side of beautiful artificial lakes. The castle of Jodhpur in Rajasthan is perched upon a lofty rock overlooking the town.

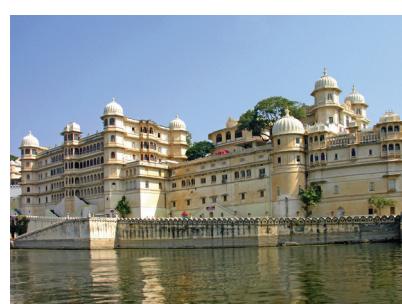
The temples the Rajput rulers built have won the admiration of art critics. The temples in Khajuraho, the Sun temple in Konark, the Dilwara Jain temple constructed in Mount Abu and Khandarya temple at Madhya Pradesh are illustrious examples of their architecture.



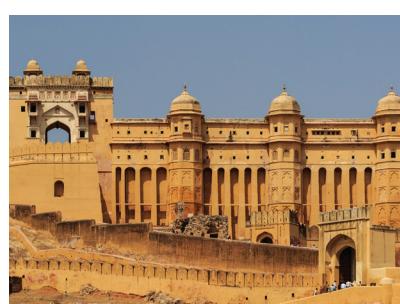
Kajuraho

The Khajuraho in Bundelkhand has 30 temples. The *shikharas* of the Khajuraho temples are most elegant. The exterior and interior parts of the temples are adorned with very fine sculptures. These temples are dedicated to Jain Tirthankaras and Hindu deities like Shiva and Vishnu.

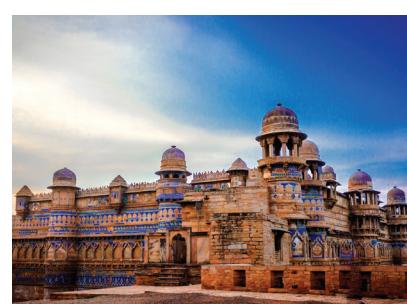
There are sixteen Hindu and Jain temples at Osian, which is 32 miles away from Jodhpur.



Udaipur Lake Palace



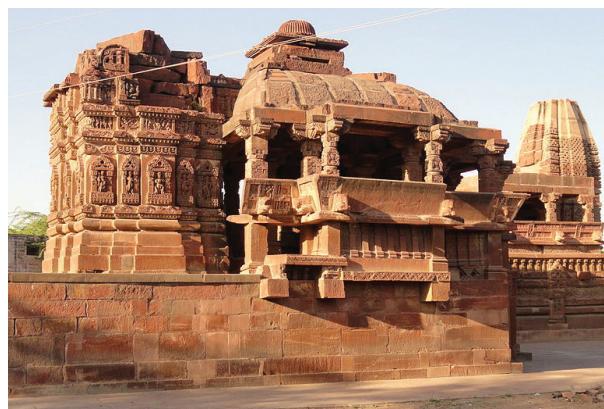
Jaipur Amber Fort



Gwalior Palace



The Jain temple at Mount Abu has a white marble hall and a central dome of 11 concentric rings and richly carved vaulted ceiling and pillars.



Temple at Osian

The *Raksha Bandhan* (*Rakhi*) tradition is attributed to Rajputs. *Raksha* (protection) *Bandhan* (to tie) is a festival that celebrates brotherhood and love. It is believed that if a woman ties a *rakhi* around the wrists of male members, it means they are treating them like brothers. Such men are placed under an obligation to protect them.

Rabindranath Tagore started a mass *Raksha Bandhan* festival during the Partition of Bengal (1905), in which he encouraged Hindu and Muslim women to tie a *rakhi* on men from the other community and make them their brothers. The exercise was designed to counter British efforts to create a divide between Hindus and Muslims.

Contribution of Palas to Culture

The Palas were adherents to the Mahayana school of Buddhism. They were generous patrons of Buddhist temples and the famous universities of

Nalanda and Vikramashila. It was through their missionaries that Buddhism was established in Tibet. The celebrated Buddhist monk, Atisha (981-1054), who reformed Tibetan Buddhism, was the president of the Vikramashila monastery. The Palas also maintained cordial relations with the Hindu-Buddhist state of the Shailendras of Sumatra and Java.

Under Pala patronage, a distinctive school of art arose, called Pala art or **Eastern Indian art**. Pala artistic style flourished in present-day states of Bihar and West Bengal, and also in present-day Bangladesh. It was chiefly represented by bronze sculptures and palm-leaf paintings, celebrating the Buddha and other divinities. The Pala bronze sculptures from this area played an important part in the spread of Indian culture in Southeast Asia.



Palm Leaf Painting of Palas

Advent of Islam

Islam as a religious faith originated at Mecca in Arabia. The founder of Islam was Prophet Muhammad. The followers of Islam are called Muslims. An Islamic state, especially the one ruled by a single religious and political leader, was known as 'Caliphate'. Caliph means a representative of the Prophet Muhammad. Two early Caliphates were 'Umayyads' and the 'Abbasids'. Both the Umayyads and the Abbasids expanded their rule separately by their conquests and by preaching the principles of Islam.

In the 8th century India, the Arab presence appeared in the form of a Muslim army that



conquered the Sind. But their further expansion was made impossible by the kings of Gangetic plains and the Deccan. By the end of the 9th century, with the decline of the Abbasid Caliphate, the Arab garrisons in India and elsewhere threw off Caliph's control and began to rule independently.

The Turkish governor, Alp-Tegin, was one among them whose capital was Ghazni (Afghanistan). His successor and son-in-law Sabuktigin wanted to conquer India from the north-west. But only his son Mahmud succeeded in this endeavour.

Arab Conquest of Sind and its Impact

In A.D. (CE) 712, Muhammad bin Qasim who was the commander of the Umayyad kingdom invaded Sind. Qasim defeated Dahir, the ruler of Sind, and killed him in the battle. The capital of Sind, Aror, was captured. Qasim extended his conquest further into Multan. He organised the administration of Sind. The people of Sind were given the status of 'protected subjects'. There was no interference in the lives and religions of the people. But soon Qasim was recalled by the Caliph.

The Arab scholars visited Sind and studied many Indian literary works. They translated many Sanskrit books on astronomy, philosophy, mathematics and medicine into Arabic. They learnt the numerals 0 to 9 from India. Until then, the people in the West did not know the use of zero. Through the Arabs, Europe gained more knowledge in mathematics. The importance of zero was learnt by them from India. It is believed that the people in the West and the Arabs learnt the game of chess only from the Indians.



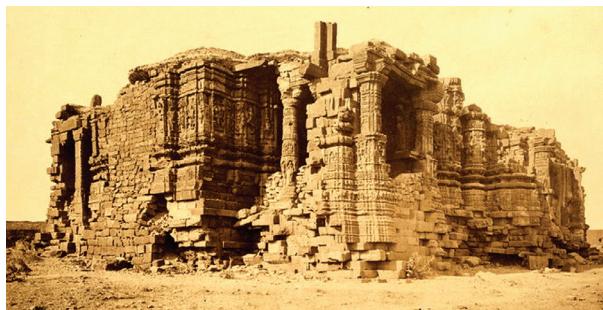
Arrival of Turks in India



Mahmud of Ghazni (A.D. (CE) 997 -1030)

Mahmud is said to have conducted 17 raids into India. At that time, North India was divided into number of small kingdoms. One of them was Shahi kingdom, which extended from Punjab to Kabul. The other important kingdoms were Kanauj, Gujarat, Kashmir, Nepal, Malwa and Bundelkhand. The initial raids were against the Shahi kingdom in which its king Jayapala was defeated in 1001. After his defeat, Jayapala immolated himself because he thought that this defeat was a disgrace. His successor Anandapala fought against Mahmud but was defeated in the battle of Waihind, near Peshawar, in 1008. As a result of his victory at Waihind, Mahmud extended his rule over Punjab.

The subsequent raids of Mahmud into India were aimed at plundering the rich temples and cities of North India. In 1011 he raided Nagarkot in Punjab hills and Thaneshwar near Delhi.



Ruins of Somnath Temple

In 1018 Mahmud plundered the holy city of Mathura. He also attacked Kanauj. The ruler of Kanauj, Rajyapala, abandoned Kanauj and later died. Mahmud returned with enormous riches. His next important raid took place in

Gujarat. In 1024 A.D. (CE) Mahmud marched from Multan across Rajaputana and defeated the Solanki king Bhimadeva I and plundered Anhilwad. Mahmud is said to have sacked the famous temple of Somanath, breaking the idol. Then he returned through the Sind desert. That was his last campaign in India. Mahmud died in 1030 A.D. (CE) The Ghaznavid Empire roughly included Persia, Trans-Oxyana, Afghanistan and Punjab.

Muhammad of Ghor (1149 - 1206)

Muhammad of Ghor or Muhammad Ghori started as a vassal of Ghazni but became independent after the death of Mahmud. Taking advantage of the decline of the Ghaznavid Empire, Muhammad Ghori brought Ghazni under his control. Having made his position strong and secure at Ghazni, Muhammad turned his attention to India. Unlike Mahmud of Ghazni, he wanted to extend his empire by conquering India. In 1175 Muhammad captured Multan and occupied whole of it in his subsequent expeditions. In 1186 he attacked Punjab and captured it.

The Battle of Tarain (1191 - 1192)

Realising the grave situation in which they were caught, the Hindu princes of North India formed a confederacy under the command of Prithiviraj Chauhan. Prithiviraj rose to the occasion and defeated Muhammad in the battle of Tarain near Delhi in 1191. This was called the first battle of Tarain. To avenge this defeat, Muhammad made serious preparations and gathered a huge army. He arrived with his large force in Lahore via Peshawar and Multan. He sent a message to Prithiviraj, asking him to acknowledge his supremacy and become a



Muslim. But Prithviraj rejected the proposal and prepared his army to resist the invader. Many Hindu kings and chieftains also joined him. In the ensuing second battle of Tarain in 1192, Muhammad thoroughly routed the army of Prithviraj who was captured and killed.

The second battle of Tarain was a major disaster for the Rajputs. Their political prestige suffered a serious setback. The whole Chauhan kingdom now lay at the feet of the invader. The first Muslim kingdom was thus firmly established in India at Ajmer and a new era in the history of India began. After his victory over Prithviraj at Tarain, Muhammad returned to Ghazni to deal with the threat from the Turks and the Mongols. After the death of Muhammad in 1206, his most capable general Qutb-ud-din Aibak who had been left behind in India took control of Muhammad's territories in India and declared himself as the First Sultan of Delhi.

Summary

- ❖ After Harsha, new regional powers emerged. Prominent ruling dynasties among them were Pratiharas, Palas, Chauhans and Paramaras.
 - ❖ Pratiharas and Palas were battling to control the northern plains. Their focus was on capturing the city of Kanauj.
 - ❖ The continued conflict over the possession of Kanauj prompted the local chieftains and kings to declare themselves independent.
 - ❖ The Rajputs and Palas made impressive contribution to the evolving Indian culture.
 - ❖ The attempts of Arabs to expand were resisted by various rulers.
 - ❖ Military raids of Mahmud of Ghazni in the 11th century followed by expeditions of Muhammad of Ghor paved the way for the establishment of Islamic rule in India.

Glossary			
1.	scion	a descendant of the notable family	வாரிசு, வழித்தோன்றல்
2.	unprecedented	exceptional	முன்னெப்போதுமில்லாத
3.	internecine	mutually destructive	இருசாராருக்கும் நாசத்தை விளைவிக்கின்ற
4.	portraiture	the art of painting	சித்தரிக்கும் கலை
5.	elegant	grand	நெர்த்தியான
6.	monastery	a place where monks live	மடாலயம்
7.	confederacy	a league or alliance of states	சூட்டமைப்பு



I. Choose the correct answer

1. Who wrote *Prithivirajraso*?

 - a. Kalhana
 - b. Vishakadatta
 - c. Rajasekara
 - d. Chand Bardai



2. Who was the first prominent ruler of Pratiharas?
 - a. Bhoja I
 - b. Naga Bhatta I
 - c. Jayapala
 - d. Chandradeva
3. Ghazni was a small principality in _____.
 - a. Mangolia
 - b. Turkey
 - c. Persia
 - d. Afghanistan
4. What was the most important cause of the invasion of Mahmud of Ghazni?
 - a. To destroy idolatry
 - b. To plunder the wealth of India
 - c. To spread Islam in India
 - d. To establish a Muslim state in India

II Fill in the blanks

1. _____ was the founder of Vikramashila University.
2. Arabs conquered Sind in _____.
3. The city of Ajmeer was founded by _____.
4. The Khandarya temple is in _____.

III Match the following

A	B
1. Khajuraho	Mount Abu
2. Sun temple	Bundelkhand
3. Dilwara Temple	Konark

IV True or False

1. Rajputra is a Latin word.
2. King Gopala was elected by the people.
3. The temple at Mount Abu is dedicated to Lord Shiva.
4. Raksha Bandan is a festival of brotherhood.

5. Indians learnt the numerals 0 – 9 from Arabs.

V Consider the following statements. Tick (✓) the appropriate answer.

1. **Assertion:-** The tripartite struggle was to have control over Kanauj.
Reason:- Kanauj was a big city.
 - a. R is the correct explanation of A.
 - b. R is not the correct explanation of A.
 - c. A is wrong and R is correct.
 - d. A and R are wrong.
2. **Statement I.** Mahipala could not extend his domain beyond Benaras.
Statement II. Mahipala and Rajendra Chola were contemporaries.
 - a. I is correct.
 - b. II is correct.
 - c. I and II are correct.
 - d. I and II are false.
3. **Assertion:-** India's Islamic period did not begin after Arab conquest of Sind in AD (CE)712.
Reason:- Gurjara Pratiharas gave a stiff resistance to Arabs.
 - a. R is the correct explanation of A.
 - b. R is not the correct explanation of A.
 - c. A is correct and R is wrong.
 - d. A is wrong and R is correct.
4. **Assertion:-** The second battle of Tarain was lost by Prithviraj.
Reason:- There was disunity among the Rajputs.
 - a. R is the correct explanation of A.
 - b. R is not the correct explanation of A.
 - c. A is correct and R is wrong.
 - d. A is wrong and R is correct.



5. Consider the following statements and find out which is/are correct.
1. *Raksha Bandan* tradition is attributed to Rajputs.
 2. Tagore started a mass *Raksha Bandan* festival during Partition of Bengal
 3. *Raksha Bandan* was to counter the British attempt to create a divide between Hindus and Muslims.
 - a. 1 is correct.
 - b. 2 is correct.
 - c. 3 is correct.
 - d. All the above are correct.

VI Answer in one or two sentences

1. Write about tripartite struggle over Kanauj.
2. Name any four Rajput clans.
3. Who was the founder of Pala dynasty?
4. Mention the first two early Caliphates.
5. Name the ruler of Sind who was defeated by Qasim.

VII Answer the following

1. What was the impact of Arab conquest of Sind? (point out any five)

VIII HOTS

a. Difference between Mahmud Ghazni's invasion and Muhammad Ghor's invasion.

b. Find out

	First battle of Tarain	Second battle of Tarain
Fought in the year		
Causes for the battle		
Who defeated whom?		
What was the result?		

IX Students activity

a. Word Splash

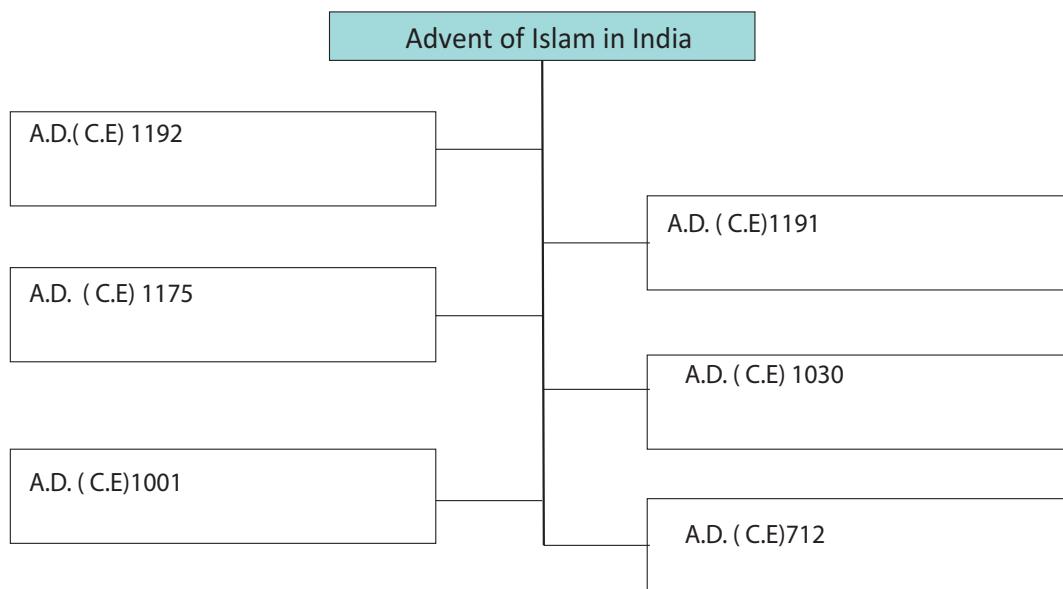
(Students discuss what they know about the words given here. They use the words from what they have learnt in a narrative form)

Harsha	Rajputs
Kanauj	Vikramashila
Prithviraj	Caliph



b. Time Line

Write the event for the given year in each column.



X Map work

On the river map of India mark the territories ruled by Pratiharas, Chauhans, Palas and Paramaras.

XI Answer Grid

1. Who was the Shahi ruler of Punjab defeated by Mahmud of Ghazni? Ans:	2. Rajput style of Painting is called _____ Ans:
3. How many Rajput clans were there? Ans:	4. Who established the first Islamic empire in India? Ans:
5. Who was the first Sultan of Delhi? Ans:	6. Where is Mecca? Ans:

XII. Life skill

Make an album with the pictures of temples built by Rajput rulers.

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Unit -III

Emergence of New Kingdoms in South India: Later Cholas and Pandyas



Temple at Darasuram

Learning Objectives

- ❖ To trace the origin of the later Cholas and the later Pandyas
- ❖ To know about the prominent rulers of both the kingdoms
- ❖ To acquaint with their administrative system
- ❖ To understand the social, economic and cultural development during their reign



I. The Later Cholas

Introduction

The Cholas are one among the popular and well-known Tamil monarchs in the history of South India. The elaborate state structure, the extensive irrigation network, the vast number of temples they built, their great contributions to art and architecture and their overseas exploits have given them a pre-eminent position in history.

Revival of the Chola Rule

The ancient Chola kingdom reigned supreme with the Kaveri delta forming the core area of its rule and with Uraiur (*present-day Tiruchirappalli*) as its capital. It rose to prominence during the reign of Karikala but

gradually declined under his successors. In the 9th century Vijayalaya, ruling over a small territory lying north of the Kaveri, revived the Chola Dynasty. He conquered Thanjavur and made it his capital. Later Rajendra I and his successors ruled the empire from Gangaikonda Cholapuram, the newly built capital.

Rajaraja I (A.D. (CE) 985 - 1016) was the most powerful ruler of Chola empire and also grew popular beyond his times. He established Chola authority over large parts of South India. His much-acclaimed naval expeditions led to the expansion of Cholas into the West Coast and Sri Lanka. He built the famous Rajarajeswaram (Brihadeshwara) Temple in Thanjavur. His son and successor, Rajendra Chola I (A.D. (CE) 1016 - 1044, matched his father in his ability to



expand the empire. The Chola empire remained a powerful force in South India during his reign. After his accession in A.D. (CE) 1023, his striking military expedition was to northern India, capturing much territory there. He proclaimed himself the Gangaikondan (conqueror of the Gangai region). The Gangaikonda Cholapuram temple was built to commemorate his victories in North India. The navy of Rajendra Chola enabled him to conquer the kingdom of Srivijaya (southern Sumatra). Cholas' control over the seas facilitated a flourishing overseas trade.

Decline of the Chola Empire

Rajendra Chola's three successors were not capable rulers. The third successor Veerarajendra's son Athirajendra was killed in civil unrest. With his death ended the Vijayalaya line of Chola rule.



Ruins of Gangaikonda Cholapuram

Matrimonial alliances between the Cholas and the Eastern Chalukyas began during the reign of Rajaraja I. His daughter Kundavai was married to Chalukya prince Vimaladitya. Their son was Rajaraja Narendra who married the daughter of Rajendra Chola named Ammangadevi. Their son was Kulothunga I.

On hearing the death of Athirajendra, the Eastern Chalukya prince Rajendra Chalukya seized the Chola throne and began the rule of Chalukya-Chola dynasty as Kulothunga I. Kulothunga established himself firmly on the Chola throne soon eliminating all the threats to the Chola Empire. He avoided unnecessary wars and earned the goodwill of his subjects. But Kulothunga lost the territories in Ceylon. The Pandya territory also began to slip out of Chola control. Kanchipuram was lost to the Telugu Cholas. The year 1279 marks the end of Chola dynasty when King Maravarman Kulasekara Pandyan I defeated the last king Rajendra Chola III and established the rule of the Pandyas in present-day Tamil Nadu.

Administration

The central administration was in the hands of king. As the head of the state, the king enjoyed enormous powers. The king's orders were written down in palm leaves by his officials or inscribed on the temple walls. The kingship was hereditary in nature. The ruler selected his eldest son as the heir apparent. He was known as Yuvaraja. The Yuvarajas were appointed as Governors in the provinces mainly for administrative training.

The Chola rulers established a well-organised system of administration. The empire, for administrative convenience, was divided into provinces or *mandalam*s. Each *mandalam* was sub-divided into *naadu*s. Within each *naadu*, there were many *kurram*s (groups of villages). The lowest unit was the *gramam* (village).



Local Governance

Local administration worked through various bodies such as Urar, Sabhaiyar, Nagarattar and Nattar. With the expansion of agriculture, numerous peasant settlements came up on the countryside. They were known as Ur. The Urar, who were landholders acted as spokesmen in the Ur. Sabhaiyar in Brahman villages also functioned in carrying out administrative, financial and judicial functions. Nagarattar administered the settlement of traders. However, skilled artisans like masons, blacksmiths, goldsmiths, weavers and potters also lived in Nagaram. Nattar functioned as an assembly of Nadu and decided all the disputes and issues pertaining to Nadu.

The assemblies in Ur, Sabha, Nagaram and Nadu worked through various committees. The committees took care of irrigation, roads, temples, gardens, collection of revenue and conduct of religious festivals.

Uttiramerur Inscriptions



Uttiramerur Inscriptions

Uttiramerur presently in Kanchipuram district was a Brahmadeya village (land grants given to Brahmins).



There is a detailed description of how members were elected to the committees of the village sabha in the inscriptions found there. One member was to be elected from each ward. There were 30 wards in total. The eligibility to contest was to men in the age group of 35–70, well-versed in vedic texts and scriptures, and also owned land and house. The process of election was as follows: The names of qualified candidates from each ward were written on the palm-leaf slips and put into a pot. The eldest of the assembly would engage a boy to pull out one slip and declare his name. Various committees were decided in this way.

Revenue

The revenue of the Chola state came mainly from the land. The land tax was known as Kanikadan. The Chola rulers carried out an elaborate survey of land in order to fix the government's share of the land revenue. One-third of produce was collected as land tax. It was collected mostly in kind. In addition to land tax, there were taxes on profession and tolls on trade.

Social Structure Based on Land Relations

The Chola rulers gifted tax-free lands to royal officials, Brahmins, temples (devadana villages) and religious institutions. Land granted to Jain institutions was called *pallichandam*. There were also of *vellanvagai* land and the holders of this land were called Vellalars. *Ulu-kudi*, a sub-section of Vellalar, could not own land but had to cultivate *Brahmadeya* and *vellanvagai* lands. The holders of *vellanvagai* land retained *melvaram* (major share in harvest). The *ulu-kudi* got *kil-varam* (lower share). *Adimai* (slaves) and *panicey-makkal* (labourers) occupied the lowest



rung of society. In the intermediate section came the armed men and traders.

Irrigation

Cholas gave importance to irrigation. The 16-mile long embankment built by Rajendra Chola in Gangaikonda Cholapuram is an illustrious example. *Vati-vaykkal*, a criss-cross channel, is a traditional type of harnessing rain water in the Cauvery delta. *Vati* is a drainage channel and a *vaykkal* is the supply channel. The commonly owned village channel was called *uruvaykkal*. The nadu level vaykkal is referred to as *nadu-vaykkal*. The turn-system was in practice in distributing the water.

Religion

Chola rulers were ardent Saivites. Hymns, in praise of the deeds of Lord Siva, were composed by the Saiva saints, the Nayanmars. NambiyandarNambi codified them, which came to be known as the *Thirumurai*.

Temples

The Chola period witnessed an extensive construction of temples. The temples in Thanjavur, Gangaikonda Cholapuram and Darasuram are the repository of architecture, sculpture, paintings and iconography of the

Chola art. Temples during the Chola period were not merely places of worship. They were the largest landholders. Temples promoted education, and devotional forms of art such as dance, music and drama. The staff of the temples included temple officials, dancing girls, musicians, singers, players of musical instruments and the priests.

Cholas as Patrons of Learning

Chola kings were great patrons of learning. Rajendra I established a Vedic college at Ennayiram (now in Villupuram District). There were 340 students learning the Vedas, grammar and Upanishads under 14 teachers. This example was later followed by his successors and as a result two more such colleges had been founded, at Tirubuvanai near present-day Puducherry and Tirumukkoodal in present-day Chengalpattu district, in 1048 and 1067 respectively. The great literary works *Periyapuranam* and *Kamba Ramayanam* belong to this period.

Trade

There was a flourishing trade during the Chola period. Trade was carried out by two guild-like groups: *anju-vannattar* and *mani-gramattar*. *Anju-vannattar* comprised West Asians, Arabs, Jews, Christians and Muslims.



Big Temple Thanjavur



Gangaikonda Cholapuram Temple



They were maritime traders and settled on the port towns all along the West Coast. It is said that *mani-gramattar* were the traders engaged in inland trade. In due course, both groups merged under the banner of *ai-nutruvar* and *disai-ayirattu-ai-nutruvar* functioning through the head guild in Ayyavole, Karnataka. This *ai-nutruvar* guild operated the maritime trade covering South-East Asian countries. Through overseas trade with South-East Asian countries elephant tusks, coral, transparent glass, betel nuts, cardamom, opaque glass, cotton stuff with coloured silk threads were imported. The items exported from here were sandalwood, ebony, condiments, precious gems, pepper, oil, paddy, grains and salt.

II. The Later Pandyas

Introduction

Pandyas were one of the three ancient Tamil dynasties that ruled southern India since the 4th century B.C. (BCE) but intermittently. Korkai, associated with pearl fisheries, is believed to have been their early capital and port. They moved to Madurai later, as many early Tamil inscriptions of Pandyas have been unearthed in Madurai and its surroundings. Under the Pandya kings of the Sangam Age, Madurai was a great centre of culture. Poets and writers of Tamil language gathered there and contributed to the development of Tamil Classics. The Pandyas had re-established their strong position in south Tamil Nadu by the end of the 6th century A.D. (CE), after eliminating the rule of Kalabhras. But they could not resist the rising power of the later Cholas who ruled South India from 9th to 13th century. Thereafter taking advantage of the decline of Chola power,

the later Pandyas re-established their authority. Their rule continued until 16th century.

Revival of Pandya Kingdom (A.D. (CE) 600 - 920)

Kadunkon recovered Pandya territory from the Kalabhras towards the close of 6th century. He was succeeded by two others. Arikesari Maravarman was the first strong Pandya ruler who ascended the throne in A.D. (CE) 642. He was a contemporary of Mahendravarman I and Narsimahavarman I. Inscriptions and copper plates praise his victory over his counterparts: Cheras, Cholas, Pallavas and Sinhalese. Arikesari Maravarman is identified with the Kun Pandian, the persecutor of Jains.

Saivite saint Thirugnanasambandar converted Arikesari from Jainism to Saivism. On his conversion, Arikesari is alleged to have impaled around 8000 Jains on stakes. Though the number is an exaggerated one, the anti-Jain attitude of Arikesari after his conversion to Saivism cannot be doubted.

After Arikesari, the greatest of the dynasty was Jatila Parantaka Nedunjadayan (Varaguna I) (756-815), the donor of the Velvikkudi plates. Nedunjadayan expanded the Pandya territory to include Thanjavur, Tiruchirappalli, Salem and Coimbatore districts. Nedunjadayan's successors Srimara Srivallabha and Varaguna II, were successively defeated by Pallavas. Later they could not face the rising Chola dynasty under Parantaka I. Parantaka I defeated the Pandya king Rajasimha II who fled the country in 920. Thus ended the Pandya rule revived by Kadungon.



Rise of Later Pandyas (1190 - 1310)

The Chola viceroyalty became weak in Pandya country after the death of Adhirajendra (the last king of Vijayalaya line). Eventually the Pandya kingdom could emerge as the only leading Tamil dynasty in the 13th century. Madurai continued to be their capital. Now Kayal was their great port. Marco Polo, a famous traveller from Venice, visited Kayal twice, in 1288 and 1293. He tells us that this port town was full of ships from Arabia and China and bustling with business activities.

Marco Polo hailed the Pandyan Kingdom as 'the richest and the most splendid province in the world'. Together with Ceylon, he added, it 'produced most of the gems and pearls that are found in the world'. In his travel account he recorded the incidents of *sati* and the polygamy practiced by the kings.

Sadaiyavarman Sundrapandyan

The illustrious ruler of the second Pandya Kingdom was Sadaiyavarman (Jatavarman) Sundrapandyan (1251 to 1268). He brought the entire Tamil Nadu under his rule, which extended up to Nellore in Andhra. He held the Hoysalas in check. The Chera ruler, the chief of *Malanadu*, accepted his feudatory position and paid tribute to Sundrapandyan. Emboldened by the decline of the Chola state, the Boja King of Malwa region Vira Someswara challenged Sundrapandyan. In a war at Kannanur, Sundrapandyan defeated Someswara. Sundrapandyan succeeded in establishing his authority over the chieftains of Cuddalore,

Kanchipuram in northern Tamil Nadu, Arcot and Salem in the western region.



Coin of Pandya Kingdom

There were two or three co-regents who ruled simultaneously along with Sundrapandyan: Vikrama Pandyan and Vira Pandyan. After Sundrapandyan, Maravarman Kulasekaran ruled successfully for a period of 40 years, giving the country peace and prosperity. He had two sons. The king's appointment of Vira Pandyan as a co-regent provoked the other son Sundara Pandyan who killed his father Maravarman Kulasekaran. In the civil war that ensued, Vira Pandyan won and became firmly established in his kingdom. The defeated Sundara Pandyan fled to Delhi and took refuge under the protection of Ala-ud-din Khalji. This provided the opening for the invasion of Malik Kafur.

After Malik Kafur's invasion, the Pandyan Kingdom came to be divided among a number of kings from the main ruling Pandya's family. In Madurai, a Muslim State subordinate to the Delhi Sultan came to be established.



Polity and Society

State

Pandya kings preferred Madurai as their capital. Madurai has been popularly venerated as *Koodal*. The kings are traditionally revered as *Koodal-kon*, *Koodal Nagar Kavalan*. The Pandyas derived military advantage over their neighbours by means of their horses. They imported these horses through Arabs with whom they had commercial and cultural contact.

The king claimed that he was ruling according to Manu Sastra. This doctrine supported the social hierarchy in the society. Kings and local chiefs created Brahmin settlements called *Mangalam* or *Chatur-vedi-mangalam* with irrigation facilities. The actual landowning groups are described as the *Bumiputtirar*, otherwise called the *vellalar*. Historically they were locals and hence they were referred to as *nattu-makkal*. The communal assembly of this group is *Cittira Meli Periyannattar*.

Royal Officials

A band of officials executed the royal orders. The prime minister was *uttara-mantri*. The historical personalities like Manickavasagar, Kulaciraiyar and Marankari worked as ministers. The royal secretariat was known as *eluttu-mandapam*. The most respected officials were *maran-eyinan*, *sattan-ganapathy*, *enathi-sattan*, *tira-tiran*, *murthi-eyinan* and others. The titles of military commanders were *palli-velan*, *parantakan-palli-velan*, *maran-adittan* and *tennavan-tamilvel*.

Administrative Divisions

Pandy nadu, as in Chola state, consisted of many provinces known as *vala-nadus*, which, in turn, were divided into many *nadus* and *kurram*s. The administrative authorities of *nadus* were the nattars. Nadu and Kurram contained settlements, viz. *mangalam*, *nagaram*, *ur* and *kudi*, where different social groups inhabited.

Village Administration

An inscription from Manur (Tirunelveli district) dated A.D. (CE) 800 provides an account of village administration. It looks similar to Chola's local governance that included village assemblies and committees. Both civil and military powers seem to have been vested in the same person.

Irrigation

The Pandya rulers created a number of irrigation sources. On either side of the rivers *Vaigai* and *Tamiraparani*, channels leading to the irrigation tanks were built. In southern Tamilnadu, like the Cholas, Pandyas introduced the new irrigation technology. Irrigation works were done by local administrative bodies, local chiefs and officials. Repairs were mostly undertaken by local bodies. Sometimes, traders also dug out tanks for irrigation.

Religion

Pandya extended patronage to vedic practices. Velvikkudi copper plates as well as inscriptive sources mention the rituals like Asvamedha yaga, Hiranya garbha and Vajapeya yaga, conducted by every great Pandya king. The impartiality of rulers towards both Saivism and Vaishnavism is also made known in the invocatory portions of the inscriptions. Temples of both sects were



patronised through land grant, tax-exemption and renovation.

The great Saiva and Vaishnava saints (Nayanmaras and Alwars) combined contributed to the growth of Tamil literature and spiritual enlightenment. The period was marked by intense religious conflict. The Bhakti movement of the time prompted the heterodox scholars for a debate. Many instances of the defeat of Buddhists and Jains in such debates are mentioned in Bhakti literature. The Pandya kings of the period supported and promoted Tamil and Sanskrit.

Temples

Medieval Pandyas and later Pandyas did not build any new temples but maintained the existing temples, enlarging them with the addition of *gopuras*, and *mandapas*. The monolithic mega size ornamented pillars are the unique feature of the medieval Pandya style. The sculptures of Siva, Vishnu, Kotravai, Ganesa and Subramanyar are the best specimens in these temples. Pandyas specially patronised the historic Meenakshi temple at Madurai and kept expanding its premises by adding *gopuras* and *mandapas*.



Meenakshi Temple, Madurai

Trade

Arab settlements on the west coast of southern India, from 7th century, had led to the expansion of their trade connection to the east coast because the governments of the east coast pursued a more liberal and enlightened policy towards overseas traders. Their charters exempted traders from various types of port dues and tolls. In Kayal, there was an agency established by an Arab chieftain by name Malik-ul-Islam Jamal-ud-din. This agency facilitated availability of horses to Pandya kings.

In 13th and 14th centuries, horse trade became brisk. Marco Polo and Wassaff state that the kings invested in horses as there was a need of horse for ceremonial purposes as well as for fighting wars. Those who were trading in horses were called *kudirai chetties*. They were active in maritime trade also. The busiest port town under the Pandyas was *Kayal Pattinam* (now in Thoothukudi district) on the east coast. Gold coins were in circulation as the trade was carried through the medium of gold. It was variously called *kasu*, *kalanchu* and *pon*.

The vast trade in horses of that time has been recorded by Wassaff. He writes: ‘...as many as 10,000 horses were imported into Kayal and other ports of India of which 1,400 were to be of Jamal-ud-din’s own breed. The average cost of each horse was 220 dinars of “red gold.”

Summary

- ❖ The Cholas and Pandyas are well known Tamil monarchs.
- ❖ Vijayalaya revived the Chola dynasty.



- ❖ The prominent Chola rulers are Rajaraja I and Rajendra I.
- ❖ Uttiramerur inscriptions provide details of village administration.
- ❖ Kodunkon recovered Pandya territory from Kalabhras. Arikesari Maravavarman and Parantaka Nedunjadayan were his two prominent successors.
- ❖ The illustrious rulers of later Pandya kingdom were Sadaayavarman Sundarapandyan and Maravarman Kulasekaran.
- ❖ Maritime trade during Pandyas is highlighted by Marco Polo and Wassaff.

Glossary

1.	Matrimonial alliances	political alliances through marriages	திருமண உறவுகள் மூலம் அரசியல் கூட்டுறவு
2.	Embankment	a wall or stone structure built to prevent a river flooding an area as well as to store its water	தடுப்பகை
3.	Ardent	passionate	தீவிரமான
4.	Feudatory	a subordinate to another sovereign/ruler	அரசருக்குக் கட்டுப்பாடு குறுநில மன்னர்
5.	Refuge	shelter	புகலிடம்
6.	Repository	place in which things are stored	கருவுலம்



Evaluation

I. Choose the Correct answer

1. Who revived the later Chola dynasty?
 - a. Vijayalaya
 - b. Rajaraja I
 - c. Rajendra I
 - d. Athirajendra
2. Who among the following Pandya rulers is known for ending the Kalabhra rule?
 - a. Kadunkon
 - b. ViraPandyan
 - c. Kun Pandyan
 - d. Varaguna



5DPQ4Q

3. Which of the following was the lowest unit of Chola administration?
 - a. Mandalam
 - b. Nadu
 - c. Kurram
 - d. Ur
4. Who was the last ruler Vijayalaya line of Chola dyanasty?
 - a. VeeraRajendra
 - b. Rajadhiraja
 - c. AthiRajendra
 - d. Rajaraja II
5. An example of Chola architecture can be seen at _____.
 - a. Kannayiram
 - b. Uraiyyur
 - c. Kanchipuram
 - d. Thanjavur



6. To which of the following, Marco Polo went in the last decade of 13th century in India?
- Chola mandalam
 - Pandya country
 - Kongu region
 - Malainadu

II Fill in the blanks

- _____ built the famous Brihadeshwara Temple at Thanjavur.
- _____ established a Vedic college at Ennayiram.
- _____ was the donor of Velvikudi copper plates.
- The royal secretariat of Pandya kingdom was known as _____.

III Match the Following

A	B
1. Madurai	Inland traders
2. Gangaikonda Cholapuram	Maritime traders
3. Anju- Vannattar	Capital of Cholas
4. Mani- gramattar	Capital of Pandyas

IV. True or False

- A Muslim state subordinate to Delhi Sultan was in Madurai.
- Koodal – nagar Kavalan was the title of a Pandya king.
- Chola kingdom was situated in Vaigai delta.
- Kulothunga I belonged to Chalukya – Chola dynasty.
- The elder son of the Chola king was called Yuvaraja.

V Consider the following statements.

Tick (✓) the appropriate answer.

- Which of the following statements about Later Cholas are correct?
 - They had a system of Local self government.
 - They maintained a strong navy.
 - They were the followers of Buddhism.
 - They built big temples.
- Which of the following statements are true with regard to Rajendra Chola?
 - He assumed the title Gangaikonda Chola.
 - He conquered Southern Sumatra.
 - He is credited with consolidating the Chola power.
 - His naval power enabled him to conquer Srivijaya.
 - 1 and 2
 - 3 and 4
 - 1,2 and 4
 - All the above
- Assertion:-** The Yuvarajas were appointed Governors in the provinces.
Reason:- This was done for their training in administration.
 - R is the correct explanation of A.
 - R is not the correct explanation of A.
 - A is wrong and R is correct.
 - A and R are wrong.
- Arrange the following administration divisions in descending order.
 - Nadu
 - Mandalam
 - Ur
 - Kurram



5. Arrange the events in chronological order.

1. Maravarman appointed Virapandyan as co – regent.
2. Civil war broke out.
3. A Muslim State was established in Madurai.
4. MaravarmanKulasekaran had two sons – Virapandyan and Sundrapandyan
5. SundraPandyan sought help from Ala – ud-din Khalji.
6. Malik Kafur invaded Madurai.

6. Find out

Brahmadeya	
Devadana	
Pallichandam	
Vellanvagai	

VI Answer in one or two sentences

1. What were the items exported during the later Chola period?
2. What was called Chatur-vedi-mangalam?
3. Write about Kanikadan.

VII. Answer the following

1. Highlight any five aspects of Cholas' legacy.

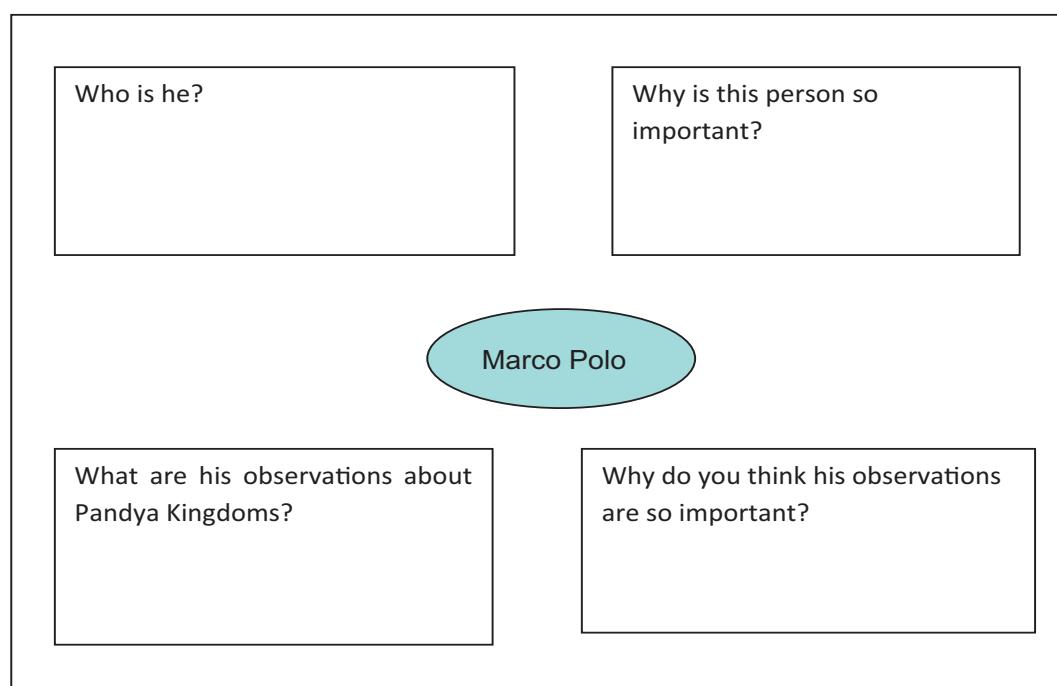
VIII HOTS

1. Chola kings were great patrons of learning: Support the statement with details.

IX Students activity

Who am I?

1. I was responsible for Malik Kafur invasion.
2. I built 16-mile embankment-lake in Gangaikonda Cholapuram.
3. I am a water supply channel.
4. I codified Thirumurai.
5. I was a great port. Marco Polo visited me twice.





X Answer Grid

1. Name the two literary works of Chola period. Ans:	2. Which port is associated with pearl fishery? Ans:
3. What do <i>kasu</i> , <i>kalanchu</i> and <i>pon</i> refer to? Ans:	4. In which district is Kayal -Pattinam located? Ans:
5. Who was the Pandya king, defeated by Parantaka I? Ans:	6. Where is the famous Meenakshi temple located? Ans:

XI Field trip.

Visit any one temple built during Chola or Pandya period and see its magnificence.

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Unit -IV

The Delhi Sultanate



Firoz Shah Kotla

Learning Objectives

To acquaint ourselves with

- ❖ Turkish Sultans of various dynasties who ruled India from Delhi
- ❖ Their military conquests and extension of sovereignty
- ❖ Administration of the Delhi Sultanate
- ❖ Art and architecture of this period



Introduction

During the eleventh century, the Turkish horsemen pillaged northern India and due to their persistent campaigns, they succeeded in seizing political control of the Gangetic plain by the next century. Though the success of their conquests could be attributed to their audacity and ferocity, their success is really due to the failure of Indians to defend themselves and their territories. Indians viewed each other with distrust, failing to take note of the success of Islam in early years of its spread. The superior military might of Muslim soldiers was yet another factor that contributed to success in their conquests. In this lesson, we discuss how Turkish warriors set about founding and consolidating their Islamic rule till the advent of Babur.

Slave Dynasty (1206 - 1290)

Muslim rule in India was established by Muhammad Ghori in 12th century A.D. (CE). As he had no sons, he nurtured special slaves called *bandagan* (a Persian term used for slaves purchased for military service). These slaves were posted as governors and they were later raised to the status of Sultans. After Ghori's death in 1206, one of his slaves Qutb-ud-din-Aibak who had been left behind by Muhammad Ghori to govern the territories he had conquered, proclaimed himself ruler of the Turkish territories in India. He laid the foundation of the Slave Dynasty. This dynasty is also known as Mamluk dynasty. Mamluk is an Arabic word meaning "slave". Qutb-ud-din-Aibak, Shams-ud-din-Iltutmish and Ghiyas-ud-din-Balban were the three great Sultans of this dynasty. The



Slave Dynasty ruled over the sub-continent for about 84 years.

Qutb-ud-din-Aibak (1206 - 1210)

Qutb-ud-din-Aibak began his rule by establishing Lahore as the capital of his kingdom. Later he shifted his capital to Delhi. He was active all through his rule in Delhi conquering new territories and suppressing rebellions. He personally led military campaigns to the central and western Indo-Gangetic plain (north India) and left the conquest of the eastern Gangetic Plain (Bihar, Bengal) to the care of Bakhtiar Khalji. Aibak built the Quwwat-ul-Islam Masjid (mosque) in Delhi. This mosque is considered to be the oldest in India. He also laid the foundation of the Qutb-Minar, but he was unable to complete it. It was later finished by his son-in-law and his successor Iltutmish. Aibak died of injuries received during an accidental fall from a horse, while playing polo in 1210.



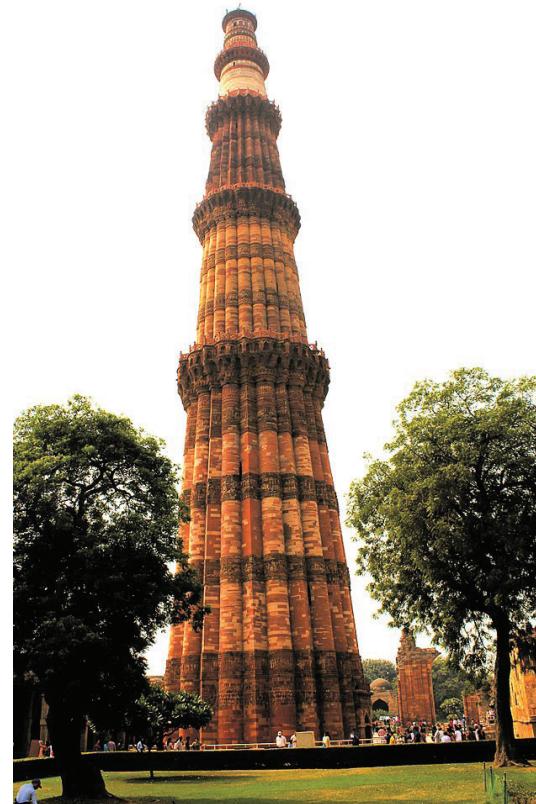
Quwwat-ul-Islam Masjid

Iltutmish (1210 - 1236)

Aibak's son Aram Shah proved incompetent and so the Turkish nobles chose Iltutmish, the son-in-law of Aibak as the Sultan, who served as a military commander of Aibak. Iltutmish firmly established his control over the territories

by suppressing rebellions. It was during his reign that the threat of Mongols under Chengiz Khan loomed large over the frontiers of India. He averted the impending danger by refusing to provide shelter to the Kwarezm Shah Jalal-ud-din, who had been driven out by Chengiz Khan. In order to counter the possible attack of the Mongols, Iltutmish organised Turkish nobility into a select group of 40 nobles known as *chahalgani* or The Forty.

Iltutmish granted *iqtas* (land) to members of his army. Iqta is the land granted to army officials in lieu of a regular wage. The iqta holder is called the iqtadar or muqti who had to provide the Sultan with military assistance in times of war. The iqtadar collected revenue from his iqta to meet the cost of maintaining his troops and horses.



Qutb-Minar



Iltutmish completed the construction of the Qutb-Minar, which had been started by Aibak. Iltutmish died in April 1236 after ruling for 26 years.

Razia (1236 - 1240)

As the most capable son of Iltutmish, Rukn-ud-din-Firuz, was dead, Iltutmish nominated his daughter Razia Sultana as his successor to the throne of Delhi. Razia was an able and brave fighter. But she had a tough time with Turkish nobles as she favoured non-Turkish nobles. She also faced the situation of the ferocious Mongols raiding Punjab during her reign.

Razia made an Ethiopian slave named Jalal-ud-din Yakut as her personal attendant and started trusting him completely. This led to a revolt of the Turkish nobles who conspired against her and got her murdered in 1240.

Ghiyas-ud-din Balban (1266 - 1287)

After Razia, three weak rulers in succession ascended the throne. After them came Ghiyas-ud-din Balban. Balban abolished The Forty as it was hostile to him. He established a department of spies to gather intelligence about the conspirators and the trouble makers against his rule. He dealt with insubordination and defiance of royal authority sternly. Tughril Khan, a provincial governor in Bengal, who raised a banner of revolt against Balban, was captured and beheaded. He was ruthless in dealing with enemies like Meos of Mewat (a Muslim Rajput community from north-western India). Balban, however, took care to maintain cordial relationship with the Mongols. He obtained from Hulagu Khan, a grandson of Chengiz Khan and the Mongol viceroy in Iran,

the assurance that Mongols would not advance beyond Sutlej.



Tomb of Balban

Balban built forts to guard his empire against the Mongol attacks. He patronised the famous Persian poet Amir Khusru. Balban died in 1287. Balban's son Kaiqubad turned out to be weak. In 1290 Malik Jalal-ud-din Khalji, the commander of the army, assumed the office of Naib (a deputy to the Sultan) and ruled the kingdom in the name of Kaiqubad. Then one day, Jalal-ud-din sent one of his officers and had Kaiqubad murdered. Jalal-ud-din then formally ascended the throne. With him began the rule of Khalji dynasty.

Khalji Dynasty (1290 - 1320)

Jalal-ud-din Khalji (1296 - 1316)

There were many military campaigns during the reign of Jalal-ud-din. But they were mostly organised and led by his nephew, Ala-ud-din, the governor of Kara. One significant military expedition was against the Deccan kingdom Devagiri. Ala-ud-din, after defeating the Yadava king Ramachandra, plundered the city and returned with huge wealth. Ala-ud-din treacherously killed Jalal-ud-din after buying off the prominent nobles and important commanders with the wealth he had brought



from the Deccan and declared himself as the Sultan of Delhi in 1296.

Ala-ud-din Khalji (1296 - 1316)

Ala-ud-din Khalji consolidated the Delhi Sultanate. The range of his conquests is impressive: in the Punjab (against the Mongols), in Rajasthan and in Gujarat. With his northern frontiers secure, he sent his chief lieutenant Malik Kafur into the southern parts who took even the distant Madurai in 1310. The Yadavas of Devagiri, the Kakatias of Warangal, the Hoysalas of Dwarasamudra and the Pandyas of Madurai accepted Ala-ud-din's suzerainty.

Sack of Chittor

(1303): When Ala-ud-din's army overwhelmed the Rajput army in Chittor and in the context of threat of defeat, the men and women of the fortress, in accordance with their old custom, performed the rite of jauhar. According to this custom, left with no other way to survive, the men would go out and die in the field of battle and women would burn themselves on a pyre.



Chittor Fort

Ala-ud-din's political and administrative reforms were as impressive as his military conquests. Ala-ud-din undertook a survey of

the agrarian resources around his capital and fixed a standard revenue demand. He entrusted the task of collecting the revenue to the military officers. This measure deprived the local chiefs and rajas of their time memorial privilege. Ala-ud-din established a system of forced procurement of food grains for Delhi and other garrison centres. The procurement prices were fixed and grain collected as tax was stored in state granaries. In order to ensure the enforcement of his new regulations, he employed spies who were responsible to report to him directly.

Ala-ud-din died in 1316. The failure of his successors to retain power led to the seizure of power by Ghiyas-ud-din Tughluq, who founded the Tughluq dynasty.

Tughluq Dynasty (1320 - 1324)

One of the major tasks of Ghiyas-ud-din as the Sultan was to recover the territories that the Sultanate had lost during the turmoil following the death of Ala-ud-din. Ghiyas-ud-din Tughluq sent his son Jauna Khan to fight against Warangal. Jauna Khan defeated Pratabarudra of Warangal and returned with a rich booty. With this looted wealth, Ghiyas-ud-din is said to have laid the foundation of the city Tughluqabad near Delhi. However, as Ala-ud-din treacherously killed his uncle, Jauna Khan was said to have killed his father and ascended the throne with title Muhammad-bin-Tughluq in 1325.

Muhammad-bin-Tughluq (1325 - 1351)

Muhammad-bin-Tughluq was a learned man. Yet he was a person of cruelty. Ala-ud-din had conquered, looted and left the old ruling families as his dependents. In contrast, Muhammad Tughluq dreamt of making the whole of the subcontinent his domain. With



the view to facilitating extended sovereignty, he shifted his capital from Delhi to the centre of the kingdom, namely Devagiri. He also changed its name to Daulatabad. When Muhammad himself decided that the move was a mistake, he ordered a return to Delhi as the capital again. When Ibn Battuta, the Morocco traveller who was with the Sultan, returned to Delhi, he found Delhi 'empty, abandoned and had but a small population.'

It was a 40-days march to Daulatabad from Delhi. Many people left. Some hid themselves. When they were found, they were punished cruelly, even though one was a blind man and another a paralytic. Describing the city as spreading over eight or ten miles, a historian observed: 'All was destroyed. So complete was the ruin that not a cat or a dog was left among the buildings of the city in its palaces or in its suburbs.'

Tughluq changed the Ala-ud-din's system of revenue collections in grain and ordered that land revenue, which was increased, should henceforward be collected in money. This proved disastrous during famines. When he discovered that the stock of coins and silver was inadequate for minting, he issued a token currency in copper. Counterfeiting soon became order of the day and, as a result, the entire revenue system collapsed. Trade suffered as foreign merchants stopped business. This forced Sultan to withdraw the token currency and pay gold and silver coins in exchange. This move led the state to become bankrupt. Tughluq increased land tax in the Doab region,

which triggered peasant revolts. As the revolts were cruelly dealt with, peasants abandoned cultivation, which resulted in the outbreak of frequent famines.



Coins of Muhammad-bin-Tughluq

Tughluq ruled as Sultan for 25 years. During his long reign, he had to face many revolts of the provincial governors. The Governors of Awadh, Multan and Sind revolted and declared themselves independent. In South India, several states arose. The new Daulatabad and the conquered territories around them were declared independent sultanate called Bahmani. Its founder after whom it was named, was a soldier formerly in Tughluq service. Madurai was proclaimed a separate sultanate in 1334. Bengal became independent in 1346. Tughluq died on 23 March 1351.

Firoz Shah Tughluq (1351 - 1388)



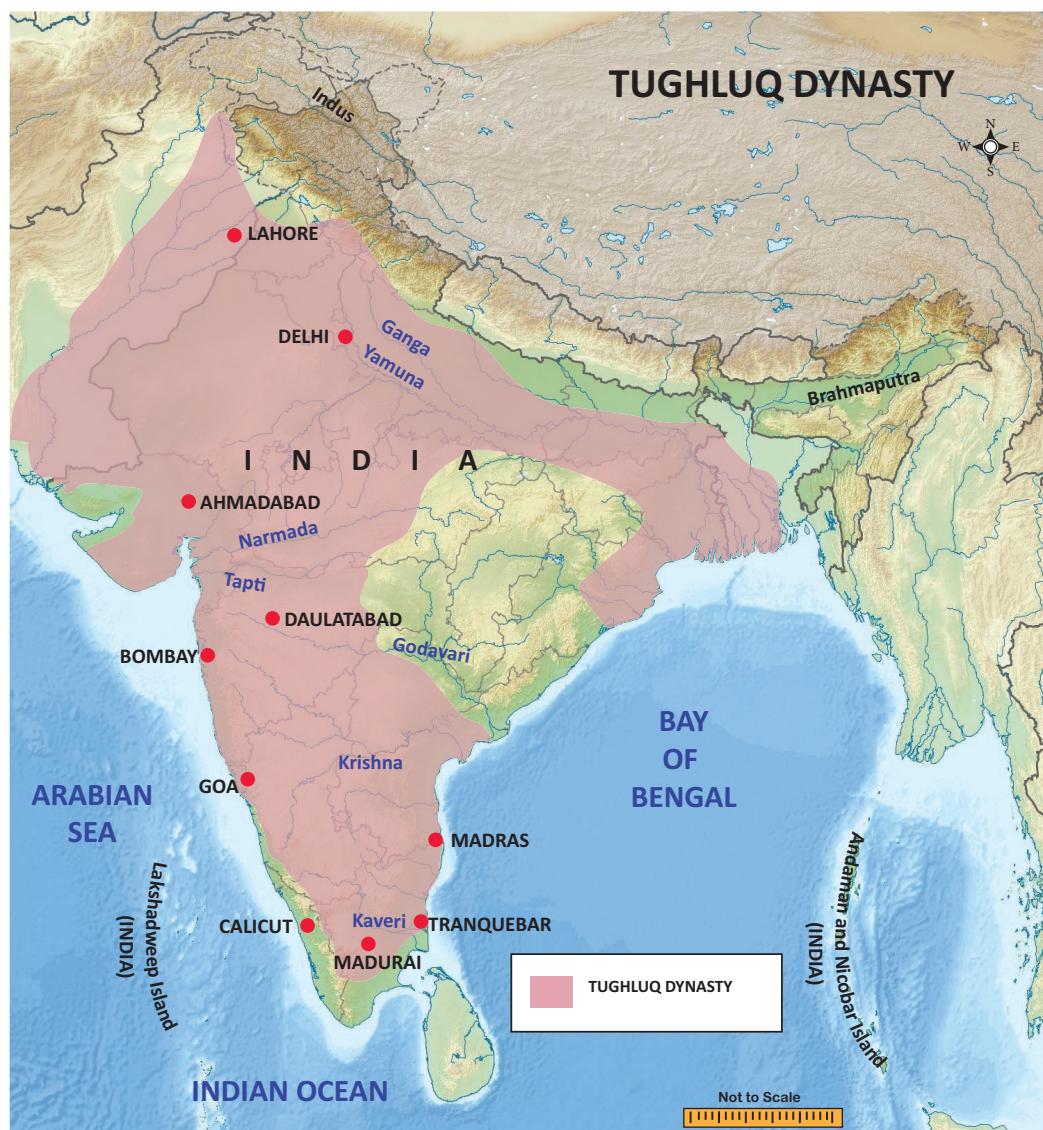
Tomb of Firoz Shah Tughluq



Firoz, the son of Ghiyas-ud-din's younger brother, succeeded Muhammad-bin-Tughluq. Firoz could neither suppress revolts nor win back the provinces that had broken away. He also showed no interest in re-conquering the southern provinces. He refused to accept an invitation (c. 1365) from a Bahmani prince to intervene in the affairs of the Deccan. Firoz rewarded Sufis and other religious leaders generously and listened to their advice. He also created charities to aid poor Muslims, built colleges, mosques, and hospitals. He adopted many humanitarian measures. He banned inhuman punishments and abolished taxes not recognised by Muslim law.

He promoted agriculture by waiving off the debts of the agriculturalists and constructing many canals for irrigation. He laid out 1200 new gardens and restored 30 old gardens of Alauddin-Khalji. He had built new towns such as Firozabad, Jaunpur, Hissar and Firozpur.

Despite adopting a peaceful approach and taking efforts to organise the Sultanate well, he had to spend his last days in unhappiness. His own son Muhammad Khan revolted against him and Firoz Shah died in September 1388, at the age of 83.





Timur's Invasion (1398)

The sacking and massacre by Tamerlane or Timur of Delhi came a decade after Firuz Shah Tughluq died. As a ruler of the region around Samarkand in Central Asia, Timur had occupied some parts in the north-west of India. Taking advantage of India's weakness, he entered India in December 1398 and plundered Delhi. Punjab, besides the Delhi city, was the province that suffered most by Timur's raid. Timur, apart from carrying huge wealth in the form of gold, silver, jewels, also took along Indian artisans like carpenters and masons to work on monuments in Samarkand.

Sayyid Dynasty (1414 - 1451)

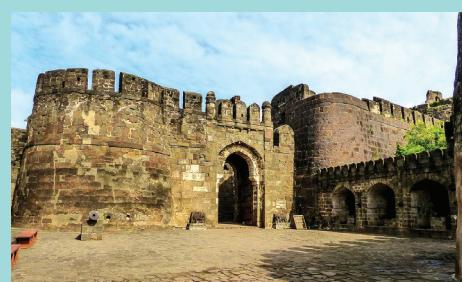
Though the Sultanate fragmented into a number of independent kingdoms, it endured for 114 years more, till the Mughal invasion. Before leaving Delhi, Timur had left behind his

representative Khizr Khan as the governor of the territories he had conquered (Delhi, Meerut and Punjab). He founded the Sayyid Dynasty in 1414, which lasted till 1451. The last ruler of this dynasty, Ala-ud-din Alam Shah, abdicated the throne in 1451. This gave Bahlol Lodi, then the governor of Sirhind (Punjab), the opportunity to become the new Sultan of Delhi, leading to the establishment of Lodi dynasty.

Lodi Dynasty (1451 - 1526)

In 1489, Bahlol Lodi was succeeded by his son Sikandar Lodi. Sikandar was a patron of arts and learning. He founded the city of Agra and made it his capital. He died in 1517 and was succeeded by his son, Ibrahim Lodi, who was defeated by Babur in 1526 in the Panipat battle. Thus the Lodi dynasty and the Delhi Sultanate were ended by Babur who went on to establish the Mughal Empire in India.

Islamic art and architecture: The mansions of high-ranking Muslim nobles, soldiers and officials were built first in cities and the neighbourhoods. Around them, the mosques in the imperial style were constructed by successive Muslim regimes in Delhi. Mosques and Madrasas looked architecturally different. The graceful decorations of doorways and walls with lines from the Koran made a distinct appearance in these buildings. The shape of all these buildings was Persian, while the decoration was Indian. So, it is called Indo-Saracenic architecture. Qutb Minar, Alai-Darwaza, Quwwat-ul Islam Masjid, Moth-ki-Masjid, the tombs of Iltutmish, Balban and the forts of Daulatabad and Firozabad were all constructed in this style.



Daulatabad Fort



Alai-Darwaza



Summary

- ❖ Establishment of Muslim rule in India by Muhammad Ghori
- ❖ Slave dynasty founded by Qutb – ud- din- Aibak and consolidated by his Son-in-law Iltutmish
- ❖ Razia, the daughter of Iltutmish, a brave fighter and a great administrator
- ❖ Balban's espionage system and the abolition of The Forty, to reduce the power of Turkish nobles
- ❖ Ala – ud- din- Khalji as the founder of Khalji dynasty - his military conquests and administrative reforms
- ❖ Firoz Shah Tughluq as a compassionate ruler with his concentration on the well - being of the people
- ❖ The sacking of Delhi by Timur
- ❖ Khizr Khan founding the Sayyid dynasty and Bahlol Lodi the governor of Sirhind establishing the Lodi dynasty
- ❖ The first battle of Panipat paving the way for the foundation of Mughal Empire by Babur in A.D. (CE)1526

Glossary

1.	impending	about to happen	எக்கணமும் நடைபெற இருக்கிற / அச்சுறுத்தும் நிலையில் இருக்கிற
2.	ferocious	cruel, violent	முர்க்கமான/ அச்சம் தருகிற வகையில்
3.	conspirator	someone who conspires secretly with other people to do something unlawful or harmful	சதிகாரர்கள்
4.	patron	supporter, promoter	புரவலர்
5.	plunder	to steal goods forcibly from a place especially during a war	கொள்ளலையாட
6.	procurement	the process of getting supplies	கொள்முதல்
7.	disastrous	causing great damage	பேரழிவு
8.	fragment	break into pieces	துண்டு துண்டாக
9.	counterfeit	fake	போலியான
10.	waiving	exempting	விலக்கு அளி



Evaluation

I Choose the correct answer

1. _____ laid the foundation of 'Mamluk' dynasty.
 - a) Mohammad Ghori
 - b) Jalal-ud-din
 - c) Qutb-ud-din Aibak
 - d) Iltutmish

2. Qutb-ud-din shifted his capital to Delhi from _____.
 - a) Lahore
 - b) Poona
 - c) Daulatabad
 - d) Agra

3. _____ completed the construction of the Qutb-Minar.
 - a) Razia
 - b) Qutb-ud-din -Aibak
 - c) Iltutmish
 - d) Balban

4. _____ laid the foundation of the city Tughluqabad near Delhi.
 - a) Muhammad-bin -Tughluq
 - b) Firoz shah Tughluq
 - c) Jalal -ud-din
 - d) Ghiyas -ud-din



5. The threat of Mongols under Chengizkhan to India was during the reign of _____.

III Match the following

A	B
1. Tughril Khan	Governor of Kara
2. Ala-ud-din	Jalal-ud-din Yakut
3. Bahol Lodi	Governor of Bengal
4. Razia	Governor of Sirhind

IV State true or false

1. Qutb-ud-din Aibak died of mysterious fever.
2. Razia was an able and brave fighter.
3. The Turkish nobles chose Iltutmish, son of Aibak, as Sultan after the death of Aibak.
4. FirozShah Tughluq refused to accept an invitation from a Bahmani Prince to intervene in the affairs of the Deccan.

V. Match the statement with the reason. Tick the appropriate answer

Assertion:-(A) Balban maintained cordial relationship with Mongols

Reason:-(R) The Mongol ruler, a grandson of Chengiz Khan, assured that Mongols would not advance beyond Sutlej.

- a) R is the correct explanation of A.
- b) R is not the correct explanation of A.
- c) A and R are wrong.
- d) A is wrong and R is the correct.

b) Find out the correct pair

1. Hoysala — Devagiri
2. Yadavas — Dwarasamudra
3. Kakatias — Warrangal
4. Pallavas — Madurai

II Fill in the Blanks

1. _____ was the founder of Tughluq dynasty.
2. Muhammad-bin-Tughluq shifted his capital from Delhi to _____.
3. _____ patronized the famous Persian poet Amir Khusrus.
4. Quwwat-ul-Islam Masjid in Delhi was built by _____.



c) Find out the wrong statement /statements

- After Ghori's death in 1206, his slave Qutb-ud-din Aibak proclaimed him self the ruler of the Turkish territories in India.
- Razia established the department of spies to gather intelligence about the conspirators and the trouble makers against her rule.
- Balban built forts to guard his empire against the Mongol attack.
- Ibrahim Lodi was defeated by Babur in 1526.

VI Answer the following in one or two sentences

- Name the land granted to army officials in lieu of a regular wage.
- Who founded the city of Agra?
- Name the ruler who established Muslim rule in India in 12th century A.D (CE).
- Write a note on *chahalgani*.
- How did Ala-ud-din Khalji consolidate the Delhi Sultanate?
- List out the contributions of Firoz Shah Tughluq.

VII Answer the following

- Write about the invasion of Timur in 1398.

VIII HOTS

- How would you evaluate Muhammad-bin-Tughluq as Sultan of Delhi?

IX. Map Work

On the river map of India draw the extent of Tughluq Dynasty and mark the following places.

- Delhi, 2. Devagiri, 3. Lahore, 4. Madurai.

X Student Activity

- Match the Father with Son

A	B
1. Qutb-ud-din Aibak	Rukn-ud-din-Firuz
2. Iltutmish	Kaiqubad
3. Balban	Ala-ud-din
4. Ghiyas-ud-din	Sikandar Lodi
5. Bahlool Lodi	Aram Shah

- Prepare an album of pictures of Islamic art and architecture of the Delhi Sultanate .

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