



GOVERNMENT OF TAMILNADU

STANDARD EIGHT

TERM - I

VOLUME 3

**SCIENCE
SOCIAL SCIENCE**

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Department of School Education

Untouchability is Inhuman and a Crime



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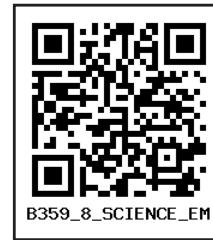
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Assessment



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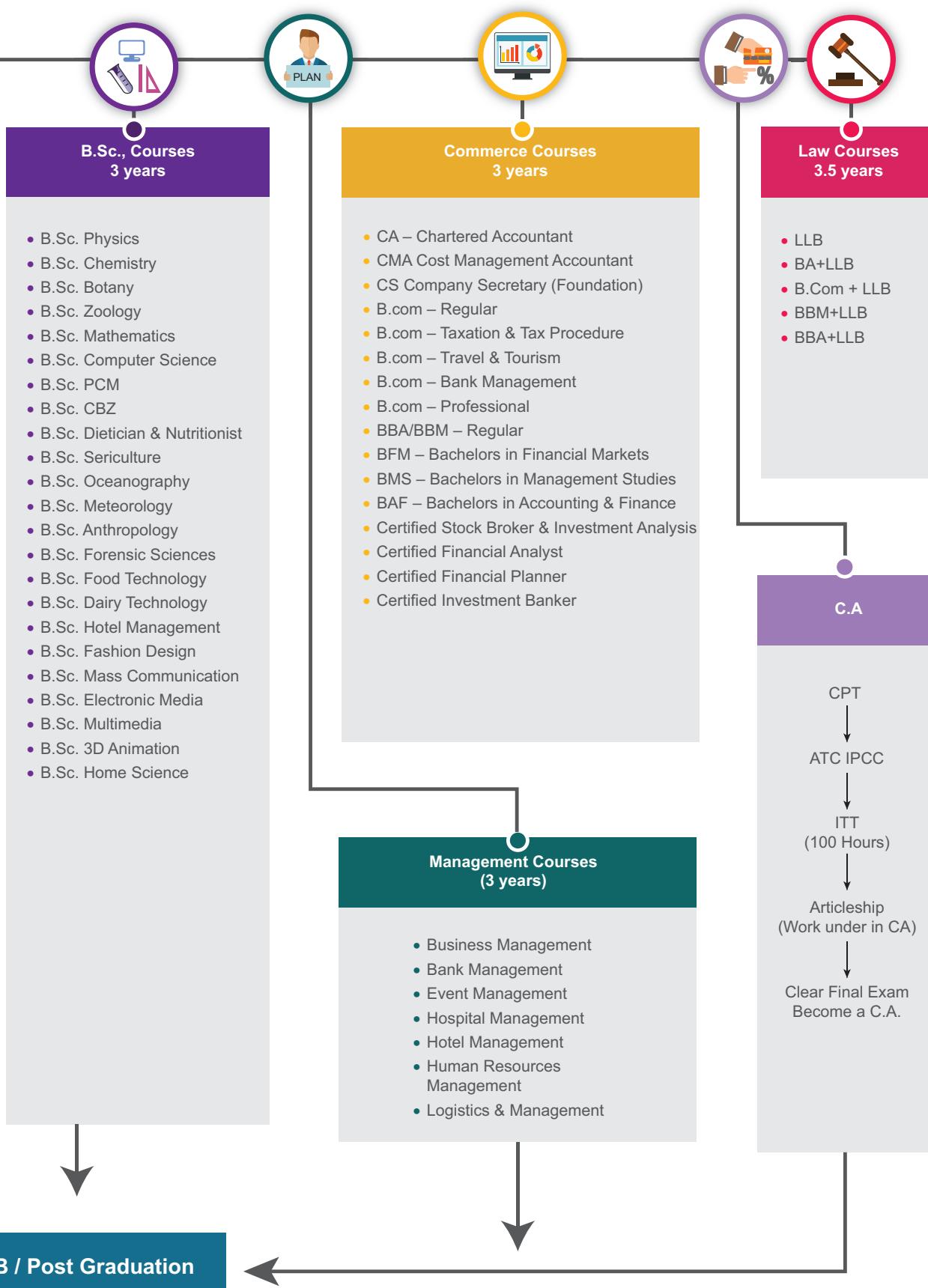


Career Guidance





Road ahead after 12th...





PREFACE

This book is developed in a holistic approach which inculcates comprehending and analytical skills. It will be helpful for the students to understand higher secondary science in a better way and to prepare for competitive exams in future. This textbook is designed in a learner centric way to trigger the thought process of students through activities and to make them excel in learning science.

HOW TO USE THE BOOK

- This term-I science book has 9 units.
- Each unit has simple activities that can be demonstrated by the teacher and also few group activities are given for students to do under the guidance of the teacher.
- Infographics and info-bits are added to enrich the learner's scientific perception.
- The "Do you know?" and "More to know" placed in the units will be an eye opener.
- Glossary has been introduced to learn scientific terms.
- ICT corner and QR code are introduced in each unit for the digital native generation.

How to get connected to QR Code?

- Download the QR code scanner from the google play store/ apple app store into your smartphone
- 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 textbook.
- Once the camera detects the QR code, a URL appears in the screen. Click the URL and go to the content page.





UNIT

1

MEASUREMENT



Learning Objectives

At the end of this lesson, students will be able to:

- ◆ Understand SI units, base quantities and base units.
- ◆ Explain the system of units and measurements.
- ◆ Analyze the different system of units.
- ◆ Know about temperature, amount of substance, electric current and luminous intensity.
- ◆ Explore the knowledge of accuracy in measurements.
- ◆ Difference between the plane angle and solid angle, different clocks.
- ◆ Solve the numerical problems.



XDED2K

Introduction

Physics is the study of nature and natural phenomena. Physics is considered as the base of all science subjects. Physics is based on experimental observations. The principles and observations allow us to develop a deeper understanding of nature. Scientific theories are valid, only if they are confirmed through various experiments.

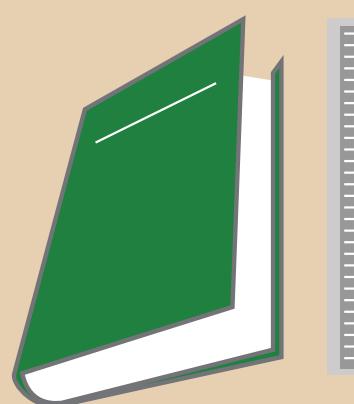
Theories in physics use many physical quantities that have to be measured.

Measurement is the base of all scientific studies and experimentations. It plays a vital role in our daily life. Measurement is the process of finding an unknown physical quantity by using a standard quantity.

We need three things for a perfect measurement. They are (i) an instrument, (ii) a standard quantity and (iii) an acceptable unit.

Activity 1

Students are asked to measure the length and breadth of their science book using a ruler (scale) and compare their measurement with those of their friends.



In this activity, let the length of the book be 15 cm, the length is the physical quantity, ruler is the ‘instrument’, 15 is the ‘magnitude’ and ‘cm’ is the unit. This process is called “Measurement”.



Here, all the students will not get the same value. Thus, one can infer that there may be an error while taking the measurement. This lesson helps us to get a better understanding of measurements.

1.1 System of Units

People in various part of the world are using different systems of units for measurement. Some common systems of units are :

1. FPS - System (Foot for length, Pound for mass and Second for time)
2. CGS -System (Centimetre for length, Gram for mass and Second for time)
3. MKS - System (Metre for length, Kilogram for mass and Second for time)



The 'CGS', 'MKS' and SI units are metric systems of units and 'FPS' is not an metric system. It is a British system of units.

1.1.1 International System of Units

In earlier days, scientists performed their experiments and recorded their results in their own system. Due to lack of communication, they couldn't organize other's experimental results. So, the scientists planned to follow a uniform system for taking the measurements.

As you studied in the lower classes, in 1960, in the 11th General Conference on Weights and Measures at Paris in France, the scientists recognized the need of using standard units for physical quantities. That was called as "International System of Units" and is popularly known as SI System (abbreviated from the French name 'Système International'). The scientists chose seven physical quantities as 'Base Quantities' and defined a 'Standard Unit' to measure each one.

They are known as Base Units or Fundamental Units (Table 1.1)

1.1.2 SI Base Units

Table: 1.1 Base Quantities and Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Electric Current	ampere	A
Amount of Substance	mole	mol
Luminous Intensity	candela	cd

You have already studied about Length, Mass and Time in the lower classes. So, now you are going to study about the other base quantities such as temperature, current, amount of substance and luminous intensity.



In December 1998, the National Aeronautics and Space Administration (NASA), USA launched the Mars Climate Orbiter to collect the data of the Martian climate. Nine months later, on September 23, 1999, the Orbiter disappeared while approaching Mars at an unexpectedly low altitude. An investigation revealed that the orbital calculations were incorrect due to an error in the transfer of information between the spacecraft's team in Colorado and the mission navigation team in California. One team was using the English FPS system of units for calculation, while the other group was using the MKS system of units. This misunderstanding caused a loss of approximately 125 million dollars.



1.2 Temperature

Identify, which of these objects are hot or cold? (Fig 1.1)



Fig 1.1 - Various Hot and Cold Objects

You can see that some objects are cold, and some are hot. You also know that, some objects are hotter than others while some of them are colder than others.

How do you decide, which is hotter and which is colder? So, you need a reliable quantity to decide the degree of hotness or coldness of an object. That quantity is ‘temperature’.

Temperature is a physical quantity that expresses the degree of hotness or coldness of a substance. Heat given to a substance will increase its temperature. Heat removed from a substance will lower its temperature.

1.2.1 Definition

Temperature is a measure of the average kinetic energy of the particles in a system.

The SI unit of Temperature is kelvin. ‘Thermometers’ are used to measure temperature directly.

Usually, thermometers are calibrated with some standard scales. Celsius, Fahrenheit, Kelvin are the most commonly used scales to measure Temperature.

In these thermometers, melting point of pure ice (0°C) is taken as Lower Fixed Point (LFP) and Boiling point of water (100°C) is taken as Upper Fixed Point (UFP).

Table : 1.2 Various Scales to measure Temperature

Types of Scale	Lower Fixed Point (LFP)	Upper Fixed Point (UFP)	No. of divisions in thermometer
Celsius	0° C	100° C	100
Fahrenheit	32° F	212° F	180
Kelvin	273 K	373 K	100

Activity 2

Measure the room temperature inside the class room and outside the class room by using a thermometer and tabulate it with different time intervals for a week. Do you find any differences in these values? Discuss your observations.

Day	10:00 a.m.		12:00 p.m.		2:00 p.m.		4:00 p.m.	
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
Day-1								
Day-2								
Day-3								
Day-4								
Day-5								



1.2.2 Conversion of Scales of Temperatures

The general formula for the conversion of scales of temperature is:

$$\frac{C - 0}{100} = \frac{F - 32}{180} = \frac{K - 273}{100}$$

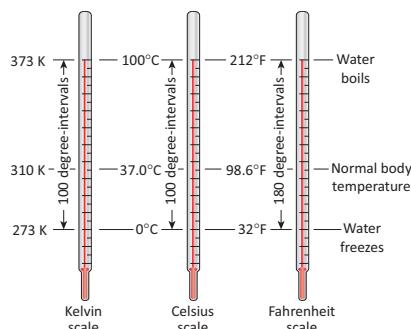


Fig: 1.2 - Various Thermometers

1.2.3 Application of various thermometric scales

1. Physicians use 'clinical thermometers'. It is graduated in 'Fahrenheit Scale'
2. Scientists are using thermometers with kelvin scale.
3. Common temperature measurements are made in celsius scale. (Example: Weather reports are given in celsius scale.)

Info bits

"Normal temperature of the human body is between 98.4° F and 98.6° F"



Infra red thermometer, measures the temperature of an object without any physical contact.



Activity 3

Collect the highest and lowest temperature details of your nearest town or city from the news paper or television for a week and record the values in a tabular column. Does this data remain same throughout the year?

1.3 Electric Current (I)

Flow of electric charges, in a particular direction is known as 'electric current'.

The magnitude of an electric current is the amount of electric charges flowing through a conductor in one second.

$$\text{Total capitalised value of the business} = \frac{\text{Average profit}}{\text{Normal rate of return}} \times 100$$

$$I = \frac{Q}{t}$$

SI unit of Electric Current is 'ampere' and it is denoted as A. Unit of charge is coulomb.

One ampere is defined as one 'coulomb' of charge moving in a conductor in one second. Ammeter is a device used to measure 'electric current'. (Fig 1.3)



Fig 1.3 - Ammeter

More to Know

At very low temperature, around 30 K (-243.2° C), some conductors conduct electric current without any loss. These conductors are known as 'SUPER CONDUCTORS'.

The super conductors are used to levitate trains from the track.

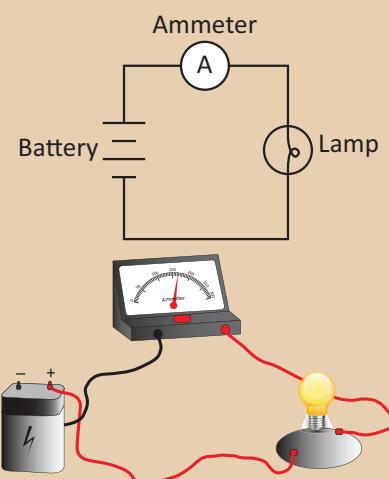
Super conductors can be used as memory or storage element in the computers.





Activity 4

Measure the current in an electric circuit.



Components Required:

Battery, Ammeter, Lamp (Bulb)

Procedure:

1. Connect the battery, ammeter and the lamp in series as shown in the figure.
2. Note the ammeter reading
3. It is the current in the circuit

1.4 Amount of substance

Can you count the number of copper coins in the picture? (Fig 1.4)

Can you count the number of copper atoms in a coin? (Fig 1.4)

It is very difficult to count the number of atoms because the atoms are not visible. There is an indirect method to count the number of atoms or molecules in a substance in multiples of mole. Let us see in detail.



Fig 1.4 - Copper Coins

Amount of substance is a measure of the number of entities (particles) present in a substance. The entity may be an atom, molecule, ion, electron or proton etc.

Generally, the amount of substance is directly proportional to the number of atoms or molecules.

The SI unit of amount of substance is mole and it is denoted as 'mol'.

Mole is defined as the amount of substance, which contains 6.023×10^{23} entities.

More to Know

The number 6.023×10^{23} is also known as Avogadro Number.

1.5 Luminous Intensity



Fig 1.5 (a & b) - Photometer in day to day life

Have you seen these scenes on the television? (Fig 1.5)

What is the umpire doing? Is he taking a 'selfie'? (Fig 1.5)

No, he is checking the intensity of light, as perceived by the human eye, by using an instrument called 'Photometer'.



1.5.1 Definition

The measure of the power of the emitted light, by a light source in a particular direction, per unit solid angle is called as Luminous Intensity.

The SI unit of luminous intensity is candela and is denoted as 'cd'.



Fig 1.6 - Photometer

The light emitted from a common wax candle is approximately equal to one candela

Luminous intensity is measured by a 'photometer' (Fig 1.6) (Luminous Intensity Meter) which gives the luminous intensity in terms of candela directly.

Info bits

Luminous Flux or luminous power is the measure of the perceived power of light. Its SI unit is 'lumen'.

One lumen is defined as the luminous flux of the light produced by the light source that emits one candela of luminous intensity over a solid angle of one steradian.

1.6 Plane angle

It is the angle between the intersection of two straight lines or intersection of two planes. (Fig 1.7)

The SI unit of Plane Angle is 'radian' and is denoted as 'rad'.

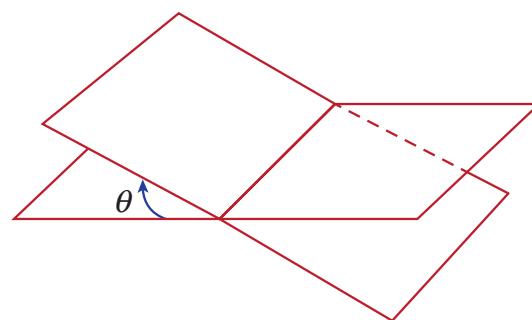


Fig 1.7 - Plane Angle

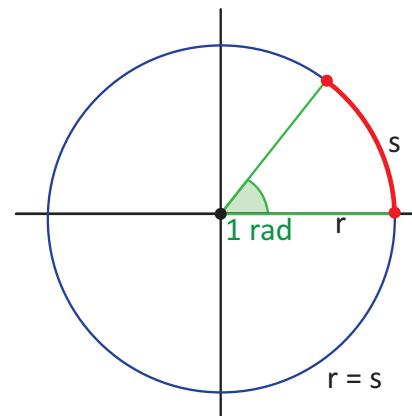


Fig 1.8 - Radian

Radian is the angle subtended at the centre of a circle by an arc whose length is equal to the radius of the circle. (Fig 1.8)

$$\pi \text{ radian} = 180^\circ$$

$$1 \text{ radian} = \frac{180^\circ}{\pi}$$

1.7 Solid Angle

It is the angle formed by three or more planes intersecting at a common point.

It can also be defined as 'angle formed at the vertex of the cone'

The SI unit of solid angle is 'steradian' and is denoted as 'sr'.



1.7.1 Definition

Steradian is the solid angle at the centre of a sphere subtended by a portion whose surface area is equal to the square of its radius of the sphere. (Fig 1.9)

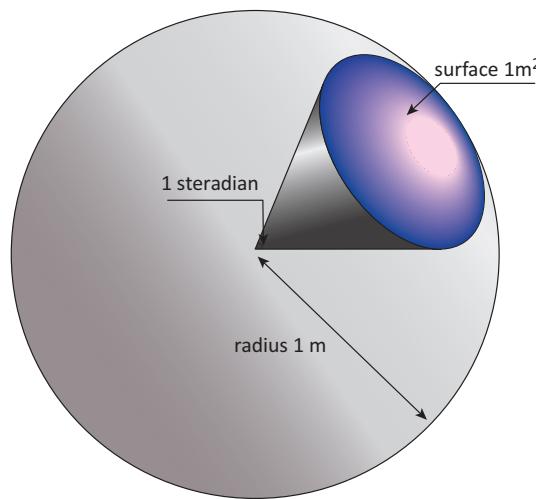


Fig 1.9 - Steradian



Until 1995, Plane Angle and Solid Angle were classified under supplementary quantities. In 1995, they were shifted to derived quantities.

Table: 1.3 Difference between Plane Angle and Solid Angle

Plane Angle	Solid Angle
Angle between the intersection of two lines or planes	Angle between the intersection of three or more planes at a common point
It is two dimensional	It is three dimensional
Unit is radian	Unit is steradian

1.8 Clocks

Clocks are used to measure time intervals. So, many clocks were used from the ancient time. Scientists modified the clock's mechanism to obtain accuracy.



Fig 1.10 - Ancient Clock

1.8.1 Types of clocks based on display:

1. Analog clocks; 2. Digital clocks

1. Analog clocks



Fig 1.11 - Analog Clock

It looks like a classic clock. It has three hands to show the time. (Fig 1.11)

Hours Hand: It is short and thick. It shows 'hour'.

Minutes Hand: It is long and thin. It shows 'minute'.

Seconds Hand: It is long and very thin. It shows 'second'. It makes one rotation in one minute and 60 rotations in one hour.

Analog clocks can be driven either mechanically or electronically.

Activity 5

Students must make a model of an Analog clock using a cardboard.

2. Digital clocks

A digital clock displays the time directly. It shows the time in numerals or other symbols. It may have a 12 hours or 24 hours display. (Fig 1.12)

Recent clocks are showing Date, Day, Month, Year, Temperature etc.

Digital clocks are often called as Electronic Clocks.



Fig 1.12 - Digital Clock

Activity 6

Students must make a model of a digital clock using match sticks on a cardboard, with date and time.

1.8.2 Types of clocks based on working mechanism

1. Quartz Clock:

These clocks are activated by 'electronic oscillations', which are controlled by a 'quartz crystal'. (Fig 1.13)

The frequency of a vibrating crystal is very precise. So, the quartz clock is more accurate than the mechanical clock.

These clocks have an accuracy of one second in every 10^9 seconds.



Fig 1.13 - Quartz Clock

More to Know

The principle of a quartz clock is the Piezo - electric property of a crystal. Piezo-electric property means that when a pressure is applied along a particular axis of a crystal, an electric potential difference is developed in a perpendicular axis.

In the reverse piezo-electric effect, a crystal becomes mechanically stressed when a voltage is applied across its opposite faces.

2. Atomic Clock:

These clocks are making use of periodic vibrations occurring within the atom. (Fig 1.14)

These clocks have an accuracy of one second in every 10^{13} seconds.

Atomic clocks are used in Global



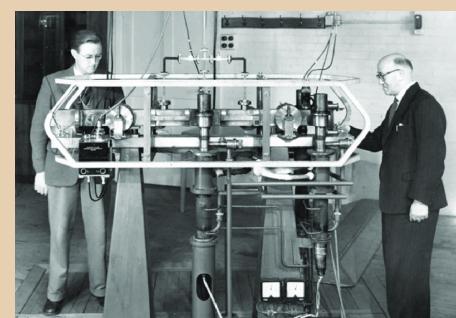
Fig 1.14 - Atomic Clock

Positioning System (GPS), Global Navigation Satellite System (GLONASS) and International time distribution services.

More to Know

The first atomic clock was developed in 1949 at the US National Bureau of Standards. But, it was less accurate than the quartz clock.

The first accurate atomic clock (based on Caesium - 133) was built by Louis Essen and Jack Penny in 1955, at the National Physics Laboratory in the United Kingdom.



Activity 7

You may know about the 'Sun Dial'. Construct a sundial of your own and read out the values from morning to evening. Compare your values with modern clocks.

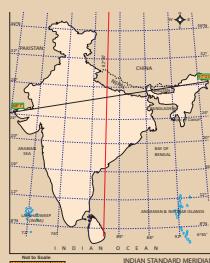


Greenwich Mean Time

(GMT) is the mean solar time at the Royal Observatory, located at Greenwich in London. It is measured at the longitude of zero degree.



The Earth is divided into 24 zones, each of a width of 15 degree longitude. These regions are called as 'Time Zones'. Time difference between two adjacent time zones is 1 hour.



Indian Standard Time (IST):

The location of Mirzapur in Uttar Pradesh is taken as the reference longitude of the Indian Standard Time. It is located at 82.5 degree longitude.

$$\text{IST} = \text{GMT} + 5:30 \text{ hours}$$

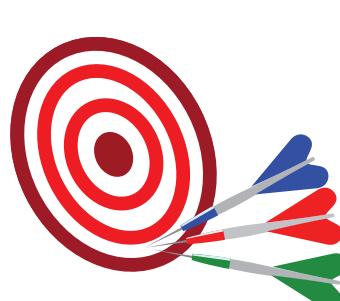
1.9 Accuracy in Measurements

Measurement is the base of all experiments in science and technology. The value of every measurement contains some uncertainty. These uncertainties are called as 'Errors'.

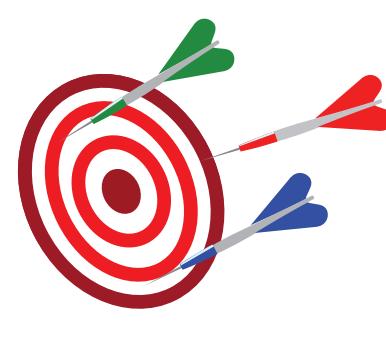
The difference between the real value and the observed value is called an error.



Good accuracy
Good precision



Poor accuracy
Good precision



Poor accuracy
Poor precision

Fig 1.15 - Accuracy and Precision



It is an estimation of a number obtained by rounding off a number to its nearest place value.

When the data are inadequate, physicists are in need of an approximation to find the solution for problems. Approximations are usually based on certain assumptions having a scientific background and they can be modified whenever accuracy is needed.

Activity 8

Calculate the approximate 'heart beat' of a man in a day. (Hint: Take number of heart beats per minute as 75, approximately)

1.11 Rounding off

Calculators are widely used in day to day life to do the calculations. The result given by a calculator has too many digits. Hence, the result containing more digits should be rounded off. The technique of rounding off is used in many areas of physics.

1.12.1 Rules for rounding off

- Decide which is the last digit to keep.
- Leave it the same, if the next digit is less than 5.
- Increase it by one, if the next digit is 5 or greater than 5.

Thinking Corner:

Since, the true value is also an observed value then what is meant by true value? Think and discuss it with your friends?

1.12 Numerical Problems:

1. Convert 80°C into kelvin.

Solution:

$$K = C + 273$$

$$K = 80 + 273$$

$$K = 353 \text{ kelvin}$$

2. Convert 300 K into celsius.

Solution:

$$C = K - 273$$

$$C = 300 - 273$$

$$C = 27 \text{ celsius.}$$

3. When 2 coulomb of charge, flows through a circuit for 10 seconds, calculate the current?

Solution:

Given: Charge $Q = 2\text{ C}$; time $t = 10\text{ s}$

$$I = \frac{Q}{t} \text{ or } I = \frac{2}{10}$$

$$I = 0.2\text{ A}$$

4. Convert 60° into radian.

$$1^{\circ} = \frac{\pi}{180}$$

$$60^{\circ} = \frac{\pi}{180} \times 60 \\ = \frac{\pi}{3} \text{ radian}$$

5. Convert $\frac{\pi}{4}$ into degrees.

$$\pi \text{ radian} = 180^{\circ}$$

$$\frac{\pi}{4} \text{ radian} = \frac{180}{4} = 45^{\circ}$$

6. Round off the number 1.864 to two decimal places

Step: 1 Identify the last digit to be kept.
6 is the last digit to be kept.

Step: 2 The following digit, i.e. 4 is less than 5. So, retain it as 6.
The answer is 1.86

7. Round off the number 1.868 to two decimal places

Step: 1 Identify the last digit to be kept.
6 is the last digit to be kept.

Step: 2. The following digit, i.e. 8 is greater than 5. So, increase 6 by one. The answer is 1.87



Points to remember

- SI units - International System of units, introduced in the 14th General Conference on Weights and Measure in 1971.
- Base quantities: Length, Mass, Time, Temperature, Electric current, Amount of substance & Luminous Intensity - 7 quantities.
- Temperature: Measure of hotness or coldness of a substance - average kinetic energy of the particles in a system - its unit is 'kelvin'.
- Electric current: Flow of electric charges (electrons) in a unit time - unit: ampere
- Amount of substance: Measure of number of entities (Particles) present in a substance - unit: mole.

- Luminous Intensity: Amount of light emitted by a light source in a particular direction per unit time - unit: candela.
- Plane angle: Angle between the intersection of two lines or planes - unit: radian.
- Solid angle: Angle between the intersection of three or more planes - unit: steradian
- Quartz clock : uses the 'electronic oscillations' controlled by a 'quartz crystal'.
- Atomic clock: uses the 'periodic vibrations occurring within the atom'.
- Accuracy: closeness of a measured value to the actual value.
- Precision: closeness of two or more measurements to each other.
- Approximation: Process of finding the solution by means of 'estimation'.



TEXT BOOK EXERCISES



DNP9YR

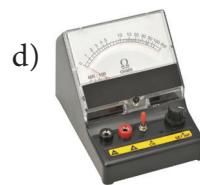
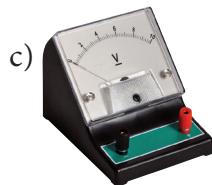
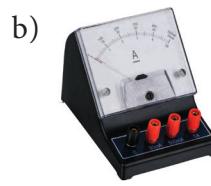
Choose the best answer

1. Which one the following system of units is the British System of unit?
a) CGS b) MKS
c) FPS d) SI
2. Electric current belongs to _____ quantities
a) base
b) supplementary
c) derived
d) professional
3. SI unit of temperature is
a) celsius b) fahrenheit
c) kelvin d) ampere

4. Amount of substance is
 - a) directly proportional to the number of atoms
 - b) inversely proportional to the number of atoms
 - c) directly proportional to the square of number of atoms
 - d) inversely proportional to the square of number of atoms
5. Luminous intensity is the intensity of
 - a) Laser light
 - b) UV light
 - c) visible light
 - d) IR light



6. Which one of the following devices is used to measure electric current



7. SI unit stands for

- a) International system of units
 - b) Integrated System of units
 - c) International symbol of units
 - d) Integrated symbol of units
8. Closeness of two or more measured values is called as
- a) accuracy
 - b) precision
 - c) error
 - d) approximation
9. Quantities other than base quantities are called as
- a) supplementary quantities
 - b) derived quantities
 - c) professional quantities
 - d) energy quantities
10. Which of the following statements about approximation is wrong?
- a) Approximation gives accurate value.
 - b) Approximation simplifies the calculation.
 - c) Approximation is very useful when little information is available.
 - d) Approximation gives the nearest value only.

II. Fill in the blanks.

1. The solid angle is measured in _____.
2. _____ recognized the need of 'Standard Units' for physical quantities.

3. The coldness or hotness of a substance is expressed by _____.
4. _____ is used to measure electric current.
5. _____ of substance, contains 6.023×10^{23} atoms or molecules.
6. Luminous Intensity is the amount of visible light, that is emitted in unit area per unit _____.
7. Quartz clock uses _____ oscillations.
8. The uncertainty in measurement is called as _____.
9. _____ is the closeness of the measured value to the original value.
10. The intersection of two straight lines gives us _____.

III. True or False.

1. SI units are metric system of units.
2. Temperature is a measure of total kinetic energy of the particles in a system.
3. In thermometers, freezing point of water is taken as the Upper Fixed Point.
4. One coulomb of charge flowing per minute is called 'ampere'.
5. Amount of substance gives the number of particles present in the substance.
6. Intensity of light from a candle is approximately equal to one 'candela'.
7. Angle formed at the top of a cone is an example of 'Plane Angle'.
8. Quartz clocks are used in GPS Devices.
9. Candela is used to express electric field intensity.
10. The number 4.582 can be rounded off as 4.58 .



IV. Match the following:

Column A		Column B
1. Temperature	a	Closeness to the Actual Value
2. Plane Angle	b	Measure of hotness or coldness
3. Solid Angle	c	Closeness to two or more measurements
4. Accuracy	d	Angle formed by the intersection of three or more planes
5. Precision	e	Angle formed by the intersection of two planes

V. Assertion & Reason.

1. **Direction:** Mark the correct choice as
 - a. If both assertion and reason are true and reason is the correct explanation of the assertion.
 - b. If both assertion and reason are true but reason is not the correct explanation of the assertion.
 - c. Assertion is true, but reason is false.
 - d. Assertion is false, but reason is true.
1. **Assertion:** The SI system of units is the suitable system for measurements.
Reason: The SI unit of temperature is kelvin.
2. **Assertion:** Electric current, amount of substance, Luminous Intensity are the fundamental physical quantities.
Reason: They are independent of each other.
3. **Assertion:** The seconds hand of a clock is having least count of one second.
Reason: Least count is the maximum measurement that can be measured accurately by an instrument.
4. **Assertion:** Avogadro's number is the number of atoms in one mole of substance.

Reason: Avogadro's number is a constant

5. **Assertion:** Radian is the unit of solid angle.

Reason: One radian is the angle subtended at the centre of a circle by an arc of length equal to its radius.

VI Answer in a word or two

(Very Short Answer):

1. What is the unit of mass in FPS system?
2. How many base quantities are included in SI system?
3. Give the name of the instrument used for the measurement of temperature.
4. What is the 'Lower Fixed Point' of the Fahrenheit scale?
5. What is the SI unit of Luminous Intensity?
6. What is the value of Avogadro's number?
7. What type of oscillations are used in atomic clocks?
8. Mention the types of clocks based on their display.
9. How many times will the 'minute hand' rotate in one hour?
10. How many hours are there in a minute?

VII Answer the questions given below (Short Answer):

1. What is measurement?
2. Name some common systems of measurement.
3. Define- Temperature.
4. Define - ampere.
5. What is electric current?
6. What is luminous Intensity?
7. Define - mole.
8. What are the differences between Plane angle and solid angle?



9. What are errors?



REFERENCE BOOKS

1. Units and measurements – John Richards, S. Chand publishing, Ram nagar, New Delhi.
2. Units of Measurement - Past, Present and Future. International System of Units - Gupta, S. V. eBook ISBN 978-3-642-00738-5 DOI 10.1007/978-3



INTERNET RESOURCES

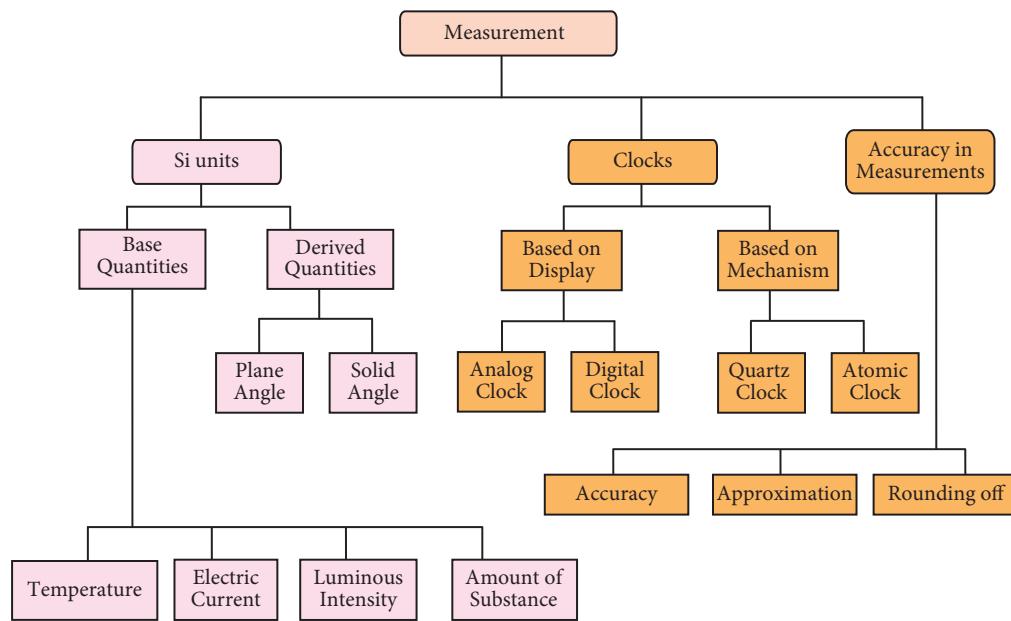
1. <http://www.npl.co.uk/reference/measurement-units/>
2. <http://www.splung.com/content/sid/1/page/units>
3. <https://www.nist.gov/sites/default/files/documents/2016/12/07/sp330.pdf>
4. <https://study.com/academy/lesson/standard-units-of-measure.html>

A-Z GLOSSARY

Kinetic energy	energy of moving objects
Calibration	process of configuring an instrument in a particular range
Electronic Oscillation	oscillations produced by an electronic circuit
Quartz Crystal	crystal formed by Silicon and Oxygen (SiO_2)
Potential Difference	the difference in potential between two points in an electric field or electric circuit.



Mind Map



ICT CORNER

This activity enables the students to learn about the various types of Time keeping devices

Measurement

History of timekeeping devices

From Wikipedia, the free encyclopedia

For thousands of years, devices have been used to measure and keep track of time. The current measurement dates to approximately 2000 BC from the Sumerians.
The Egyptians divided the day into 12 hours, which were large divisions to track the rising and setting of the sun. This was later adopted by the Phoenicians and later outside Egypt by the Ancient Greeks, who called them cleopatra. The Zhou dynasty is believed to have used similar time devices which were introduced from Mesopotamia as early as 2000 BC.
Other ancient timekeeping devices include the candle clock, used in ancient China, ancient Japanese timer, widely used in India and Tibet, as well as some parts of Europe, and the hourglass, clock. The sundial, another early clock, relies on shadows to provide a good estimate of the time, cloudy weather or at night requires recalibration as the seasons change. If the gnomon was tilted at an angle, it could measure the time of day more accurately.



Step1

Step2

Step3

Step4

Web link: <https://playablo.com/Blog/5-fun-activities-to-teach-temperature-hot-and-cold-to-preschoolers/> https://en.wikipedia.org/wiki/History_of_timekeeping_devices

(or) scan the QR Code

*Pictures are indicative only





UNIT

2

FORCES AND PRESSURE



Learning Objectives

After learning this unit, students will be able to:

- ◆ Understand the concept of force and its effects.
- ◆ Differentiate thrust and pressure.
- ◆ Understand pressure and its application.
- ◆ Understand the relation between force and pressure.
- ◆ Understand the characteristics of atmospheric and liquid pressure.
- ◆ State Pascal's law and know its applications.
- ◆ Apply Pascal's law in day to day life.
- ◆ Know the instrument used to measure atmospheric and liquid pressure.
- ◆ Understand the property of surface tension and viscosity.
- ◆ Analyze friction in rest and motion.
- ◆ Know the ways to increase and decrease the friction.
- ◆ Solve numerical problems related to force and pressure.



Introduction

Every day you can observe bodies around you. When you are coming to school, you can notice that some of them are moving, some of them are at rest. What pushes or pulls them? What brings the moving bodies to rest? What is the effect of these pulls or pushes?

All the above questions can be answered by saying just one word, which is "Force".

2.1 FORCE

Observe the following actions in day to day life:

Opening up a pen, opening a door, kicking a football, striking a carrom coin, making of chapattis etc., all these actions need a force.

Force is an 'action of push or pull', which makes the bodies to move or brings the moving bodies to rest. It even changes the shape and size of certain bodies.

Activity 1

Make two groups of students. Let them stand along a straight line, one behind the other, on a playground. Start the game of "tug of war" with a rope. Observe the movement of the students.

Who are the winners?

The group of students who pull the rope with a greater force will definitely win. The winners are applying a greater amount of force. Hence, the rope moves in the direction of the greater force.



2.1.1 Definition of force

Force is that which changes or tends to change: i) the state of rest or ii) the state of uniform motion of a body or iii) the direction of a moving body or iv) the shape of a body.

Pushes and pulls are forms of forces. The direction of a force is in the direction in which a push or a pull is applied. Thus, force is a vector quantity, which has magnitude and direction. It is measured with a unit called “newton (N)”.

2.1.2 Factors on which a force depends

You have studied the effects of force so far. Now, you are going to study the factors on which the effect of a force actually depends.

When you play any game, the greater the force you apply on a body, greater will be its effect on it. Just observe the strokes of the bat by a batsman. If he wants to hit the cricket ball to the boundary, the striking force on the ball must be greater.

Now, the question before you is does it depend on the area of impact?

Activity 2

Fix a matrix of sharp pins on a wooden board in rows and columns. Take a big blown up balloon. Next, place it gently over the pins. Place a small book on the top of the balloon. Will the balloon burst? Will the pins prick the balloon?



Inference: It is a wonderful sight to see that the balloon will not burst. How is this possible?

Reason: If you prick the blown up balloon with a single pin it will burst. But, this did not

happen even though many more pins were pricking the balloon.

A single pin produces a large pressure over a small area. But, when a large number of pins prick a body, each pin exerts very little pressure on the balloon, as the applied force gets distributed over a larger surface of the body. So, the balloon will not burst.

We conclude that the effect of a force depends on the magnitude of the force and the area over which it acts.

2.1.3 Thrust

It is a force acting perpendicularly on any given surface area of a body. It is measured by the unit newton.

2.1.4 Pressure

The effect of force can be measured using a physical quantity called pressure. It can be defined as the amount of force or thrust acting perpendicularly on a surface of area one square meter of a body. Unit of pressure is pascal (Pa) or $N\ m^{-2}$.

Pressure = $\frac{\text{Thrust (or) Force}}{\text{Area}}$, $P = \frac{F}{A}$. The SI unit of pressure is pascal (named after the French scientist Blaise Pascal). 1 pascal = $1\ N\ m^{-2}$

Pressure exerted by a force depends on the magnitude of the force and the area of contact.

SOLVED PROBLEM: 2.1

Calculate the pressure exerted by the foot of an elephant using the following data. Average weight of an elephant is 4000 N. Surface area of the sole of its foot is $0.1\ m^2$.

Solution:

Average weight of the elephant = 4000 N

Weight of one leg = force exerted by one leg = $4000/4 = 1000\ N$

Area of the sole of one foot = $0.1\ m^2$.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{1000}{0.1}$$



$$= 10000 \frac{\text{N}}{\text{m}^2} = 10^4 \text{ N m}^{-2}$$

Pressure exerted by one leg of the elephant is 10,000 newton on one square metre.

Increasing pressure:

The effect of pressure can be increased by increasing the thrust or by decreasing the area of the surface of the body experiencing the thrust.

Examples:

The axe, nail, knife, injection needle, bullet etc., all these are having sharp fine edges so as to exert a larger pressure on a smaller area of the body; in order to get the maximum effect from them.

It is very difficult to walk on sand. But, camels can walk easily on it because they have large padded feet, which increase the area of contact with the sandy ground. This reduces the pressure and enables them to walk easily on the sand.

Examples:

1. More number of wheels are provided for a heavy goods-carrier for decreasing the pressure; thereby increasing the area of contact on the road.
2. Broader straps are provided on a backpack for giving a lower pressure on the shoulders by providing a larger area of contact with the shoulder.
3. It is difficult to drive an automobile, which has flattened tyres.



Figure 2.1 Broader straps

2.2 PRESSURE EXERTED BY AIR - ATMOSPHERIC PRESSURE

You all know very well that air fills the space all around us. This envelope of air is called as atmosphere. It extends up to many kilometres above the surface of the Earth. All objects on the surface of the Earth experience the thrust or force due to this atmosphere.

The amount of force or weight of the atmospheric air that acts downward on unit surface area of the surface of the Earth is known as **atmospheric pressure**. It can be measured using the device called **barometer**. The barometer was invented by "Torricelli".

Atmospheric pressure decreases with altitude from the surface of the Earth.

Atmospheric pressure can be measured by the height of the mercury column in a barometer. The height of the mercury column denotes the atmospheric pressure at that place at a given time in 'millimetre of mercury'. Even if you tilt the tube at various angles, you will see that the level of mercury will not vary. At sea level, the height of the mercury column is around 76 cm or 760 mm. The pressure exerted by this mercury column is considered as the pressure of magnitude 'one atmosphere' (1 atm).

More to know

Cooking in a place located at a higher altitude is difficult. Why?

At a higher altitude, due to the lack of atmospheric pressure the boiling point of a substance reduces. So, the water boils even at 80° C. At this temperature, the thermal energy that is produced is not sufficient enough for baking or cooking. So, cooking is difficult at higher altitude.



1 atmospheric pressure = 1 atm = pressure exerted by the mercury column of height 76 cm in the barometer = $1.01 \times 10^5 \text{ N m}^{-2}$.

In the SI system 1 atm = 1,00,000 pascal (approximately).

SI unit of atmospheric pressure is Nm^{-2} or pascal.

To realise the effect of atmospheric pressure:



Activity 3

Take a conical flask. Take a well boiled egg, after removing its shell. Place the egg on the mouth of the flask. It will not enter the flask. Next, take a piece of paper. Burn it and drop it inside the flask. Wait for a few seconds; let it burnt fully. Now, keep the egg on the mouth of the flask. Wait for a few minutes. What did you observe?



Inference: The egg placed at the mouth of the flask gets compressed and it falls into the flask, due to the atmospheric pressure.

Reason: When the paper is burning in the flask, the oxygen present in the air inside the conical flask is used up for its combustion. This reduces the pressure of the air in the flask. The air in the atmosphere tends to occupy the low pressure region in the flask. So, it rushes through the mouth of the flask, thus pushing the egg into the flask. Eventually, the egg falls down to the bottom of the flask.

2.3 FORCES IN LIQUIDS

2.3.1 Buoyant force of a liquid

An upward force is exerted by water on a floating or a partly submerged body. This

upward force is called **buoyant force**. The phenomenon is known as “buoyancy”. This force is not only exerted by liquids, but also by gases. Liquids and gases together are called fluids.

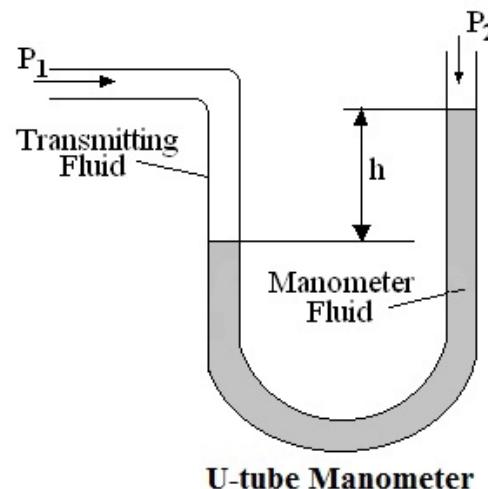
This upward force decides whether an object will sink or float. If the weight of the object is less than the upward force, then the object will float. If not, it will sink.

A body floats if the buoyant force > its weight; A body sinks if its weight > buoyant force.

2.3.2 Pressure exerted by liquids

Liquids do not have a definite shape. The force acting on unit area of the surface, on which the liquid is placed, is called the static pressure of the liquid. Liquids exert a pressure not only on the base of their container/vessel, but also on its side walls. The pressure exerted by a liquid depends upon the depth of the point of observation considered in it.

An instrument used to measure the difference in the liquid pressure is called a “manometer”. You can measure the pressure of fluids enclosed in a definite container using the manometer.



U-tube Manometer

Figure 2.2 Manometer

a) Pressure exerted by a liquid on the base of a container depends upon the height of the liquid column:



Activity 4

Take a glass tube that is open at both ends. Fix a rubber balloon at the lower end of the tube. Put some water into the tube and observe the balloon. Now, pour some more water into the balloon and again observe the balloon.

Inference: The balloon starts bulging outwards. The bulge increases with an increase in the height of the water column.

Reason: The pressure exerted by a liquid at the bottom of a container depends on the height of the liquid column in it.

You have already studied that the atmospheric pressure is measured in terms of the height of the mercury column in a barometer.

b) Liquids exert the same pressure in all directions at a given depth:

c) Liquid pressure varies with the depth:

Activity 5

Take a plastic bottle. Punch three holes on its sides at the same height from its base. Now, pour some water into it and let it flow through the holes. Observe the flow of the water.

Inference: The water comes out from all the holes with the same force and falls on the ground/table, at the same distance from the bottle.



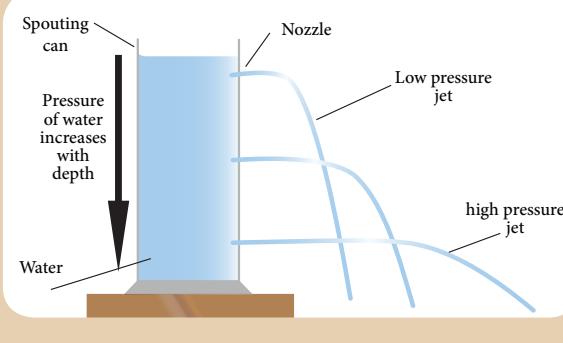
Reason: This activity confirms that liquids exert the same pressure in all directions, at a given depth in their container.

Activity 6

Take a plastic bottle. Punch three holes on its side in the same direction, but at different heights. Now pour some water into it and let it flow through the holes. Observe the flow of water.

Inference: The water comes out from all the holes with a different force and falls on the table at points that are at variable distances from the bottle. Water from the lowest hole comes out with the greatest force and falls at a point that is at the maximum distance from the bottle. Water from the topmost hole comes out with the least force and falls at the point that is at the minimum distance from the bottle.

Reason: This activity confirms that the pressure in a liquid varies with the depth of the point of observation in it.



Thinking Corner



Why dams are made stronger and thicker at the bottom than at the top?

Why do scuba divers wear a special suit while they go into deep sea levels?

Home Assignments

1. Ask your family doctor how blood pressure is to be measured?
2. Read the life history of Blasie Pascal.



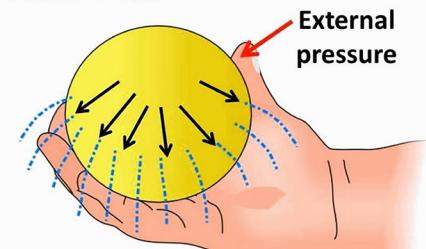
Activity 7

Take a rubber ball. Fill it with water. Then, make tiny holes on it with a pin at different points on its surface. Press anywhere on the ball. What do you observe?

Inference: There are identical streams of water flowing in all directions from the holes.

Reason: This is due to the phenomenon that the pressure, which is applied on the liquid, is equally transmitted in all direction. This concept was first given by the French scientist Blasie Pascal.

Pascal's law



Pressure applied on one point of liquid transmits equally in all direction

2.3.3 Pascal's law:

The pressure applied at any point of a liquid at rest, in a closed system, will be distributed equally through all regions of the liquid.

2.3.4 Application of Pascal's law:

Some of the following examples highlight their working according to Pascal's law.

- In an automobile service station, the vehicles are lifted upward using the hydraulic lift, which works as per Pascal's law.
- The automobile brake system works according to Pascal's law.
- The hydraulic press is used to make the compressed bundles of cotton or cloth so as to occupy less space.

Activity 8

Fill two identical syringes with water. Connect them with a plastic tube. Press gently on one end of a piston. What do you observe?

Inference: If one piston is pressed downward, then the other piston will move up slightly, depending on the pressure given on the first piston.

Reason: This activity confirms that the pressure exerted on a liquid at rest is transmitted equally to other portions of the liquid.



2.4 SURFACE TENSION

Thinking Corner



- Why are rain drops spherical in nature?
- A liquid flowing out of a very small opening of a tube or tap comes out in the form of fine drops and not as a continuous stream. Why?
- Trees are greenish. They are greenish at the tip too. How does the water rise upward in a tree or plant against the force of gravity?

All the above questions have an answer, i.e., "due to surface tension".

Surface tension is the property of a liquid. The molecules of a liquid experience a force, which contracts the extent of their surface area as much as possible, so as to have the minimum value. Thus, the amount of force acting per



unit length, on the surface of a liquid is called surface tension. It has the unit $N\ m^{-1}$.

Activity 10

Take a paper clip. Take a beaker of water. Take a tissue paper and spread it on the surface of the water. Gently, place the paper clip on the tissue paper. Observe what happens to the paper pin after some time.



Inference: After a few moments the tissue paper will submerge and the paper clip will make a small depression on the surface of the water. It will instantly begin to float on the surface, even though it is denser than water.

Reason: This is due to the water molecules on the surface, which tend to contract themselves like the molecules of an elastic membrane. A force exists on them, which tends to minimize the surface area of water. The paper clip is balanced by the molecules on the water surface that is now behaving like a stretched elastic membrane. So, it does not submerge.

2.4.1 Application of surface tension:

- Water molecules rise up due to surface tension. Xylem tissues are very narrow vessels present in plants. Water molecules are absorbed by the roots and these vessels help the water to rise upward due to "capillarity action" (you will study this topic in the forth-coming classes), which is caused by the surface tension of water.
- For a given volume, the surface area of a sphere is the minimum. This is the reason for the liquid drops to acquire a spherical shape.

- Water strider insect slides on the water surface easily due to the surface tension of water.
- During a heavy storm, sailors pour soap powder or oil into the sea near their ship to decrease the surface tension of sea water. This process reduces the impact of the violent water current against the all of ship.



Figure 2.3 Water strider

2.7 VISCOSITY

Activity 11

Take a small quantity of different kinds of liquid like coconut oil, honey, water and ghee etc., in a cup. Place one drop of each liquid on a separate glass plate. Next, gently raise one end of the glass plate, one by one, so as to allow the liquid to slide down the smooth surface of the plate. Observe the speed of each liquid.

Inference: Each liquid moves with a different speed. Water flows faster than other liquids. Coconut oil flows with a moderate speed. Ghee flows very slowly.

Reason: Between the layers of each liquid, in motion, there is a frictional force parallel to the layers of the liquid. This frictional force opposes the motion of the liquid layers while they are in motion.

Definition:

When a liquid is flowing, there is a frictional force between the successive layers of the liquid. This force which acts in order to oppose the relative motion of the layer is known as viscous force. Such a property of a liquid is called viscosity.



Viscosity force is measured by the unit called poise in CGS and $\text{kg m}^{-1} \text{s}^{-1}$ or N s m^{-2} in SI.

2.6 FRICTION

Thinking Corner



Ram is a good student. But, sometimes he does not care about the cleanliness of his surroundings. Once, he got bananas from his mother. After eating them he just threw the peels of banana on the path of his house. When his brother crossed the path, unknowingly he kept his leg on them. He fell down with a scream. Ram rushed out and helped him. This incident occurred because of his negligence. He realised his mistake. He took the peels of banana and put them in the dustbin.

He then asked himself how the peels of banana had made his brother slide over the path. Could you help him?

Reason: Ram's brother falls down due to the lack of friction between his feet and the banana peels.

You have studied that forces are classified into two types: contact force and non-contact force. Now, you are going to study one of the contact forces, i.e., **friction**.

It is easy to hold a tumbler due to the friction between the surfaces of your palm and the tumbler. But, when oil is applied to your palm, the contact force between your fingers and the tumbler is reduced. So, the friction is reduced. Hence, it is difficult to hold it with an oily hand.

2.6.1 Origin of friction

Frictional force or friction arises when two or more bodies in contact move or tend to move, relative to each other. It acts always in the opposite direction of the moving body. This force is produced due to the geometrical dissimilarities of the surface of the bodies, which are in relative motion.

2.6.2 Effects of friction:

Friction can produce the following effects:

- Friction opposes motion.
- Friction causes wear and tear of the surfaces in contact.
- Friction produces heat.

2.6.3 Types of friction:

Friction can be classified into two basic types: static friction and kinetic friction.

Static friction: The friction experienced by the bodies, which are at rest is called static friction. (E.g.: all the objects rigidly placed to be at rest on the Earth, a knot in a thread.)

Kinetic friction: Friction existing during the motion of bodies is called kinetic friction.

Further, kinetic friction can be classified into two: sliding friction and rolling friction.

Sliding friction: When a body slides over the surface of another body, the friction acting between the surfaces in contact is called sliding friction.

Rolling friction: When a body rolls over another surface, the friction acting between the surfaces in contact is called rolling friction.

Rolling friction is less than sliding friction. That is why wheels are provided in vehicles, trolleys, suitcases etc.

Activity 12

Push or slide a book on a rough surface. It is difficult to push it. Isn't it? Now, keep some cylindrical pencils underneath the book. Again, push it. It is easy to move the book. Why?

Reason: When you push the book, the pencils roll in the direction of the applied force. They prevent the contact of the book



with the rough surface. Rolling pencils offer the least amount of friction. So, it is easy to displace the book in comparison with sliding it on the table.

This method is often used in moving heavy wood from one place to another.

2.6.4 Factors affecting friction

a) Nature of a surface:

Activity 13

Arrange some notebooks one over the other to form a platform, on a table. Keep a wide scale, as a slide, such that one of its ends rests on the pile of books. Take different kinds of materials like cotton cloth, plastic paper, newspaper, writing pad etc. Place some glass marbles in a bowl placed on the table.

First, keep a rectangular piece of paper near the end of the scale, which is in contact with the table. Now, release a glass marble from the top end of the scale such that it rolls down the scale. Allow the marble to roll over the piece of paper and finally, come to rest.

Measure the distance travelled by the marble over the paper, using the meter scale. Replace the 'rolling surface' by placing the plastic sheet, wooden plank, cotton cloth, etc. In each trial measure the distance travelled by the glass marble. Tabulate the distance covered by the marble over each surface.

S. No.	Rolling surface placed on the table	Distance covered by the glass marble after sliding down (in centimetre)
1	Paper	
2	Glass	
3	Cotton cloth	
4	Wood	

Inference: The marble covers a lesser distance over the cotton cloth in comparison with the distance it covers over the glass plate.

Reason: A rough surface like the cotton cloth, offers more frictional force. So, the marble moves slowly and covers a minimum distance. The smooth surface of glass, offers lesser friction. So, the glass marble travels a greater distance over it.

The above activity reveals the 'effect of the force of friction', which increases as the roughness of the surface increases.

It is easy to walk or ride a vehicle on a road, but it is difficult to do the same on sand due to its greater friction (roughness).

b) Weight of the body:

It is easy to pedal your cycle without any load on its carrier. With a load placed on its carrier, it is difficult to move it because the weight on the carrier increases the friction between the surface of the tyre and the road.

c) Area of contact:

For a given weight, the friction is directly related to the area of contact between the two surfaces. If the area of contact is greater, then, the friction will be greater too.

A road roller has a broad base, so it offers more friction on the road. But, a cycle has the least friction, since the area of contact of the tyre with the surface of the road is less.

2.6.5 Advantages of friction



Friction is a necessity in most of our day to day activities. It is desirable in most situations of our daily life.

- We can hold any object in our hand due to friction.
- We can walk on the road because of friction. The footwear and the ground help us to walk without slipping.



- Writing easily with a pen on paper is due to friction.
- Automobiles can move safely due to friction between the tyres and the road. Brakes can be applied due to frictional resistance on brake shoes.
- We are able to light a matchstick, sew clothes, tie a knot or fix a nail in the wall because of friction.

Though it is giving a negative effect, in most of our day to day life friction helps us to make our life easy. So, it is called as “necessary evil”.

2.6.6 Disadvantages of friction

- Friction wears out the surfaces rubbing with each other, like screws and gears in machines or soles of shoes.
- To overcome the friction an excess amount of effort has to be given to operate a machine. This leads to wastage of energy.
- Friction produces heat, which causes physical damage to the machines.

2.6.7 Increasing and decreasing friction

a) Area of contact:

Friction can be increased by increasing the area of the surfaces in contact. Have you seen the sole of a shoe, which has grooves? It is done to provide the shoes a better grip with the floor, so that you can walk safely. Treaded tyres (tyres with slots and projections) are used to increase the friction.

Brake shoes in a cycle have to be adjusted so that they are as close as possible to the rim of the wheel, in order to increase the friction.

E.g.: Sumo players, Kabbadi players rub their hand with mud, to get a better grip. Football shoes are having soles with many projections, for providing a stronger grip with the ground.

b) Using lubricants:

A substance, which reduces the frictional force, is called a lubricant. E.g.: grease, coconut oil, graphite, castor oil, etc.

The lubricants fill up the gaps in the irregular surfaces between the bodies in contact. This provides a smooth layer thus preventing a direct contact between their rough surfaces.

c) Using ball bearing:

Since, the rolling friction is smaller than sliding friction, sliding is replaced by rolling with the usage of ball bearings. You can see lead shots in the bearing of a cycle hub.

Points to remember

Force

- Force is defined as ‘a push’ or ‘a pull’ acting on a body, which tends to change i) its state of rest or of motion or ii) its shape. The SI unit of force is newton.
- Force acts only when two or more objects interact with one other.
- A force can start a motion, stop a motion, change the direction of motion, and can change the shape or size of a body.

Pressure

- The effect of force can be measured using the physical quantity called pressure. It can be defined as the amount of force or thrust acting perpendicularly on one square meter area of a surface. Unit of pressure is pascal (Pa) or Nm^{-2}
- Fluids (liquids, gases and air) also exert pressure.
- All objects on the surface of the Earth experience a constant thrust or force due to the atmosphere.
- The amount of force due to the atmospheric air that acts on unit surface area of the Earth is known as atmospheric pressure.
- Atmospheric pressure can be measured by a device called barometer.
- $1 \text{ atmospheric pressure} = 1 \text{ atm} = \text{pressure due to } 76 \text{ cm of mercury column in a barometer} = 1.01 \times 10^5 \text{ N m}^{-2}$



Friction

- Friction is the force that opposes the motion of an object.
- It slows down or prevents the motion of a body. Friction always opposes the motion and it produces heat.
- Friction is caused by irregularities on the surfaces, which are in contact.
- Friction depends on the nature of the surfaces and mass of the bodies in contact.
- Friction is classified into two types: static friction and kinetic friction. Kinetic friction can be further classified as rolling friction and sliding friction.

Surface Tension

- Surface tension is the property of a liquid.

A-Z GLOSSARY

Force	action of push or pull
Thrust	Force acting perpendicularly on any given surface area
Pressure	force acting on unit area
buoyant force	An upward force exerted by liquid on floating body
Surface tension	The surface molecules of a liquid experience a force which contracts the surface area
Friction	This force is produced due to the geometrical dissimilarities of the surface of the bodies which are in relative motion.



TEXT BOOK EXERCISES

I. Choose the correct answer for each of the following:

1. If we apply a force against the direction of motion of a body, then the body will
 - a) stop moving
 - b) move with an increased speed
 - c) move with a decreased speed
 - d) move in a different direction

- The water molecules experience a force that contracts the surface of water as much as possible, so as to occupy the minimum surface area. The amount of force acting per unit length on the liquid surface is called surface tension. It has the unit Nm^{-1} .

Viscous Force

- When the liquids are flowing there is a frictional force between the layers of the liquid, which oppose their relative motion. This force is called viscous force and the phenomenon is known as viscosity.
- Viscosity is measured by the unit called poise in CGS and $\text{kg m}^{-1} \text{s}^{-1}$ and N s m^{-2} in SI.



2. Pressure exerted by a liquid is increased by
 - a) the density of the liquid
 - b) the height of the liquid column
 - c) Both (a) & (b)
 - d) None of the above
3. Unit of pressure is
 - a) pascal
 - b) N m^{-2}
 - c) poise
 - d) Both (a) & (b)



4. The value of the atmospheric pressure at sea level is
 - a) 76 cm of mercury column
 - b) 760 cm of mercury column
 - c) 176 cm of mercury column
 - d) 7.6 cm of mercury column
5. Pascal's law is used in
 - a) hydraulic lift
 - b) brake system
 - c) pressing heavy bundles
 - d) All the above
6. Which of the following liquids has more viscosity?
 - a) Grease
 - b) Water
 - c) Coconut oil
 - d) Ghee
7. The unit of viscosity is
 - a) N m²
 - b) poise
 - c) kg m s⁻¹
 - d) no unit

II. Fill in the blanks

1. The pressure of a liquid column _____ with the depth of the column.
2. Hydraulic lift works under the principle of _____.
3. The property of _____ of a liquid surface enables the water droplets to move upward in plants.
4. A simple barometer was first constructed by _____.

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

1. Force acting on a given area is called pressure.
2. A moving body comes to rest due to friction alone.
3. A body will sink if the weight of the body is greater than the buoyant force.
4. One atmosphere is equivalent to 1,00,000 newton force acting on one square metre.
5. Rolling friction is slightly greater than the sliding friction.
6. Friction is the only reason for the loss of energy.

7. Liquid pressure decreases with the decrease of depth.
8. Using barometers, one can measure the height of a building.
9. Surface tension causes the spherical nature of a water drop.
10. Viscosity depends on the pressure of a liquid.

IV. Arrange the following in the increasing order:

1. Rolling friction, static friction, sliding friction
2. Let a marble roll on the following surfaces. Arrange the choice of the material such that a marble moving over it covers a greater distance.

Cotton cloth, glass plate, paper, card board, silver plate

V. Match the following

Match: I	
Column I	Column II
a) Static friction	viscosity
b) Kinetic friction	least friction
c) Rolling friction	objects are in motion
d) Friction between the liquid layers	objects are sliding
e) Sliding friction	objects are at rest

Match: II	
Column I	Column II
a) Barometer	reduce friction
b) Increase friction	atmospheric pressure
c) Decrease friction	cause of friction
d) Lubricants	increasing area of contact
e) Irregular surface	decreasing area of contact

VI. ANALOGY

1. Knot in a thread : _____ friction; ball bearing : _____ friction
2. Downward force : weight ; Upward force offered by liquid : _____



VII. Problems:

1. A stone weighs 500 N. Calculate the pressure exerted by it if it makes a contact with a surface of area 25 cm^2 .
2. In a hydraulic lift, the surface area of the input piston is 10 cm^2 . The surface area of the output piston is 3000 cm^2 . A 100 N force applied to the input piston raises the output piston. Calculate the force required to raise the output piston.

VIII. ASSERTION & REASON

1. Mark the correct choice as:
 - a. If both assertion and reason are true and the reason is the correct explanation of the assertion.
 - b. If both assertion and reason are true, but the reason is not the correct explanation of the assertion.
 - c. If the assertion is true, but the reason is false.
 - d. If the assertion is false, but the reason is true.
1. Assertion: Sharp knives are used to cut the vegetables.
Reason: Sharp edges exert more pressure.
2. Assertion: Broad straps are used in bags.
Reason: Broad straps last for long life.
3. Assertion: Water strider slides easily on the surface of water.
Reason: Water strider experiences less buoyant force.

IX (A). Answer the following in one or two sentences (LOT):

1. Give two examples to verify that a force changes the shape of a body.
2. Give two examples to verify that a force tends to change the static condition of a body.
3. Taking out paste from a tooth paste tube is an example to highlight which physical property?
4. What do you feel when you touch a nail immediately after it is hammered into a wooden plank? Why?

5. How does the friction arise between the surfaces of two bodies in relative motion?
6. Name two instruments, which help to measure the pressure of a fluid.
7. Define one atmosphere.
8. Why are heavy bags provided with broad straps?
9. How does surface tension help a plant?
10. Which has greater viscosity, oil or honey?
Why?

X. Answer the following questions with a few sentences (MOT):

1. Define friction. Give two examples of the utility of friction in day to day life.
2. Write down three ways of minimising friction.
3. How do sailors protect their ship during a heavy storm?
4. Write down three applications of Pascal's law.
5. Why is a ball bearing used in a cycle hub?

XI. Answer the following questions in detail:

1. "Friction is a necessary evil"- explain.
2. Give the different types of friction and explain each with an example.
3. Describe an experiment to prove that friction depends on the nature of a surface.
4. Explain how friction can be minimised.
5. Describe an experiment to prove that the pressure in a liquid increases with depth.

XII. HOT CORNER

1. Why is it not advisable to take a fountain pen while travelling in an aeroplane?
2. Is there any possibility of making a special device to measure the magnitude of friction directly?
3. Vidhya posts a question: Mercury is costly. So, instead of mercury can we use water as a barometric liquid? Answer to Vidhya and explain, the difficulty of constructing a water barometer.



4. A bubble rises from the bottom of a pond to its surface by increasing its radius by 3 times its value when it was at the bottom. Calculate the depth of the pond. (Hint: Pressure depends on the depth of the pond. Volume is inversely related to pressure.) [Science Olympiad]

3. Concepts of Physics (Volume-1) 1st Edition (English, Paperback) H. C. Verma.
4. Fundamentals of Physics (English, Hardcover) David Halliday



INTERNET RESOURCES

1. <https://www.youtube.com/watch?v=Oe6bDTL3YQg>
2. <https://www.youtube.com/watch?v=KndNN28OcEI>
3. <https://www.youtube.com/watch?v=B5IBoZ08-I>
4. <https://www.stufftoblowyourmind.com/videos/51302-stuff-to-blow-your-kids-mind-atmospheric-pressure-video.htm>
5. http://www.cyberphysics.co.uk/graphics/diagrams/forces/spouting_can.gif

PROJECT WORK:

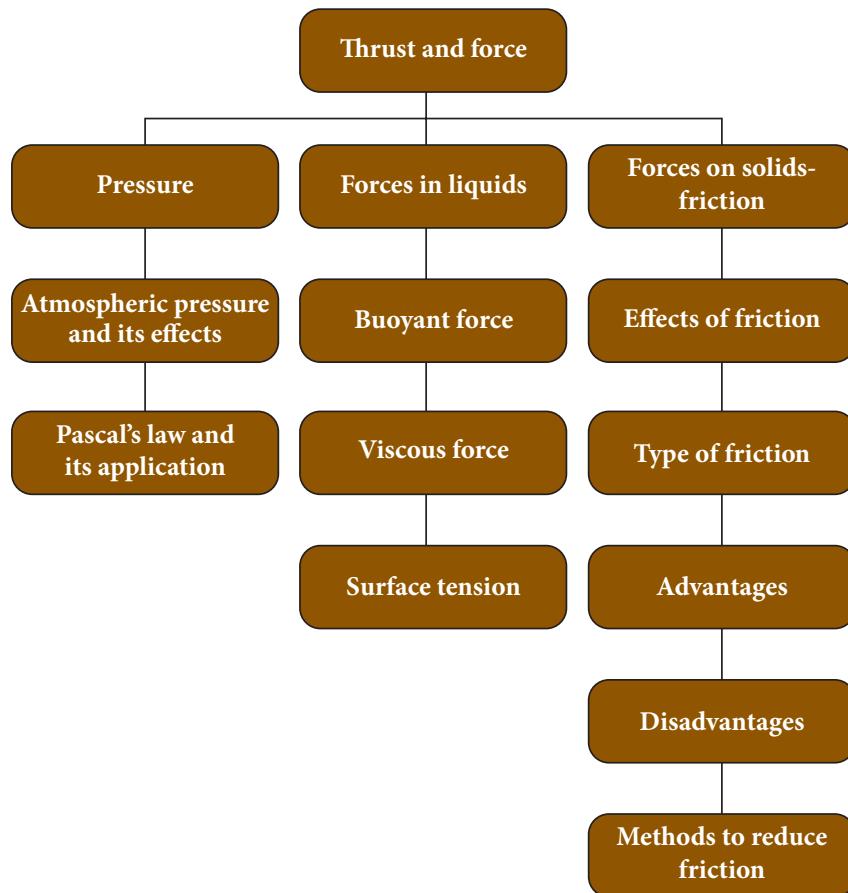
Observe the devices, gadgets or things around you. List out the types of friction involved in each device? How would you minimise the friction? Record your observations and discuss your results with your classmates.



REFERENCE BOOKS

1. Fundamentals of Physics (English, Hardcover) David Halliday & Jearl Walker.
2. Principles of Physics, International Student Version (English, Paperback) Jearl Walker, David Halliday, Robert Resnick.

Mind Map

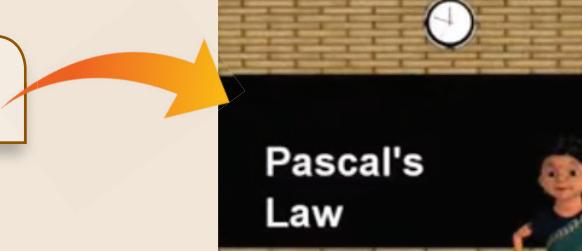




ICT CORNER

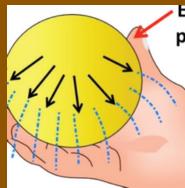
This activity helps to learn about the Fluid pressure & Pascal's Law

Force & Pressure

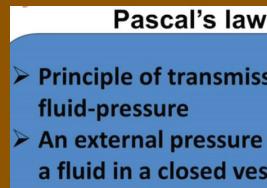


Steps

- Open the Browser and type the URL link given below (or) Scan the QR Code.
- Select the “Fluid Pressure and Pascal’s Law” .You can view this page
- You can view this page .Touch the play button
- To get more idea about the Pascal’s Law for fluid pressure through Experiment



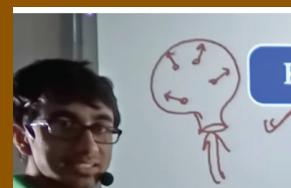
Step1



Step2



Step3



Step4

Web link: <https://www.youtube.com/watch?v=dx2P7i1GPaw>

(or) scan the QR Code

*Pictures are indicative only



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UNIT

3

LIGHT



Learning Objectives

At the end of this lesson, students will be able to:

- ◆ Acquire knowledge about various types of mirrors.
- ◆ Understand image formation in spherical mirrors.
- ◆ Know the applications of spherical mirrors.
- ◆ Acquire knowledge about laws of reflection.
- ◆ Compare regular and irregular reflections.
- ◆ Know the working principle of kaleidoscope and periscope.
- ◆ Understand refraction and dispersion of light.



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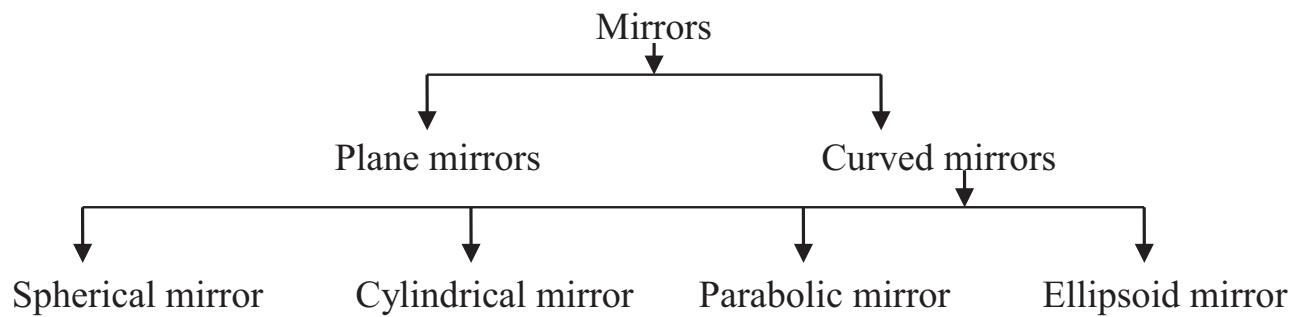
Introduction

Lofty mountains covered with greenish vegetation, magnificent trees reaching up to the clouds, beautiful streams drifting down the valleys, bluish sea water roaring towards the coast and the radiant sky in the morning being filled with golden red color, all give delight to our eyes and peace to our mind. But, can we see them all without light? No, because, we can see things around us only when the light reflected by them reaches our eyes.

Light is a form of energy and it travels in a straight line. You have studied in your lower classes, how it is reflected by the polished surfaces such as plane mirrors. In this lesson, you will study about other types of mirrors like the spherical mirrors and parabolic mirrors and their applications in our daily life. You will also study about the laws of reflection and the laws of refraction and some of the optical instruments, such as periscope and kaleidoscope, which work on these principles.

3.1 Types of Mirrors

We use mirrors in our daily life for various purposes. We use them for decoration. In vehicles, they are used as rear view mirrors. They are also used in scientific apparatus, like telescope. The mirror is an optical device with a polished surface that reflects the light falling on it. A typical mirror is a glass sheet coated with aluminium or silver on one of its sides to produce an image. Mirrors have a plane or curved surface. Curved mirrors have surfaces that are spherical, cylindrical, parabolic and ellipsoid. The shape of a mirror determines the type of image it forms. Plane mirrors form the perfect image of an object. Whereas, curved mirrors produce images that are either enlarged or diminished. You would have studied about plane mirrors in your lower classes. In this section, you will study about spherical and parabolic mirrors.



Method of coating a glass plate with a thin layer of reflecting metals was in practice during the 16th century in Venice, Italy. They used an amalgam of tin and mercury for this purpose. Nowadays, a thin layer of molten aluminium or silver is used for coating glass plates that will then become mirrors.

3.1.1 Spherical mirrors

Spherical mirrors are one form of curved mirrors. If the curved mirror is a part of a sphere, then it is called a 'spherical mirror'. It resembles the shape of a piece cut out from a spherical surface. One side of this mirror is silvered and the reflection of light occurs at the other side.

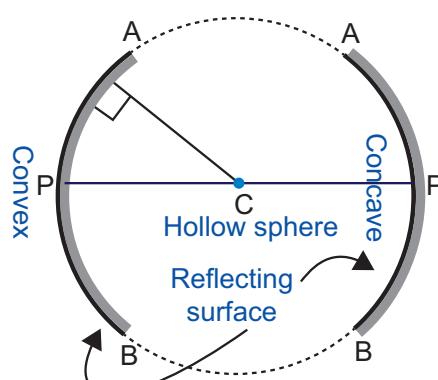


Figure 3.1 Spherical mirror

Concave mirrors

A spherical mirror, in which the reflection of light occurs at its concave surface, is called a concave mirror. *These mirrors magnify the*

object placed close to them. The most common example of a concave mirror is the make-up mirror.

Convex mirror

A spherical mirror, in which the reflection of light occurs at its convex surface, is called a convex mirror. *The image formed by these mirrors is smaller than the object.* Most common convex mirrors are rear viewing mirrors used in vehicles.

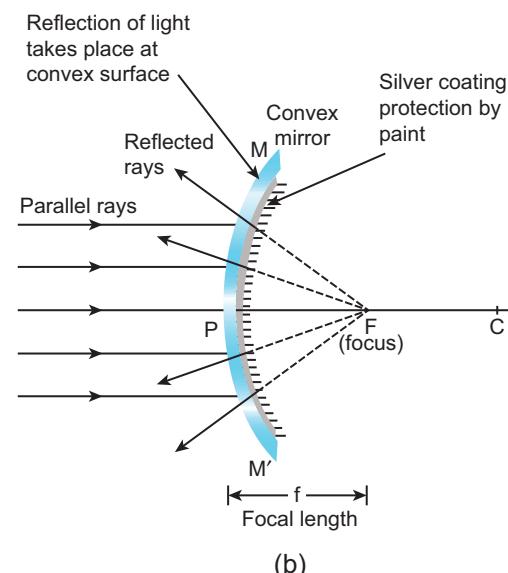
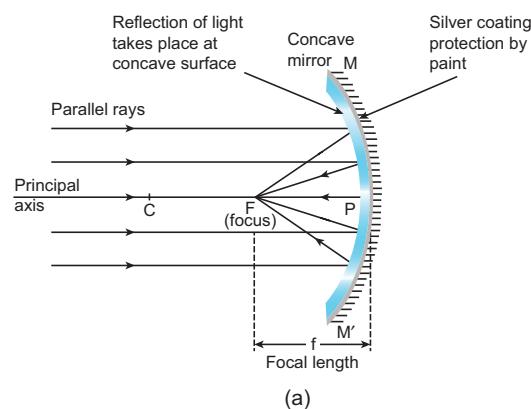


Figure 3.2 Concave and Convex mirrors



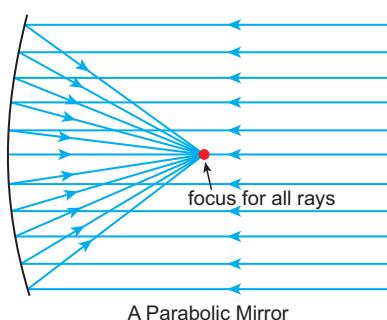
Convex mirrors used in vehicles as rear-view mirrors are labeled with the safety warning: 'Objects in the mirror are closer than they appear' to warn the drivers. This is because inside the mirrors, vehicles will appear to be coming at a long distance.

3.1.2 Parabolic mirrors

A parabolic mirror is one type of curved mirror, which is in the shape of a parabola. It has a concave reflecting surface and this surface directs the entire incident beam of light to converge at its focal point.

In the same way, light rays generated by the source placed at this focal point will fall on this surface and they will be diverged in a direction, which is parallel to the principal axis of the parabolic mirror. Hence, the light rays will be reflected to travel a long distance, without getting diminished.

Parabolic mirrors, also known as parabolic reflectors, are used to collect or project energy such as light, heat, sound and radio waves. They are used in reflecting telescopes, radio telescopes and parabolic microphones. They are also used in solar cookers and solar water heaters.



A Parabolic Mirror



Figure 3.3 Parabolic mirror



The principle behind the working of a parabolic mirror has been known since the Greco-Roman times. The first mention of these structures was found in the book, 'On Burning Mirrors', written by the mathematician Diocles. They were also studied in the 10th century, by a physicist called Ibn Sahl. The first parabolic mirrors were constructed by Heinrich Hertz, a German physicist, in the form of reflector antennae in the year 1888.

3.2 TERMS RELATED TO SPHERICAL MIRRORS

In order to understand the image formation in spherical mirrors, you need to know about some of the terms related to them.

Center of Curvature: It is the center of the sphere from which the mirror is made. It is denoted by the letter C in the ray diagrams. (A ray diagram represents the formation of an image by the spherical mirror. You will study about them in your next class).

Pole: It is the geometric centre of the spherical mirror. It is denoted by the letter P.

Radius of Curvature: It is the distance between the center of the sphere and the vertex. It is shown by the letter R in ray diagrams. (*The vertex is the point on the mirror's surface where the principal axis meets the mirror. It is also called as 'pole'.*)

Principal Axis: The line joining the pole of the mirror and its center of curvature is called principal axis.

Focus: When a beam of light is incident on a spherical mirror, the reflected rays converge (concave mirror) at or appear to diverge from (convex mirror) a point on the principal axis. This point is called the 'focus' or 'principal focus'. It is also known as the focal point. It is denoted by the letter F in ray diagrams.



Focal length: The distance between the pole and the principal focus is called focal length (f) of a spherical mirror.

There is a relation between the focal length of a spherical mirror and its radius of curvature. The focal length is half of the radius of curvature.

That is, focal length = $\frac{\text{Radius of curvature}}{2}$.

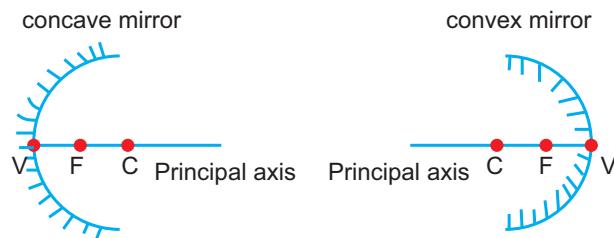


Figure 3.4 Terms related to a spherical mirror

PROBLEM 1

The radius of curvature of a spherical mirror is 20 cm. Find its focal length.

Solution:

$$\text{Radius of curvature} = 20 \text{ cm}$$

$$\begin{aligned}\text{Focal length } (f) &= \frac{\text{Radius of curvature}}{2} \\ &= \frac{R}{2} = \frac{20}{2} = 10 \text{ cm}\end{aligned}$$

PROBLEM 2

Focal length of a spherical mirror is 7 cm. What is its radius of curvature?

Solution:

$$\text{Focal length} = 7 \text{ cm}$$

$$\begin{aligned}\text{Radius of curvature } (R) &= 2 \times \text{focal length} \\ &= 2 \times 7 = 14 \text{ cm}\end{aligned}$$

3.3 IMAGES FORMED BY SPHERICAL MIRRORS

Images formed by spherical mirrors are of two types: i) real image and ii) virtual image. Real images can be formed on a screen, while virtual images cannot be formed on a screen.

Image formed by a convex mirror is always erect, virtual and diminished in size. As a result, images formed by these mirrors cannot be projected on a screen.

The characteristics of an image are determined by the location of the object. As the object gets closer to a concave mirror, the image gets larger, until attaining approximately the size of the object, when it reaches the centre of curvature of the mirror. As the object moves away, the image diminishes in size and gets gradually closer to the focus, until it is reduced to a point at the focus when the object is at an infinite distance from the mirror.

The size and nature of the image formed by a convex mirror is given in Table 3.1.

Concave mirrors form a real image and it can be caught on a screen. Unlike convex mirrors, concave mirrors show different image types. Depending on the position of the object in front of the mirror, the position, size and nature of the image will vary. Table 3.2 provides a summary of images formed by a concave mirror.

Table 3.1 Image formed by a convex mirror

POSITION OF THE OBJECT	POSITION OF THE IMAGE	IMAGE SIZE	NATURE OF THE IMAGE
At infinity	At F	Highly diminished, point sized	Virtual and erect
Between infinity and the pole (P)	Between P and F	Diminished	Virtual and erect



Table 3.2 Image formed by a concave mirror

POSITION OF THE OBJECT	POSITION OF THE IMAGE	IMAGE SIZE	NATURE OF THE IMAGE
At infinity	At F	Highly diminished	Real and inverted
Beyond C	Between C and F	Diminished	Real and inverted
At C	At C	Same size as the object	Real and inverted
Between C and F	Beyond C	Magnified	Real and inverted
At F	At infinity	Highly magnified	Real and inverted
Between F and P	Behind the mirror	Magnified	Virtual and erect

You can observe from the table that a concave mirror always forms a real and inverted image except when the object is placed between the focus and the pole of the mirror. In this position, it forms a virtual and erect image.

Activity 1

Take a curved silver spoon and see the image formed by it. Now, turn it and find the image formed. Do you find any difference? Find out the reason.



- They are used in torches, search lights and head lights as they direct the light to a long distance.
- They can collect the light from a larger area and focus it into a small spot. Hence, they are used in solar cookers.
- They are used as head mirrors by doctors to examine the eye, ear and throat as they provide a shadow-free illumination of the organ.
- They are also used in reflecting telescopes.



Figure 3.3 Concave mirrors

Concave mirrors

- Concave mirrors are used while applying make-up or shaving, as they provide a magnified image.

Convex mirrors

- Convex mirrors are used in vehicles as rear view mirrors because they give an upright image and provide a



wider field of view as they are curved outwards.

- They are found in the hallways of various buildings including hospitals, hotels, schools and stores. They are usually mounted on a wall or ceiling where hallways make sharp turns.
- They are also used on roads where there are sharp curves and turns.



Figure 3.3 Convex mirrors

Activity 2

List out various convex and concave mirrors used in your daily life.

3.5 LAWS OF REFLECTION

Activity 3

Take a plane mirror and try to focus the light coming from the Sun on a wall. Can you see a bright spot on the wall? How does it occur? It is because the light rays falling on the mirror are bounced onto the wall by it. Can you produce the same bright spot with the help of any other object having a rough surface?

Not all the objects can produce the same effect as produced by the plane mirror. A ray of

light, falling on a body having a shiny, polished and smooth surface alone is bounced back. This bouncing back of the light rays as they fall on the smooth, shiny and polished surface is called reflection.

Reflection involves two rays: i) incident ray and ii) reflected ray. The incident ray is the light ray in a medium falling on the shiny surface of a reflecting body. After falling on the surface, this ray returns into the same medium. This ray is called the reflected ray. An imaginary line perpendicular to the reflecting surface, at the point of incidence of the light ray, is called the normal.

The relation between the incident ray, the reflected ray and the normal is given as the law of reflection. The laws of reflection are as follows:

- The incident ray, the reflected ray and the normal at the point of incidence, all lie in the same plane.
- The angle of incidence and the angle of reflection are always equal.

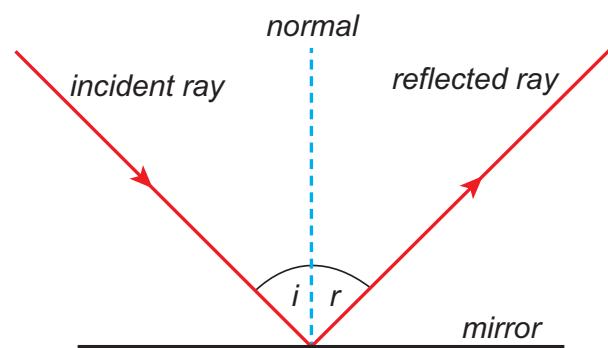


Figure 3.7 Reflection of light



Silver metal is the best reflector of light. That's why a thin layer of silver is deposited on the side of materials like plane glass sheets, to make mirrors.



3.6 TYPES OF REFLECTION

You have learnt that not all bodies can reflect light rays. The amount of reflection depends on the nature of the reflecting surface of a body. Based on the nature of the surface, reflection can be classified into two types namely, i) regular reflection and ii) irregular reflection.

3.6.1 Regular reflection

When a beam of light (collection of parallel rays) falls on a smooth surface, it gets reflected. After reflection, the reflected rays will be parallel to each other. Here, the angle of incidence and the angle of reflection of each ray will be equal. Hence, the law of reflection is obeyed in this case and thus a clear image is formed. This reflection is called 'regular reflection' or 'specular reflection'. Example: Reflection of light by a plane mirror and reflection of light from the surface of still water.

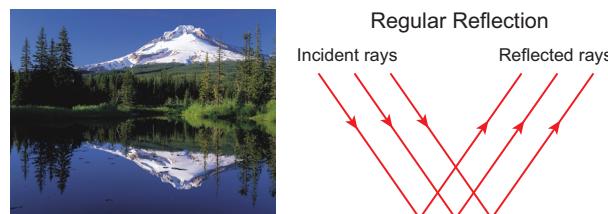


Figure 3.8 Regular reflection

3.6.2 Irregular reflection

In the case of a body having a rough or irregular surface, each region of the surface is inclined at different angles. When light falls on such a surface, the light rays are reflected at different angles. In this case, the angle of incidence and the angle of reflection of each ray are not equal. Hence, the law of reflection is not obeyed in this case and thus the image is not clear. Such a reflection is called 'irregular reflection' or 'diffused reflection'. Example: Reflection of light from a wall.

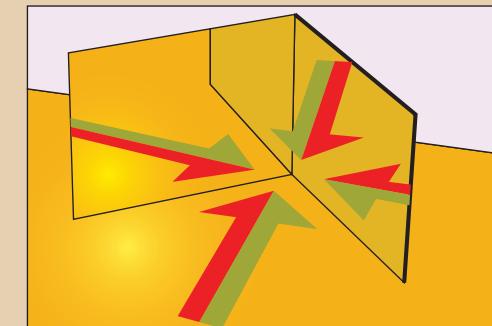


Figure 3.8 Irregular reflection

3.7 MULTIPLE REFLECTIONS

Activity 4

Take two plane mirrors and keep them perpendicular to each other. Place an object between them. You can see the images of the object. How many images do you see in the mirrors? You can see three images. How is it possible to have three images with two mirrors?



In the activity given above, you observed that for a body kept in between two plane mirrors, which were inclined to each other, you could see many images. This is because, the 'image' formed by one mirror acts as an 'object' for the other mirror. The image formed by the first mirror acts as an object for the second mirror and the image formed by the second mirror acts as an object for the first mirror. Thus, we have three images of a single body. This is known as multiple reflection. This type of reflections can be seen in show rooms and saloons.

The number of images formed, depends on the angle of inclination of the mirrors. If



the angle between the two mirrors is a factor of 360° , then the total number of reflections is finite. If θ (Theta) is the angle of inclination of the plane mirrors, the number of images formed = $\frac{360^\circ}{\theta} - 1$. As you decrease this angle, the number of images formed increases. When they are parallel to each other, the number of images formed becomes infinite.

PROBLEM 3

If two plane mirrors are inclined to each other at an angle of 90° , find the number of images formed.

Solution:

$$\text{Angle of inclination} = 90^\circ$$

$$\text{Number of images formed} =$$

$$\frac{360^\circ}{\theta} - 1 = \frac{360^\circ}{90^\circ} - 1 = 4 - 1 = 3$$

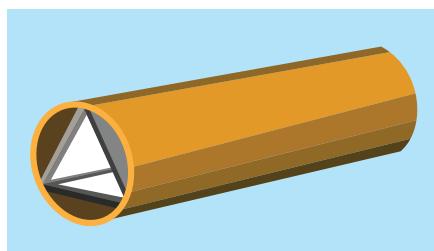
Activity 5

Take three equal sized plane mirror strips and arrange them in such a way that they form an equilateral triangle. Cover the sides of the mirrors with a chart paper. With the help of a chart paper cover the bottom of the mirrors also. Put some coloured things such as pieces of bangles and beads inside it. Now, cover the top portion with the chart paper and make a hole in it to see. You can wrap the entire piece with coloured papers to make it attractive. Now, rotate it and see through its opening. You can see the beautiful patterns.

CAUTION: Be careful while handling the glass pieces. Do this under the supervision of your teacher.

3.7.1 Kaleidoscope

It is a device, which functions on the principle of multiple reflection of light, to produce numerous patterns of images. It has two or more mirrors inclined with each other. It can be designed from inexpensive materials and the colourful image patterns formed by this will be pleasing to you. This instrument is used as a toy for children.



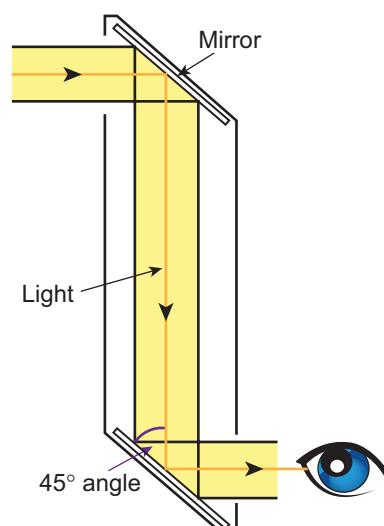
Kaleidoscope



Figure 3.10 Image formed in a Kaleidoscope

3.7.2 Periscope

It is an instrument used for viewing bodies or ships, which are over and around another body or a submarine. It is based on the principle of the law of reflection of light. It consists of a long outer case and inside this case mirrors or prisms are kept at each end, inclined at an angle of 45° . Light coming from the distant body, falls on the mirror at the top end of the periscope and gets reflected vertically downward. This light is reflected again by the second mirror kept at the bottom, so as to travel horizontally and reach the eye of the observer. In some complex periscopes, optic





fibre is used instead of mirrors for obtaining a higher resolution. The distance between the mirrors also varies depending on the purpose of using the periscope.

Uses

- It is used in warfare and navigation of the submarine.
- In military it is used for pointing and firing guns from a 'bunker'.
- Photographs of important places can be taken through periscopes without trespassing restricted military regions.
- Fibre optic periscopes are used by doctors as endoscopes to view internal organs of the body.



Figure 3.11 Periscope used in Submarine

3.8 REFRACTION OF LIGHT

We know that when a light ray falls on a polished surface placed in air, it is reflected into the air itself. When it falls on a transparent material, it is not reflected completely, but a part of it is reflected and a part of it is absorbed and most of the light passes through it. Through air, light travels with a speed of $3 \times 10^8 \text{ m s}^{-1}$, but it cannot travel with the same speed in water or glass, because, optically denser medium such as water and glass offer some resistance to the light rays.

So, light rays travelling from a rarer medium like air into a denser medium like glass or water are deviated from their straight

line path. This bending of light about the normal, at the point of incidence; as it passes from one transparent medium to another is called refraction of light.

When a light ray travels from the rarer medium into the denser medium, it bends towards the normal and when it travels from the denser medium into the rarer medium, it bends away from the normal. You can observe this phenomenon with the help of the activity given below.

Activity 6

Take a glass beaker, fill it with water and place a pencil in it. Now, look at the pencil through the beaker. Does it appear straight? No. It will appear to be bent at the surface of the water. Why?



In this activity, the light rays actually travel from the water (a denser medium) into the air (a rarer medium). As you saw earlier, when a light ray travels from a denser medium to a rarer medium, it is deviated from its straight line path. So, the pencil appears to be bent when you see it through the glass of water.

3.8.1 Refractive Index

Refraction of light in a medium depends on the speed of light in that medium. When the speed of light in a medium is more, the bending is less and when the speed of light is less, the bending is more.



8ZPIP5



The amount of refraction of light in a medium is denoted by a term known as refractive index of the medium, which is the ratio of the speed of light in the air to the speed of light in that particular medium. It is also known as the absolute refractive index and it is denoted by the Greek letter ' μ ' (pronounced as 'mew').

$$\mu = \frac{\text{Speed of light in air (c)}}{\text{Speed of light in the medium (v)}}$$

Refractive index is a ratio of two similar quantities (speed) and so, it has no unit. Since, the speed of light in any medium is less than its speed in air, refractive index of any transparent medium is always greater than 1.

Refractive indices of some common substances are given in Table 3.3.

Table 3.3 Refractive Index of substances

SUBSTANCES	REFRACTIVE INDEX
Air	1.0
Water	1.33
Ether	1.36
Kerosene	1.41
Ordinary Glass	1.5
Quartz	1.56
Diamond	2.41

In general, the refractive index of one medium with respect to another medium is given by the ratio of their absolute refractive indices.

$$1\mu_2 = \frac{\text{Absolute refractive index of the second medium}}{\text{Absolute refractive index of the first medium}}$$

$$1\mu_2 = \frac{\frac{c}{V_2}}{\frac{c}{V_1}} \quad \text{or} \quad 1\mu_2 = \frac{V_1}{V_2}$$

Thus, the refractive index of one medium with respect to another medium is also given by the ratio of the speed of light in first medium to its speed in the second medium.

PROBLEM 4

Speed of light in air is $3 \times 10^8 \text{ m s}^{-1}$ and the speed of light in a medium is $2 \times 10^8 \text{ ms}^{-1}$. Find the refractive index of the medium with respect to air.

Solution:

$$\text{Refractive index } (\mu) = \frac{\text{Speed of light in air (c)}}{\text{Speed of light in the medium (v)}}$$

$$\mu = \frac{3 \times 10^8}{2 \times 10^8} = 1.5$$

PROBLEM 5

Refractive index of water is $4/3$ and the refractive index of glass is $3/2$. Find the refractive index of glass with respect to the refractive index of water.

Solution:

$$w\mu_g = \frac{\text{Refractive index of glass}}{\text{Refractive index of water}} = \frac{\frac{3}{2}}{\frac{4}{3}} = \frac{9}{8} = 1.125$$

3.8.2 Snell's Law of Refraction

Refraction of light rays, as they travel from one medium to another medium, obeys two laws, which are known as Snell's laws of refraction. They are:

- I) The incident ray, the refracted ray and the normal at the point of intersection, all lie in the same plane.
- II) The ratio of the sine of the angle of incidence (i) to the sine of the angle of refraction (r) is equal to the refractive index of the medium, which is a constant.

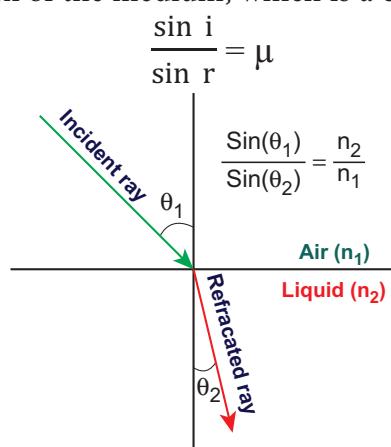


Figure 3.12 Snell's Law



3.9 DISPERSION

Activity 7

Place a prism on a table and keep a white screen near it. Now, with the help of a torch, allow white light to pass through the prism. What do you see? You can observe that white light splits into seven colored light rays namely, violet, indigo, blue, green, yellow, orange and red (VIBGYOR) on the screen. Now, place another prism in its inverted position, between the first prism and the screen. Now, what do you observe on the screen? You can observe that white light is coming out of the second prism.



In the above activity, you can see that the first prism splits the white light into seven coloured light rays and the second prism recombines them into white light, again. Thus, ***it is clear that white light consists of seven colours***. You can also recall the Newton's disc experiment, which you studied in VII standard.

Splitting of white light into its seven constituent colours (wavelength), on passing through a transparent medium is known as dispersion of light.

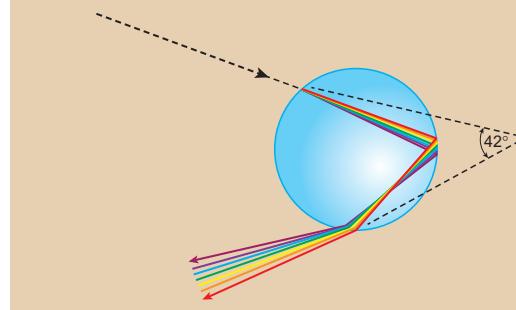
Why does dispersion occur? It is because, light of different colours present in white light have different wavelength and they travel at different speeds in a medium. You know that refraction of a light ray in a medium depends on its speed. As each coloured light has a different speed, the constituent coloured lights are refracted at different extents, inside the

prism. Moreover, ***refraction of a light ray is inversely proportional to its wavelength***.

Thus, the red coloured light, which has a large wavelength, is deviated less while the violet coloured light, which has a short wavelength, is deviated more.



The formation of rainbow is an example of dispersion of white light. This can be seen on the opposite side of the Sun. After a rainfall, large number of droplets still remain suspended in the air. When white light passes through them, it is split into seven colours. Dispersion of white light from a large number of droplets eventually forms a rainbow.



Points to remember

- Mirror is an optical device with a polished surface that reflects the light falling on it.
- Curved mirrors have surfaces that are spherical, cylindrical, parabolic and ellipsoid.
- If the curved mirror is a part of a sphere, then it is called a 'spherical mirror'.
- A spherical mirror, in which the reflection of light occurs at its concave surface, is called a concave mirror.
- A spherical mirror, in which the reflection of light occurs at its convex surface, is called a convex mirror.
- Parabolic mirrors, also known as parabolic reflectors, are used to collect or project energy such as light, heat, sound and radio waves.



- The focal length of a spherical mirror is half of its radius of curvature.
- Real images can be formed on a screen, while virtual images cannot be formed on a screen.
- Concave mirrors form a real image and it can be caught on a screen.
- Concave mirrors are used as make-up mirrors.
- Convex mirrors are used in vehicles as rear view mirrors.
- The laws of reflection are: The incident ray, the reflected ray and the normal at the point of incidence, all lie in the same plane. The angle of incidence and the angle of reflection are always equal.
- Based on the nature of the surface, reflection can be classified into two types namely, i) regular reflection and ii) irregular reflection.
- The number of images formed by a mirror depends on the angle of inclination of the mirrors.
- Snell's laws of refraction are: The incident ray, the refracted ray and the normal at the point of intersection, all lie in the same plane; The ratio of the sine of the angle of incidence (i) to the sine of the angle of refraction (r) is equal to the refractive index of the medium, which is a constant.

A-Z GLOSSARY

Mirror	Glass sheet coated with aluminium or silver on one of its sides to produce an image.
Center of Curvature	The center of the sphere from which the mirror is made.
Radius of Curvature	Distance between the center of the sphere and the vertex.
Pole	Point on the mirror's surface where the principal axis meets the mirror.
Principal Axis	Line joining the pole of the mirror and its center of curvature.
Focus	Point where the reflected rays converge at or appear to diverge from a point on the principal axis.
Focal length	Distance between the pole and the principal focus.
Reflection	Bouncing back of the light rays as they fall on the smooth, shiny and polished surface.
Specular reflection	Reflection that obeys the laws of reflection and produces a clear image.
Diffused reflection	Reflection that does not obey the laws of reflection and does not produce a clear image.
Kaleidoscope	Device, which produces numerous and wonderful image patterns.
Periscope	Instrument used for viewing objects, which are over and around another body.
Refraction of light	Bending of light about the normal, at the point of incidence; as it passes from one transparent medium to another.
Refractive index	Ratio of the speed of light in the air to the speed of light in that particular medium.
Dispersion of light	Splitting of white light into its seven constituent colours (wavelength).



TEXT BOOK EXERCISES



I. Choose the best answer.

1. Mirrors having a curved reflecting surface are called as
a) plane mirrors b) spherical mirrors
c) simple mirrors d) None of the above
2. The spherical mirror with a reflecting surface curved inward is called
a) convex mirror b) concave mirror
c) curved mirror d) None of the above
3. The centre of a sphere of which the reflecting surface of a spherical mirror is a part is called
a) pole
b) centre of curvature
c) cradius of curvature
d) aperture
4. The spherical mirror used as a rear view mirror in the vehicle is
a) concave mirror b) convex mirror
c) plane mirror d) None of the above
5. The imaginary line passing through the centre of curvature and pole of a spherical mirror is called
a) centre of curvature b) pole
c) principal axis d) radius curvature
6. The distance from the pole to the focus is called
a) Pole length b) focal length
c) principal axis d) None of the above

7. Focal length is equal to half of the
a) centre of curvature b) axis
c) radius of curvature d) None of the above
8. If the focal length of a spherical mirror is 10 cm, what is the value of its radius of curvature?
a) 10 cm b) 5 cm
c) 20 cm d) 15 cm
9. If the image and object distance is same, then the object is placed at
a) infinity b) at F
c) between f and P d) at C
10. The refractive index of water is
a) 1.0 b) 1.33
c) 1.44 d) 1.52

II. Fill in the blanks.

1. The spherical mirror used in a beauty parlour as make-up mirror is _____.
2. Geometric centre of the spherical mirror is _____.
3. Nature of the images formed by a convex mirror is _____.
4. The mirror used by the ophthalmologist to examine the eye is _____.
5. If the angle of incidence is 45° , then the angle of reflection is _____.
6. Two mirrors are parallel to each other, then the number of images formed is _____.



III. Match the following.

A)

- 1. Convex mirror - a. Radio telescopes
- 2. Parabolic mirror - b. wall
- 3. Regular reflection - c. rear-view mirror
- 4. Irregular reflection - d. Plane mirror

B)

- 1. Snell's law - a. Kaleidoscope
- 2. Dispersion of light - b. $\sin i / \sin r = \mu$
- 3. Refractive index - c. Rainbow
- 4. Multiple reflection - d. $c/v = \mu$

IV. Answer in brief.

- 1. What is called a spherical mirror?
- 2. Define focal length?
- 3. The radius of curvature of a spherical mirror is 25 cm. Find its focal length.
- 4. Give two applications of a concave and convex mirror.
- 5. State the laws of reflection.
- 6. If two plane mirrors are inclined to each other at an angle of 45° , find the number of images formed.
- 7. Define the refractive index of a medium.
- 8. State the Snell's law of refraction

V. Answer in detail.

- 1. Explain the images formed by a concave mirror?
- 2. What is reflection? Write short notes on regular and irregular reflection?
- 3. Explain the working of a periscope.
- 4. What is dispersion? Explain in detail.
- 5. Speed of light in air is $3 \times 10^8 \text{ m s}^{-1}$ and the refractive index of a medium is 1.5. Find the speed of light in the medium.



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- 2. Concise Physics (2017). Selena Publishers, New Delhi.
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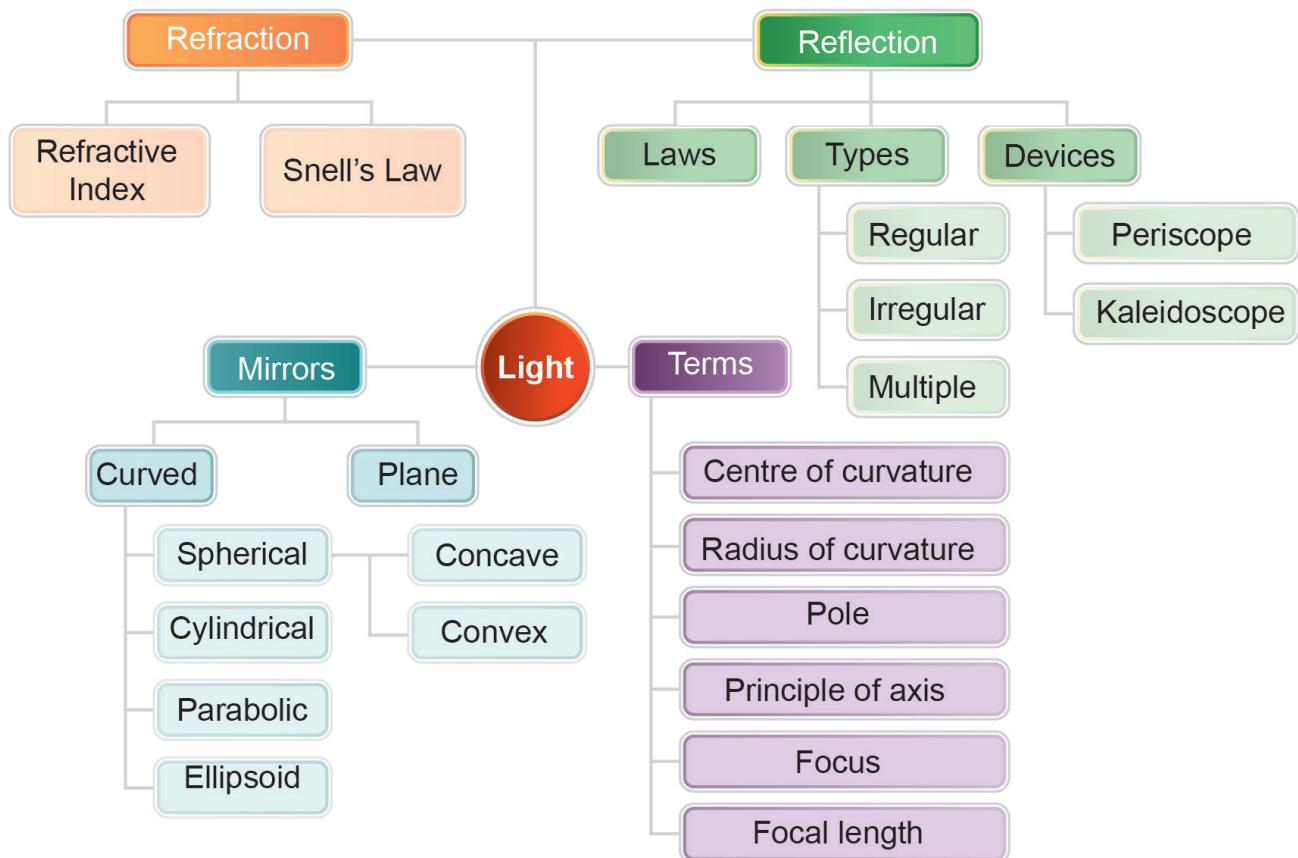


INTERNET RESOURCES

- 1. [https://farside.ph.utexas.edu](http://farside.ph.utexas.edu)
- 2. <https://britannica.com>
- 3. <https://studyread.com>
- 4. <https://sciencelearn.org>



MIND MAP





UNIT

4

MATTER



Learning Objectives

After completing this lesson you will be able to

- ◆ Know about the types of matter.
- ◆ Know the symbols of various elements.
- ◆ Classify elements into metals, non-metals and metalloids
- ◆ Compare the properties of metals and non metals.
- ◆ Acquire knowledge about compounds of solids, liquids and gases state.
- ◆ Know about the uses of compounds in daily life.



KWBDE1

INTRODUCTION

a)



b)



c)



Figure 4.1 a) Ice, b) water, c) Steam

In the universe all manifestations, phenomena and evolution of life are caused by matter and energy. The various objects which exist around us are made of some kind of matter. We perceive some of these objects through our senses like sight, touch, hearing, taste and smelling. A glass tumbler can be seen, agarbatti burning can be recognized by its smell whereas wind blowing can be felt. All kinds of matter possess mass and occupy space, of course some are heavy and others are light. Thus, matter can be defined as anything, which occupies space or volume and mass and can be perceived by our senses.

As we know already matter exists in

Solids: Substances like wood, stone, sand, iron etc.

Liquids: Substances like water, milk, fruit juice, etc

Gases: Substances like oxygen, nitrogen, carbon dioxide, steam, etc.,

How the matter is composed?

Matter in any physical state is composed of smaller particles such as atom, molecules or



ions. Molecules are also made up of atoms of same or different kinds. Hence, atoms are the building blocks of matter.

- Atom:** An atom is the smallest particle of an element, which exhibits all the properties of that element. It may or may not exist independently but takes part in every chemical reaction. We have learned about the basics of atoms in Class VII, atomic structure chapter.
- Molecules:** Atoms of the same element or different elements combine to form a molecule. A molecule is the smallest particle of a pure substance (element or compound), which can exist independently and retain the physical and chemical properties of the substance.
- Ions :** Atoms or group of atoms having a charge (positive or negative) are called ions.

4.1 Why symbols?

A symbol is an image, object, etc., that stands for some meaning. For instance, a dove is a symbol of peace. Similarly, we denote mathematical operations by symbols. For example (+) denotes addition; (-) denotes subtraction, etc. In the same way in chemistry each element is denoted by a symbol. Writing out the name of an element every time would become too troublesome. So, the name of an element is represented by shortened form called as symbol.

4.1.1 Symbol of elements

Let us learn the brief history of symbols of elements.

Greek symbols

The symbols in form of the geometrical shapes were those used by the ancient

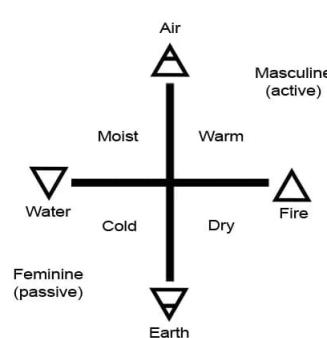


Figure 4.2 Greek symbols

Greeks to represent the four basic elements around us such as earth, air, fire and water.

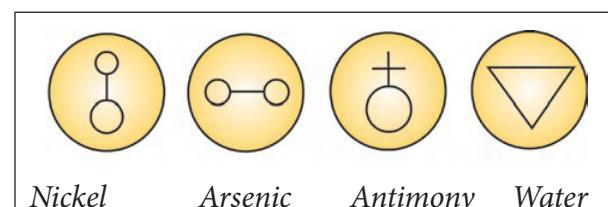
Alchemist symbol

In the days of alchemists, the different materials that they used were represented by the above-mentioned symbols while they try to change less valuable metal into gold. The process was called **alchemy** and the men who did this work were known as **alchemists**.

Dalton symbols

In 1808, John Dalton, English scientist tried to name the various elements based on these pictorial symbols. These symbols are difficult to draw and hence they are not used. It is only of historical importance.

Pictorial symbols



Daltons 1808AD(CE) symbols and formulae.

(○)	Hydrogen	(○○)	Ammonia
(○)	Nitrogen	(○○)	Pot Ash
(●)	Carbon	(○○)	Olefiant
(⊕)	Sulphur	(○○)	Carbonic Oxide
(⊖)	Phosphorus	(○○)	Copper
(○○)	Alumina	(○○)	Lead
		(○○○)	Carbonic Acid
		(○○○○)	Water
		(○○○○○)	Sulphuric Acid

Figure 4.3 Dalton Symbols

Berzelius symbols

In 1813, Jon Jakob Berzelius devised a system using letters of alphabet rather than signs,. The modified version of Berzelius system follows under the heading 'System for Determining Symbols of the Elements'

Present System for Determining Symbols of the Elements

- The symbols of the most common elements, mainly non-metals, use the first letter of their English name.



Element	Symbol	Element	Symbol
Boron	B	Oxygen	O
Carbon	C	Phosphorus	P
Fluorine	F	Sulphur	S
Hydrogen	H	Vanadium	V
Iodine	I	Uranium	U
Nitrogen	N	Yttrium	Y

2. If the name of the element has the same initial letter as another element, then symbol uses the first and second letters of their Element name. First letter in upper case and the second letter is in lower case.

Element	Symbol	Element	Symbol
Aluminium	Al	Gallium	Ga
Barium	Ba	Helium	He
Beryllium	Be	Lithium	Li
Bismuth	Bi	Neon	Ne
Bromine	Br	Silicon	Si
Cobalt	Co	Argon	Ar

3. If the first two letters of the names of elements are the same, then the symbol consists of first letter and second or third letter of English name that they do not have in common.

Element	Symbol	Element	Symbol
Argon	Ar	Calcium	Ca
Arsenic	As	Cadmium	Cd
Chlorine	Cl	Magnesium	Mg
Chromium	Cr	Manganese	Mn
Bromine	Br	Silicon	Si
Cobalt	Co		

4. Some symbols are used on the basis of their old names or Latin name of an element. There are eleven elements.

Name of element	Latin Name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Iron	Ferrum	Fe

Name of element	Latin Name	Symbol
Copper	Cupurum	Cu
Silver	Argentum	Ag
Gold	Aurum	Au
Mercury	Hydrargyrum	Hg
Lead	Plumbum	Pb
Tin	Stannum	Sn
Antimony	Stibium	Sb
Tungsten	Wolfram	W

5. Some elements are named using name of country/scientist/colour/mythological character/planet.

Name	Symbol	Name Derived from
Americium	Am	America (country)
Europium	Eu	Europe (country)
Nobelium	No	Alfred Nobel (scientist)
Iodine	I	Violet (colour, Greek)
Mercury	Hg	God Mercury (mythologic character)
Plutonium	Pu	Pluto (planet)
Neptunium	Np	Neptune (Planet)
Uranium	U	Uranus (planet)

Do you know how to write a symbol for a given element?

While writing a symbol for an element, we should adhere to the following method.

- If the element has a single English letter as a symbol, it should be written in capital letter.
- For elements having two letter symbols, the first letter should be in capital followed by small letter

What is the significance of the symbol of an element?

Symbol of an element signifies

- Name of the element
- One atom of the element For example,



- The symbol O stands for the element of Oxygen
- One atom of oxygen

Activity 1

Teacher: Dear students, let us play a memory game. This is an interesting game, which helps you to remember the symbols and their names. Make cards as instructed and then form a small group with your class mates to play.

INSTRUCTIONS:

Prepare 15 cards with the name of elements written on them and 15 cards with their corresponding symbols. Here is a list of names of elements (you have the freedom to choose the name of the elements)

Hydrogen	Calcium	Arsenic
Sodium	Mercury	Oxygen
Argon	Chlorine	Gold
Magnesium	Copper	Helium
Chromium	Iron	Manganese

How to play?

1. Shuffle the 30 cards and place the cards face down on the table.
2. Start the game. Each player will get a chance of taking 2 cards at a time to see. If a player does not get the correct pair, then he/she should keep the cards at the original position. If the name and symbol of the cards match correctly, then he/she can show to all the players and can keep the correct pair of cards with him/her. If correct pairs are shown, players will get another chance until the player makes wrong match. Game will continue till all the cards are taken up. The winner is the one having maximum number of cards.

4.2 METALS AND NON-METALS

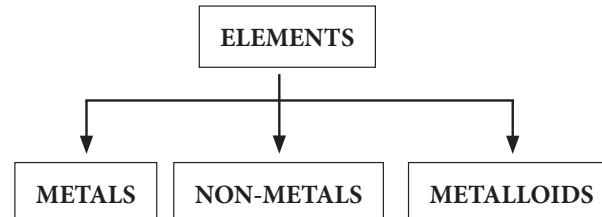
The progress of man towards civilization is linked with the discovery of several metals and non-metals. Even today, the index of prosperity of a country depends upon the amount of metals and non-metals it produces

and uses. The wealth of a country is measured by the amount of gold in its reserve.

These days, metals and non-metals are used for making tools, machines, cars, utensils, etc. Some of the common metals used are iron, copper, silver, gold, lead, zinc, aluminium, magnesium, nickel, chromium and mercury etc. Similarly, the common non-metals used are nitrogen, oxygen, hydrogen, carbon, sulphur, phosphorus and chlorine etc.

An element can be identified as metal or non-metal by comparing its properties with the general properties of metals and non-metals. In doing so, we find that some elements neither fit with the metals or with non-metals. Such elements are called semi-metals or metalloids.

Elements are classified into metals, non-metals, and metalloids based on their properties



4.2.1 METALS

Iron, copper, gold, silver, etc. that we use in our daily life are metals. Can you add some more examples that you come across in day to day activities.



Figure 4.4 Copper



Physical properties of metals

- Physical state:** Metals are solid under normal conditions of temperature and pressure. Mercury is liquid at room temperature. Elements cesium (Cs), rubidium (Rb), Francium (Fr) and Gallium (Ga) become liquid at or just above room temperature.
- Hardness:** Most metals are hard. The exception here is sodium and potassium, which is soft enough to be cut by a knife. Osmium is so hard that it can scratch glass.
- Lustre:** All metals are shiny. The typical shine of metals is called metallic lustre. All metals have a typical metallic lustre. An exception is calcium.



Figure 4.5 Shine Appearance

- Density:** Metals generally have high density. Sodium and potassium have exceptionally low density.
- Melting point and boiling point:** Metals in general have high melting point and boiling point. Sodium, potassium, mercury and gallium are exceptions.
- Tensile strength:** Metals have the capacity to withstand strain without breaking. This property is called tensile strength. It is the property that owes the use of iron for the construction of railway tracks. Zinc, arsenic and antimony are exceptions.
- Malleability:** Metals can be hammered into very thin sheets. This tendency of metals is called malleability. Aluminum

makes use of this property to transform into silvery foils.

Activity 2

Take a hammer and beat the samples, which are given below. Observe the changes in samples. Record your observations in the table

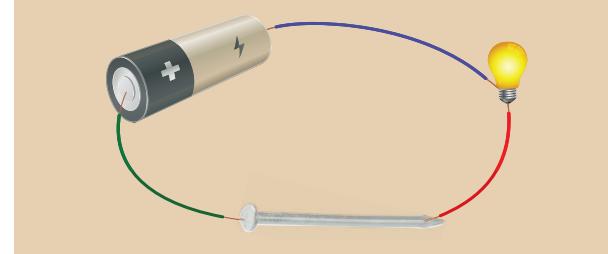
Name of sample	Observing the change in sample
Coal piece	Breaks/ converts into powder
Iron nail	
Copper wire	
Sulphur	

- Ductility:** Metals can be drawn into thin wires. This property of metals is called ductility. Example: copper wires.
- Conductivity:** Metals are good conductors of heat and electricity. Silver and copper are very good conductors of electricity. However, bismuth and tungsten are poor conductors.

Activity 3

Recall how to make an electric circuit to test whether electricity can pass through an object or not.

Object to be used: iron nail and pencil lead (graphite)



- Sonorous:** On being hit, metals produce a typical sound. Hence, they are said to be sonorous. This property is being made used in making temple bells.



4.2.2 NON-METALS

Elements that generally do not shine, neither too hard nor too soft, are non-metals. All gases are non-metals. Some non-metals are Sulphur, Carbon, Oxygen etc..



sulphur



carbon

Figure 4.6 Non-metals

PHYSICAL PROPERTIES OF NON-METALS

- Physical state:** Non-metals occur as solids, liquids or gases at normal temperature; for example sulphur, phosphorus occurs in solid state while bromine occurs in liquid state. Gases like oxygen, nitrogen, etc., occur in the gaseous state.
- Hardness:** Non-metals are generally not hard except diamond.(a form of carbon)
- LUSTRE:** Non-metals have a dull appearance; Graphite and iodine are exceptions as they are shiny and lustrous.
- Density:** Non-Metals are generally soft and have low densities. The exception here is diamond (a form of carbon) which is the hardest naturally occurring substance
- Melting point and boiling point:** Non-metals have low melting point and boiling point. However, carbon, silicon and boron are exceptions.
- Tensile strength:** Non-metals do not have tensile strength. However, carbon fibre (a form of carbon) is as tensile as steel.
- Malleability:** Non-metals are non-malleable. If hammered, they form a



Figure 4.7 Dull appearance

powdery mass. Actually non-metals in solid state are brittle in nature.

- Ductility:** Non-metals are not ductile. Carbon fibre is highly ductile.
- Conductivity:** Non-Metals are generally bad conductor of electricity. Graphite (a form of carbon) is exception.
- Sonorously:** Non-Metals do not produce sound(non-sonorously) when hit.

Activity 4

To demonstrate that metals produce a sound when struck.

Strike a metal utensil with a metal spoon. Note the kind of sound emitted. Now, strike a piece of wood charcoal with the same spoon. Do you find a difference in the kind of sound produced?

Most metals produce ringing sound when struck i.e. they are sonorous. Non-metals are non sonorous.

A Comparative Study of Metals and Non-Metals

Property	Metal	Non Metal
Physical state at room Temperature	Usually Solid (Occasionally liquid)	Solid, liquid or gas
Malleability	Good	Poor-usually soft or brittle
Ductility	Good	Poor-usually soft or brittle
Melting point	Usually high	Usually low
Boiling point	Usually high	Usually low
Density	Usually high	Usually low
Conductivity (Thermal and electrical)	Good	Very poor

4.2.3 Uses of Metals and Non-Metals

Metal

- Iron is used for making bridges, engine parts, iron-sheet and bars.



- Copper is used for making electrical wires, coins and statue.



Figure 4.8 Coins contain nickel

- Silver and gold are used for making jewels, in decorative purposes and photography.



Figure 4.9 Gold is very decorative

- Mercury is used in thermometers and barometers because of its high density and uniform expansion at different temperature.
- Aluminium is used in electrical wires, cables and in aerospace industries.



Figure 4.10 Planes are made of an alloy which contains magnesium and aluminium

- Lead is used in automobile batteries, X-ray machines.

Non-Metals

- Diamond (a form of carbon) is used for making jewels, **Figure 4.11** Diamond cutting and grinding equipments. Graphite is used in making pencil lead.
- Sulphur is used in the manufacturing of gun powder and vulcanization of rubber.

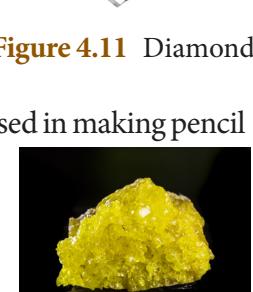


Figure 4.12 Sulphur

- Phosphorus is used in matches, rat poison etc.
- Nitrogen is used for manufacturing ammonia.
- Chlorine is used as a bleaching agent and in sterilizing water.
- Hydrogen is used as a rocket fuel and hydrogen flame is used for cutting and welding purposes, as well as a reducing agent

4.2.4 Metalloids

The elements which exhibit the properties of metals as well as non-metals are called metalloids. Examples: boron, silicon, arsenic, germanium, antimony, tellurium and polonium.

Physical properties of metalloids

Metalloids are all solid at room temperature.

- They can form alloys with other metals
- Some metalloids, such as silicon and germanium, can act as electrical conductors under the specific conditions, thus they are called semiconductors.
- Silicon for example appears lustrous, but is not malleable nor ductile (it is brittle - a characteristic of some non metals). It is a much poorer conductor of heat and electricity than the metals
- The physical properties of metalloids tend to be metallic, but their chemical properties tend to be non-metallic.

Uses of metalloids

- Silicon is used in electronic devices .
- Boron is used in fireworks and as a fuel for ignition in rocket.

4.3 Compound

A compound is a pure substance which is formed due to the chemical combination of two or more elements in a fixed ratio by mass. The properties of a compound are different from those of its constituents.

Water, carbon di oxide, sodium chloride etc. are few examples of compounds. A molecule of water is composed of an oxygen atom and two hydrogen atoms in the ratio 1:2 by volume or 8:1 by mass.



4.3.1 Classification compound

Based on the origin of chemical constituents, compounds are classified as inorganic compounds and organic compounds.

a) Inorganic compounds

Compounds obtained from non living sources such as rock, minerals etc., are called inorganic compounds. Example: chalk, baking powder etc.,

b) Organic compounds

Compounds obtained from living sources such as plants, animals etc., are called organic compound. Example: Protein, carbohydrates, etc.,

Both inorganic and organic compounds exists in all three states of matter ie., solids, liquids and gases.

Let us learn some important compounds in solids, liquids and gaseous state.

4.3.2 Compounds in solid

Some important compounds that exist in solid state are tabulated as follows

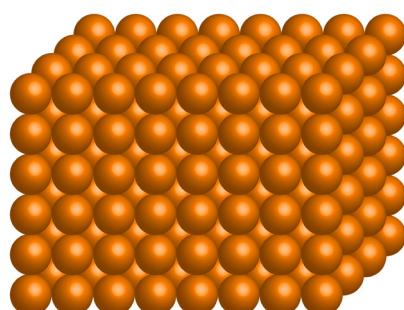


Figure 4.13 Solid

Compound	Constituent Elements
Silica (sand)	Silicon, Oxygen
Potassium hydroxide (caustic potash)	Potassium, Hydrogen, Oxygen
Sodium hydroxide (Caustic soda)	Sodium, Oxygen, Hydrogen
Copper sulphate	Copper, Sulphur, Oxygen
Zinc carbonate (calamine)	Zinc, carbon, oxygen

4.3.3 Compounds in liquid

Some important compounds that exist in liquid state are tabulated as follows

Compound	Constituent Elements
Water	Hydrogen, Oxygen
Hydro chloric Acid	Hydrogen, Chlorine
Nitric Acid	Hydrogen, Nitrogen, Oxygen
Sulphuric Acid	Hydrogen, Sulphur, Oxygen
Acetic acid (Vinegar)	Carbon, Hydrogen, Oxygen

Liquid

4.3.4 Compounds in gas

Some important compounds that exist in gaseous state are tabulated as follows

Compound	Constituent Elements
Carbon dioxide, carbon monoxide	Carbon, Oxygen
Sulphur dioxide	Sulphur, Oxygen
Methane	Carbon, Hydrogen
Nitrogen dioxide	Nitrogen, Oxygen
Ammonia	Nitrogen, Hydrogen





4.3.5 Uses of Compounds

Let us tabulate some compounds and their constituents that we use in our daily life.

Common Name	Chemical Name	Constituents	Uses
Water	Hydrogen Oxide	Hydrogen and oxygen	For drinking and as solvent
Table salt	Sodium chloride	Sodium and chlorine	Essential component of our daily diet, preservative for meat and fish.
Sugar	Sucrose	Carbon, hydrogen and oxygen	Preparation of sweets, toffees and fruit juices.
Baking soda	Sodium bicarbonate	Sodium, hydrogen, carbon and oxygen	Fire extinguisher, preparation of baking powder and preparation of cakes and bread.
Washing soda	Sodium carbonate	Sodium, carbon and oxygen	As cleaning agent in soap and softening of hardwater.
Bleaching powder	Calcium oxy chloride	Calcium, oxygen and chlorine	As bleaching agent, disinfectant and sterilisation of drinking water.
Quick lime	Calcium oxide	Calcium and oxygen	Manufacture of cement and glass.
Slaked lime	Calcium hydroxide	Calcium, oxygen and hydrogen	White washing of walls.
Lime stone	Calcium carbonate	Calcium, carbon and oxygen	Preparation of chalk pieces.

More to Know

Compound	Constituent Elements
Copper sulphate	Blue Vitriol
Ferrous sulphate	Green Vitriol
Potassium nitrate	Saltpetre
Sulphuric acid	Oil of Vitriol
Calcium sulphate	Gypsum
Calcium sulphate hemi hydrate	Plaster of paris
Potassium chloride	Muriate of potash

Points to remember

- **Matter:** Anything which occupies space and has mass is called matter.
- **Compound:** The molecule of a substance that contains two or more atoms of different elements combined together in a definite ratio, is said to be a molecule of a compound.
- **Solid:** Material which has a definite shape and definite volume at room temperature with any number of free surfaces is called solid.
- **Liquid:** Material which has a definite volume, but no definite shape and has one free surface, is called liquid.



- **Gases:** Material which has neither definite shape nor definite volume, is easily compressible and has no free surface is called gas.
- **Metals:** Metals are elements that are hard and shiny in appearance. Some metals used in our daily life are iron, copper, gold, silver, etc. Metals conduct heat and electricity.
- **Non metal:** Elements that generally do not shine, neither too hard nor too soft are non-metals. All gases are non-metals. Some non-metals are sulphur, carbon, oxygen etc..
- **Metalloids:** Elements which have some properties of metal and some of non-metals are called metalloids. Some examples are arsenic, germanium etc...
- **Sonority:** On being hit, metals produce a typical sound. They are said to be sonorous. This property is being made used in making temple bells.
- **Symbol:** The easiest way to represent the element and to write the chemical formulas easily.

A-Z GLOSSARY

Disinfectant	Chemical substance which kills or prevents the disease causing microorganism.
Semiconductor	Substance which acts as bad conductor at low temperature and act as good conductor at high temperature.
Reducing agent	Substance which undergo oxidation reaction.
Carbohydrate	Compound contains carbon, hydrogen and oxygen are called carbohydrate.
Bleaching agent	Substance which is used to remove the colour.
Preservative	Substance which prevent from food spoiling organism.



TEXT BOOK EXERCISE



I. Choose the best answer.

1. Matter is composed of
 - a) atoms
 - b) molecules
 - c) ions
 - d) all of the above
2. The liquid metal used in thermometers is
 - a) Copper
 - b) Mercury
 - c) Silver
 - d) Gold
3. The Pictorial symbol for water given by the alchemists was
 - a)
 - b)
 - c)
 - d)
4. Which one of the element name not derived from planet?
 - a) Plutonium
 - b) Neptunium
 - c) Uranium
 - d) Mercury
5. Symbol of Mercury is
 - a) Ag
 - b) Hg
 - c) Au
 - d) Pb
- 6) A form of non-metal which has high ductility is
 - a) nitrogen
 - b) oxygen
 - c) chlorine
 - d) carbon



7. Which one of metal possess low tensile strength?
a) Silver b) Copper
c) Zinc d) Aluminium
8. The property which allows metals to be hammered into their sheets is _____
a) ductility b) malleability
c) conductivity d) tensile strength
9. The non-metal which conduct current is
a) carbon b) oxygen
c) aluminium d) sulphur
10. Pencil lead contains
a) graphite b) diamond
c) aluminium d) sulphur

II. Fill in the blanks.

1. The element which possess character of both metals and non metals are called.....
- 2 . The symbol of Tungsten.....
3. Melting point of most metal is _____ than non-metal.
4. Water contains and element.
- 5 is the used in semiconductor industry.

III. True or False , if false correct the statement

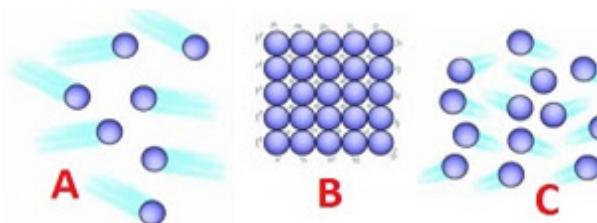
1. Metals are generally good conductors of electricity, but not good conductors of heat.
2. Gallium metal is in solid state at or just above room temperature.
3. Compounds can be made up of one atom.
4. Coal can be drawn into wires.
5. Zinc is highly ductile in nature.

IV. Match the substance given in column A with their use given in Column B.

A	B
1. Iron	For making wires
2. Copper	Sewing needle
3. Tungsten	As a fuel for ignition in rocket.
4. Boron	Making the filament of a bulb

2. Match the following:

1. Atom	A. building block of matter
2. Element	B. atoms of different kinds
3. Compound	C. atoms of the same kind



4. Molecule ---- D. smallest unit of a substance

- A)1 - A, 2 - C, 3 - B, 4 - D
B) 1 - C, 2 - A, 3 - B, 4 - D
C) 1 - D, 2 - C, 3 - B, 4 - A
D)1 - B, 2 - C, 3 - A, 4 - D

3. Identify the state of matter based on the arrangement of the molecules.

- A) A - gas, B - solid, C – liquid
B) A - Liquid, B - solid, C – Gas
C) A - gas, B - solid, C - liquid
D) A - Liquid, B - Gas, C - Solid

V. Very Short Answer Questions

- 1 .What is ductility?
2. Write the constituent elements and their symbols for the following compounds
- Carbon monoxide
 - Washing soda



3. Write the symbols for these elements
 - a) Oxygen b) Gold
 - c) calcium d) cadmium e) Iron
4. Name two soft metals that can be cut with a knife.
5. Which non-metal is essential for our life and all living beings inhale it during breathing?
6. Why are bells made of metals?
7. What does a chemical symbol represent?
8. Give two examples for metalloids.
9. Mention any three compounds that exist in liquid state.
10. Write three properties of metalloids.

VI. Short Answer Questions

1. Can you store pickle in an aluminium utensil? Explain.
2. Tabulate four points of difference between metals and non-metals.
3. Define tensile strength.
4. Why are utensils made up of aluminium and brass?
5. Define Alchemy.
6. Name the elements for following symbols.
 - a) Na
 - b) W
 - c) Ba
 - d) Al
 - e) U

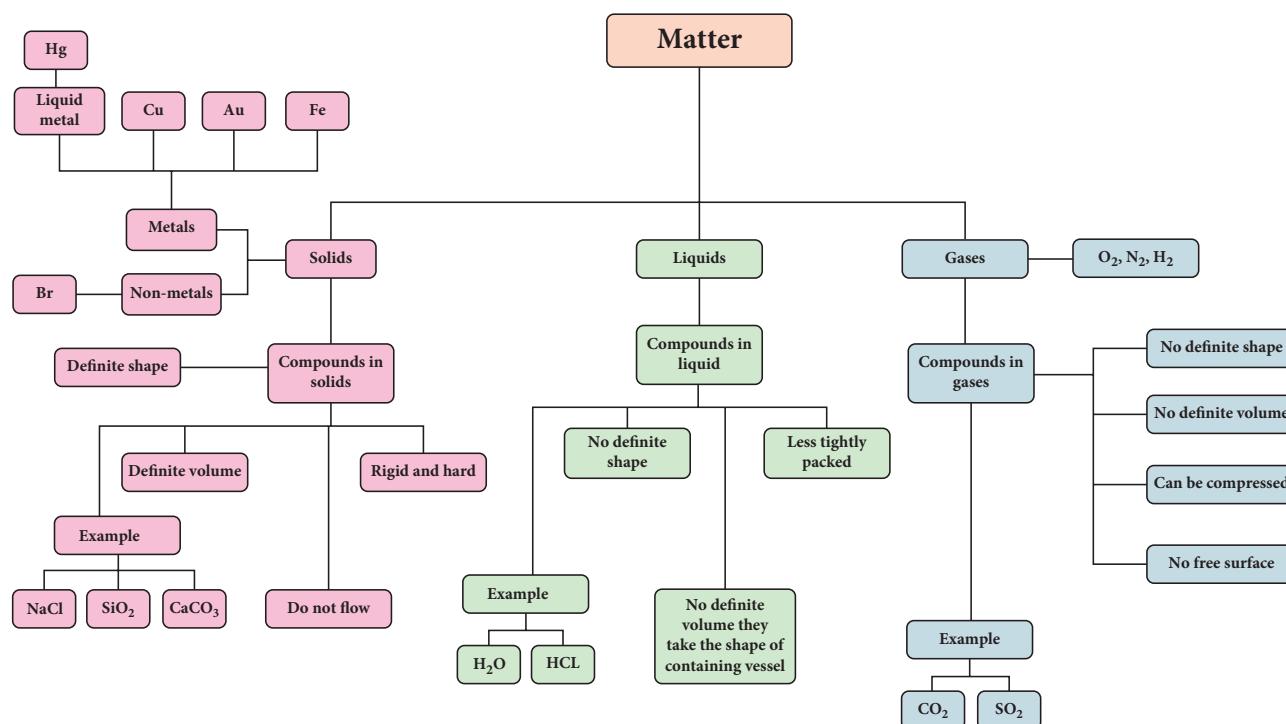
7. Name six common non-metals and write their symbols.
8. Mention any four compounds and their uses.
9. Mention the metals that are used in jewellery.
10. Mention the uses for the following compounds.
 - a) Baking soda
 - b) Bleaching powder
 - c) quick lime

VII. Reason out

1. Give reasons for the following.
 - (a) Aluminum foils are used to wrap food items.
 - (b) Immersion rods for heating liquids are made up of metallic substances.
 - (c) A doctor prescribed a tablet to a patient suffering from iron deficiency. The tablet does not look like iron.
 - (d) Sodium and potassium are stored in kerosene.
 - (e) Mercury is used in thermometers.
2. Why wires cannot be drawn from materials such as stone or wood?



Mind Map



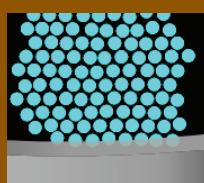
ICT CORNER MATTER



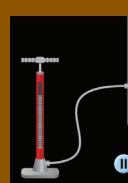
This activity enables the students helps to know about the States of Matter

Steps

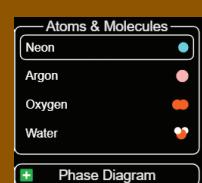
- Open the Browser and type the URL link given below (or) Scan the QR Code.
- Select the title “States of Matter: Basics”
- States of Matter: Basics display on the screen. Follow this Experiment
- Click the next and to know about this states of matter



Step1



Step2



Step3



Step4

Cells alive

URL: https://phet.colorado.edu/sims/html/states-of-matter-basics/latest/states-of-matter-basics_en.htm (or) scan the QR Code

*Pictures are indicative only





UNIT

5

CHANGES AROUND US



Learning Objectives

At the end of this lesson, students will be able to:

- ◆ Define chemical reaction
- ◆ Differentiate chemical changes from physical changes
- ◆ Learn how chemical reactions take place by physical contact, solution of reactants, electricity, heat, light and catalyst.
- ◆ Experiment chemical reactions based on contact, solutions, heat, light, electricity and catalyst
- ◆ Learn about the importance and effects of chemical reactions
- ◆ Identify chemical reactions in day to day life
- ◆ Observe the changes during a chemical reaction
- ◆ Infer what happens during a chemical reaction



4BPSEI

INTRODUCTION

Adithya, a standard VIII student once visited Qutub Minar, Delhi and wondered about the 1500 years old rust resistant iron-pillar. He was thinking about why the iron pillar has not rusted for more than 1500 years. One day he noticed milk turned into curd and he wondered how it is happening.

As you studied earlier in standard VII changes like folding a paper, drying wet clothes, bending of iron rod are some examples for physical changes. On the other hand, changes like burning of paper, digestion of food, turning of milk into curd and decaying of vegetables are some of the examples for chemical changes.

Now, shall we do an activity?

Dear students, can you define a chemical change? Yes, you can. A chemical change is a permanent, irreversible change and produces a new substance.

Activity 1

Identify the following changes as Physical or Chemical.

1. Melting of ice, 2. Ripening of fruits,
3. Rusting of iron, 4. Spoilage of food,
5. Burning of wood, 6. Bursting crackers,
7. Burning of camphor, 8. Browning of apples,
9. Running of steam engine, 10. Combustion of petrol and diesel, 11. recycling of plastics

Complete: A chemical change is -----

1-----, ----- 2 ----- and produces
3 -----

1. Temporary/permanent
2. Reversible/Irreversible
3. New substance / no new substance



Chemical changes are otherwise called as chemical reactions, because one or more substances(Reactants)undergo a reaction to form one or more new substances(Products).

Reactant(s) ————— Product(s)

In a society people live in different conditions not under same conditions. Likewise, all chemical reaction will not occur at all conditions. For every chemical reaction to take place, certain specific condition is required.

Do you know what are the conditions required for a chemical reaction to take place?

Chemical reactions can be done through;

1. Physical contact
2. Solution of reactants
3. Electricity
4. Heat
5. Light
6. catalyst

Let us discuss the conditions that are necessary to carryout a chemical reaction with one or two examples.

5.1 CHEMICAL REACTIONS BASED ON PHYSICAL CONTACT

Dear children, could you remember some of the day to day activities like burning of matchstick on rubbing, iron materials turning into reddish brown. Why and how these changes happen?

Students, these changes are due to chemical reactions by contact in physical state. Combination of reactants in their naturally occurring states (solids, liquids, gases) is referred as phycial contact.

- 1) When dry wood comes into contact with fire, it burns with the help of oxygen to form carbon dioxide, which is given out as smoke.

- 2) When a matchstick is rubbed on the sides of a matchbox, a chemical reaction takes place to form heat, light and smoke.
- 3) When quick lime (calcium oxide) comes in contact with water, it forms slaked lime (calcium hydroxide).



Fig:5.1 Burning a match stick

From above reactions, we can conclude that certain chemical reactions take place only when the reactants are brought in contact with each other in their physical states.

Activity 2

Take two test tubes and couple of rust free iron nails. In one test tube pour some water and put an iron nail. Keep the test tube opened for few days. Take another test tube and pour some water as well. But this time pour some coconut oil above the water level to completely immerse the nail inside. Now, place the second iron nail. Leave the set up for a few days. Observe the changes and record them. Which iron nail gets rusted and Why?



5.2 CHEMICAL REACTIONS BASED ON SOLUTION OF REACTANTS

Do you like coffee? How coffee is prepared? As your mother does, when milk is mixed with coffee decoction the colour of milk and decoction changes due to chemical reaction. Your mother adds enough sugar to make it tasty.



MORE TO KNOW

The head of a matchstick contains potassium chlorate and antimony tri sulphide. The sides of the matchbox contain red phosphorous.

Like this when we mix two substances(Reactants)in solution form, the chemical reaction takes place to form new substances(Products). For example take small amount of solid silver nitrate and sodium chloride in a test tube. Do you observe any change? No, the reactants in solid state have no reactions. Now you dissolve the same reactants in water in separate test tubes. Mix both the solutions. What do you observe? Silver nitrate solution reacts with sodium chloride solution to form a white precipitate of silver chloride and sodium nitrate solution. From the above reaction, we infer that some chemical reactions proceed only in solution form not in solid form.

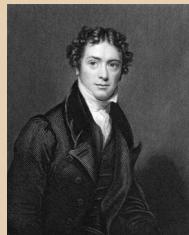
5.3 CHEMICAL REACTION BASED ON ELECTRICITY

Can we live without electricity? Absolutely not. Electricity is very essential for our living. We use electricity for cooking, lighting, grinding, watching TV, charging mobiles, laptops, computers, water heaters etc. Do you know electricity can be used to carry out chemical reactions? Yes, by using electricity many chemical reactions are done which are industrially very important. As you know, water is made of hydrogen and oxygen molecules. When electricity is passed through water containing small amounts of sulphuric acid, hydrogen and oxygen gases are liberated. Similarly, a concentrated solution of sodium chloride called BRINE is electrolysed to produce chlorine and hydrogen gases along with sodium hydroxide. This is a very important reaction to produce chlorine industrially.

From the above two reactions, we infer that some chemical reactions proceed only by the passage of electricity. Hence, such reactions are called as **electrochemical reaction or electrolysis**.



The term electrolysis was introduced by Michael Faraday in the 19th century. Electrolysis is a combination of electron + lysis. Electron is related to electricity and lysis means decomposition.



5.4 CHEMICAL REACTIONS BASED ON HEAT

As you know food is very important for our survival and also many other living beings. Have you closely watched your mother cooks food for you? She boils rice, cooks vegetables, and prepares kuzhambu and rasam etc by heating them over stove. When enough heating is given some chemical reactions take place to convert the raw food (uncooked) items into cooked ones.

You can perform this reaction in your laboratory. Take small amount of lead nitrate in a dry test tube and heat it gently over a flame. Observe the changes closely. You will hear cracking sound and an evolution of reddish brown coloured gas (nitrogen dioxide). In industries limestone rocks are heated to get quicklime (calcium oxide). Hence, some of the chemical reactions can be achieved by the supply of heat only. These reactions are called **thermo chemical reactions or thermolysis**.



Limestone is the raw material for quicklime, slaked lime, cement and mortar



MORE TO KNOW

Chemical reactions accompanying evolution of heat are called exothermic reactions whereas reactions involving absorption of heat are called endothermic reactions.



5.5 CHEMICAL REACTIONS BASED ON LIGHT

What will happen if there is no sunlight? All the human activities will be affected and there will be no food for us to survive. Isn't it?

Sunlight is important not only for us but also for plants as well. As you know photosynthesis is a process in which light energy from the sun is used by the plants to prepare starch from carbon dioxide and water. The sunlight uses the chemical reactions between carbon dioxide and water, which finally ends up in the production of starch (photo means light and synthesis means production). These chemical reactions induced by light are called as photochemical reactions.



Photolysis In Atmosphere:

The ultraviolet rays from the sun break Ozone (O_3) molecules in the stratosphere into oxygen and atomic oxygen. This atomic oxygen again combines with molecular oxygen to form Ozone.

MORE TO KNOW

Photochemistry is the branch of chemistry that deals with chemical reactions involving light.

5.6 CHEMICAL REACTION BASED ON CATALYST:

Do you like cakes and buns? Yes, you do. Have you ever questioned about why idly batter prepared by your mother turns into sour taste after few hours? The answer for your question is fermentation. It is a

chemical reaction in which a substance is decomposed with the help of yeast or bacteria to give simpler products. In the case of yeasts, the enzymes released by the yeast makes the reaction faster. Like this, in industries some chemical substances are used to alter the speed of a chemical reaction. These substances are called catalysts. For example, metallic iron is used as a catalyst in the manufacture of ammonia using Haber process. This ammonia is the basic material for the production of urea, an important fertilizer in agriculture. In Vanaspati ghee (dalda) preparation finely divided nickel is used as a catalyst.

Thus, speed of the certain reactions is influenced by the catalysts and such reactions are called **catalytic reactions**.



Fig 5.2 Applying urea on paddy crops



Enzymes and yeasts are called biocatalysts.



MORE TO KNOW

Alcoholic beverages like beer, wine etc are produced by fermentation process in industries. The beer making industries are called BREWERIES.

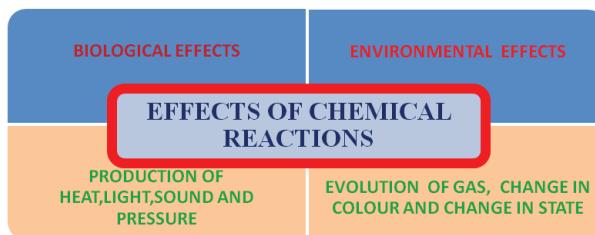


Activity 3

Buy some fresh yeast from a grocery shop nearby. Prepare a paste of wheat flour with water in a vessel. Add some yeast and leave the vessel closed for few hours under sunlight. Observe the changes closely. What do you infer?

5.7 EFFECTS OF CHEMICAL REACTIONS

We know that every chemical reaction requires a specific condition to occur. When chemical reactions take place there will be production of heat, light, sound, pressure etc. Let us discuss these effects elaborately.



5.7.1 Biological Effects

a) Spoilage of food and vegetables: Food spoilage may be defined as any change that causes food unfit for human consumption. The chemical reactions catalyzed by the enzymes result in the degradation of food quality such as development of bad tastes and odor, deterioration and loss of nutrients.
e.g. 1. Rotten eggs develop a bad smell due to formation of hydrogen sulphide gas
e.g. 2. Decaying of vegetables and fruits due to microbes

b) Rancidity of fishes and meat:

Fishes and meat containing high levels of polyunsaturated fatty acids that undergo oxidation causes bad odour when exposed to air or light. This process is called Rancidity.



Fig 5.3 Rancid fish on the shore

c) Apples and fruits turn brown when cut:

Apples and some fruits turn brown due to chemical reaction with oxygen in air. This chemical reaction is called browning. The cells of apples, fruits and other vegetables contain an enzyme called polyphenol oxidase or tyrosinase that when in contact with oxygen catalyses a biochemical reaction of plants' phenolic compounds to brown pigments known as melanins.

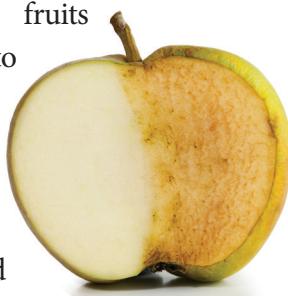


Fig 5.4 Browning of apple



5.7.2 Environmental Effects

a) Environment is the place around you that comprises both living and non living things. Our environment provides air to breathe, water to drink and the land to produce food. Due to human activities like industries, increasing number of automobiles etc our environment is badly affected now-a-days. So, there is an unwanted change in physical, chemical and biological properties of the environment. This is termed as pollution. The substances which cause these changes are called pollutants. Generally there are three types of pollutions viz air, water and land pollution. Due to increasing human activities lot of chemical substances are produced artificially which harm all the living and non living things.



Fig 5.5 Smoke from industries



We can tabulate the types of chemical substances and their effects.

Sl.no	Type of pollution	Chemical substances responsible for the pollution	Effects
1	Air pollution	Carbon di oxide, Carbon monoxide, oxides of sulphur, oxides of nitrogen, Chlorofluorocarbons, methane etc	Acid rain, Global warming, respiratory problems etc.
2	Water pollution	Waste water containing chemical substances (e.g dyeing industries), detergents, oil spillage etc	Decrease in quality of water, skin diseases etc
3	Land pollution	Fertilizers like urea, various pesticides, herbicides etc.	Spoilage of land, cancer, respiratory diseases etc.

- b) What happens to the steel benches and tables during rainy season? They turn into reddish brown. Isn't it?

Do you know why? This is because the iron metal comes into contact with water and oxygen, it undergoes a chemical reaction called RUSTING.



c) Tarnishing of metal articles:

Shiny metal surfaces and other articles lose their shining appearance due to chemical reactions on the surface. For example, silver articles become black on exposure to atmospheric air. Similarly, brass vessels which contain copper as one of constituents develop a greenish layer on exposure to air for a long time. This is due to a chemical reaction between copper and moist air to form basic copper carbonate and copper hydroxide.



Fig 5.6 Rusted iron barrels and chairs



Fig 5.7 Damaged iron sheets

5.7.3 Production of heat, light, sound and pressure

a) Production of heat:

Have you ever rubbed your palms in winter season to keep yourself warm? Have you noticed the heat produced when you use cycle pump? Chemical reactions also produce heat energy. Such reactions are called EXOTHERMIC REACTIONS. For example when you add water to quicklime (Calcium oxide), lot of heat is released to produce slaked lime (Calcium hydroxide).

Activity 4

Take two clean test tubes. Take sulphuric acid in one test tube and a solution of sodium hydroxide in another tube. Slowly add sodium hydroxide solution to sulphuric acid carefully. Touch the sides of test tube. What do you feel? What do you infer?

Thus we conclude that some chemical reactions produce heat energy.

b) Production of light:

What happens when you ignite a candle? You get light as a result of burning. Some chemical reactions like these produce light. For example when a piece of magnesium ribbon is burnt in a flame, bright light is produced with heat. Even the fireworks during festival times produce different coloured lights which are all



due to chemical reactions. Similarly when we ignite methane gas, it produce heat and light.

So, we can say that light is produced during the chemical reactions .

c) Production of sound:

We produce sound when we speak. When you hit metals like iron, copper etc sound is heard. Some chemical reactions do produce sound when they take place. What happens when you fire cracker during Deepavali? The chemical substances kept in the crackers undergo some chemical reactions to produce sound.

So, sound will be produced in certain chemical reactions.

Activity 5

Take a clean test tube. Add some dilute hydrochloric acid. Drop a piece of magnesium or a piece of zinc metal. What do you see? Now bring a burning matchstick near the mouth of the test tube.

What do you hear? Anything special?
What do you infer?

You heard a POP SOUND. Isn't it? When a metal like zinc or magnesium reacts with diluted acids hydrogen gas is produced. Since hydrogen gas is highly flammable it reacts with oxygen in air to produce POP sound.

d) Production of pressure:

What happens when you compress hard a balloon having full of air? Will it burst or not?

Yes, it will burst. This is due to sudden release of air from the balloon as a result of increased pressure on compression. Like this some chemical reactions produce gases which build up the pressure when the reaction takes place in a closed container. If the pressure level goes beyond the limit, we get the explosion. Explosives, fireworks work on this basis. When they are ignited they explode due to pressure generated by gases from the chemical reactions. Thus you hear a huge sound.

So, we conclude that pressure can be generated by certain chemical reactions.

5.7.4 Evolution of Gas, Change in Colour and Change in State

In addition to above effects certain other effects may also take place as a result of chemical reactions.

a) Evolution of gas:

What happens when you open a soda bottle? You can see air bubbles coming out of soda water. Similarly gas evolution may take place as a result of chemical reactions. For example

when dilute hydrochloric acid is added to a solution of sodium carbonate or sodium bicarbonate carbon dioxide gas is evolved.

b) Change in colour:

What happens when you play under hot sun for a long time? Your skin becomes dark. Right?

Like this certain chemical changes produce change in colour. For example when you place a iron nail in a solution of copper sulphate, the blue colour of copper sulphate slowly changes into green due to chemical reaction between iron copper sulphate solution.

c) Change in state:

Take a small ice cube and place it on a plate. What happens after some time? Ice melts into water. Isn't it? Here solid ice cubes change into liquid water. Like this in certain chemical reaction change of state is observed. For example when you burn a piece of camphor, smoke comes out as result of chemical reaction between solid camphor and oxygen. Here, there is a change of state from solid to gas.

Points to remember

- A chemical change is a permanent, irreversible change and produces a new substance.
- In a chemical reaction reactant/reactants give product/products.



- A chemical reaction may take place via physical contact in solid state, solution of reactants, electricity, heat, light and catalyst.
- Rusting is a chemical reaction in which iron objects form hydrated ferric oxide in presence of oxygen and water.
- Electrolysis is a process in which electricity is used to carry out chemical reactions.
- Photolysis is a process in which light is used to carry out chemical reactions.
- Thermolysis is a process in which heat is used to bring about chemical reactions.
- Chemical substance used to alter the speed of the reaction is called catalyst and the process is called catalysis.
- Chemical reactions cause spoilage of food, vegetables and fruits, acid rain, green house effect and damage to materials.
- Global warming is a dangerous condition in which earth's average temperature rises alarmingly due to various human activities.
- Rancidity is a condition in which the food items develop bad odour due to chemical reactions by microbes.

A-Z GLOSSARY

Irreversible	No reverse action
Reactant	Reacting substance in a chemical reaction
Product	Newly formed substance in a chemical reaction
Catalyst	Substance that alters the speed of a chemical reaction
Combustion	Burning with oxygen in air
Rusting	Corrosion of iron objects
Rust	Hydrated iron oxide (ferric oxide)
Precipitate	A new insoluble substance formed in a chemical reaction
Moist Air	Air having water
Decompose	Dissociate/split/broken down
Thermal Decomposition	Dissociation/splitting by heat
Quicklime	Calcium oxide
Ozone	a form of oxygen having three oxygen atoms
Stratosphere	The second layer of atmosphere
Yeast	A kind of single celled fungus

Fertilizer	Artificial manure/ chemically synthesized manure
Spoilage	Deterioration of food items
Rancidity	A chemical change involving food items to produce bad odour
Polyunsaturated Fatty Acids	A long chain carbon based acids present in fats
Oxidation	Addition of oxygen
Splitting Of Fats	Breaking of fats into acid and glycerol
Enzyme	Catalyzing substance in a biological system
Biochemical Reaction	Chemical reaction involving biological substances
Pigments	Colour giving substance/ colourants
Phenomenon	Happening
Acidic	Having acid character
Global Warming	Rise in earth's average temperature
Fossil Fuel	Fuels like coal, petrol obtained from plants and animals once lived and buried beneath the earth
Tarnishing	Losing shine
Lustre	Shine



TEXT BOOK EXERCISE



I. Multiple choice questions.

1. Burning of paper is a _____ change.
a) Physical b) chemical
c) physical & chemical d) neutral
2. The burning of matchstick is an example for chemical reaction based on _____.
a) Contact b) electricity
c) light d) catalyst
3. _____ metal undergoes rusting.
a) tin b) sodium
c) copper d) iron
4. The pigment responsible for browning of apples is _____.
a) Hydrated iron (II) oxide
b) melanin
c) starch
d) ozone
5. Brine is a concentrated solution of _____.
a) Sodium sulphate
b) sodium chloride
c) calcium chloride
d) sodium bromide
- 6) Limestone contains _____ mainly.
a) Calcium chloride
b) calcium carbonate
c) calcium nitrate
d) calcium sulphate
7. Which of the following factor induces electrolysis?
a) Heat b) light
c) electricity d) catalysis

8. In Haber's process of producing ammonia _____ is used as a catalyst.
a) Nitrogen b) hydrogen
c) iron d) nickel
9. Dissolved gases like sulphur dioxide, nitrogen oxides in rain water causes _____.
a) Acid rain b) base rain
c) heavy rain d) neutral rain
10. _____ is responsible for Global warming.
a) Carbon di oxide b) methane
c) chlorofluoro carbons d) all the above

II. Fill in the blanks.

1. Reactants → _____.
2. Photosynthesis is a chemical reaction that takes place in presence of _____.
3. Iron objects undergo rusting when exposed to _____ and _____.
4. _____ is the basic material to manufacture urea.
5. Electrolysis of Brine solution gives _____ gases.
6. _____ is a chemical substance which alters the speed of a chemical reaction.
7. _____ is the enzyme responsible for browning of vegetables, fruits.

III. Write TRUE OR FALSE for the following.

1. A chemical reaction is a temporary reaction.
2. Change in colour may take place during a chemical reaction.



3. Formation of slaked lime from quicklime is a endothermic reaction.
4. CFC is a pollutant.
5. Browning of some vegetables and fruits is due to tannin formation.

IV. Match the following:

A	B
1. Rusting	a) photosynthesis
2. Electrolysis	b) Haber's process
3. Thermolysis	c) Iron
4. food	d) Brine
5. Catalysis	e) Decomposition of limestone

A	B
1. Rancidity	a) Decomposition
2. Ozone	b) biocatalyst
3. Tarnishing	c) oxygen
4. Yeast	d) chemical reaction
5. Calcium Oxide	e) fish

V. Give Short Answers For The Following Questions.

1. Define a chemical reaction.
2. Mention the various conditions required for a chemical reaction to occur
3. Define catalysis.
4. What happens when an iron nail is placed in copper sulphate solution?
5. What is pollution?
6. What is Tarnishing? Give an example.
7. What happens to the brine during electrolysis?
8. On heating, calcium carbonate gives calcium oxide and oxygen. Is it exothermic reaction or endothermic reaction?
9. What is the role of a catalyst in a chemical reaction?
10. Why photosynthesis is a chemical reaction?

HOT QUESTIONS

1. Explain the role of yeast in making cakes?
2. Justify the statement. Burning of fossil fuels is responsible for global warming.
3. Discuss acid rain occurs due to emission of smoke from vehicles and industries?
4. Is rusting good for Iron materials? Explain.
5. Do all the fruits and vegetables undergo browning? Explain.
6. Classify the following day to day activities based on chemical reactions by physical contact, solutions of reactants, heat, light, electricity and catalyst.
 - a) burning of crackers during festivals
 - b) addition of water to quicklime to make it slaked lime
 - c) silver ornaments become black on exposure to air for a longtime
 - d) copper vessel kept in open air for long time

VI. Answer In Detail

1. Explain how food items are spoilt due to chemical reactions?
2. Explain the three types of pollution.
3. Explain any three conditions that is required for a chemical reaction to take place by citing one example each.

VII. Value Based Questions

1. Kumar is going to build a house. To purchase the iron rods required for construction, he visited an Iron& steel shop nearby. The seller showed him some Iron rods which are fresh and good. He also showed him little older Iron rods which are brownish in appearance. The price of fresh rods are costlier than the older ones, the seller also gave some offer to older ones. Kumar's friend Ramesh advised him not to buy the cheaper rods.



- a) Is Ramesh right in his suggestion?
b) Could you explain the reason for his suggestion?
c) What are the values shown by Ramesh?
- 2. Palanikumar is a Lawyer. He lives in a costly flat. Due to high rent, he wants to shift his residence to a place where he has a chemical industry nearby. There the rent is very cheap and the area is less populated also. Rajasekar, his son studying VIII does not like this and likes to go to some other place.
 - a) Is Rajasekar right in his attitude?
b) Why did he refuse to go there?
c) What are the values shown by Rajasekar?



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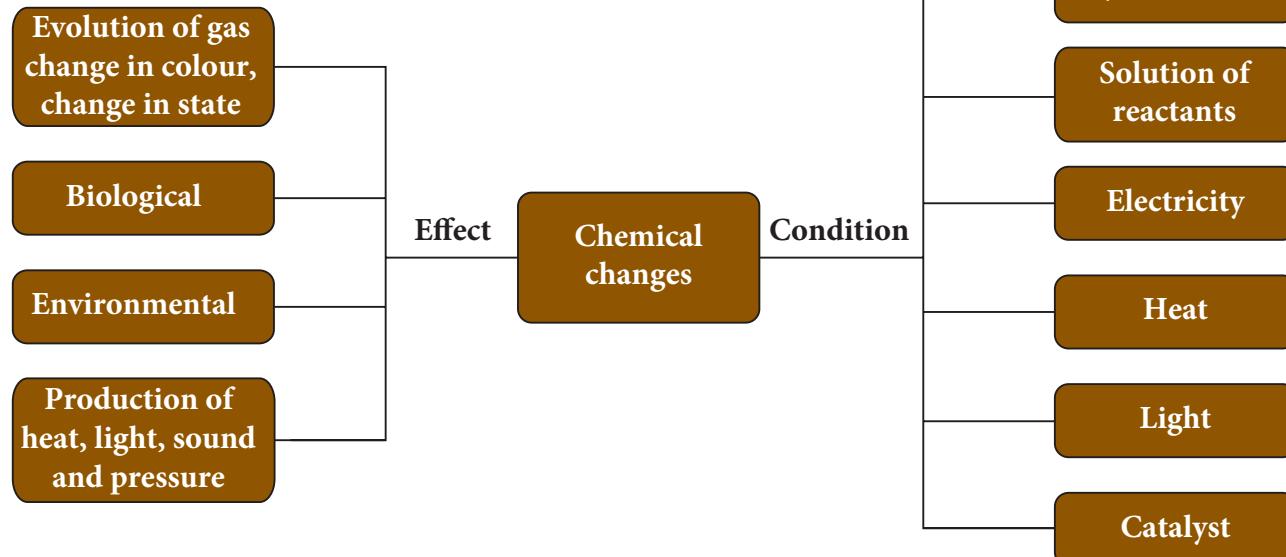
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Mind Map





ICT CORNER

This activity enables the students to understand about the Causes and affects of climate change

Changes Around Us



Steps

- Open the Browser and type the URL link given below (or) Scan the QR Code.
- Select the topic “Causes & affects of climate change”
- Click the title “Causes & affects of climate change”
- To know the various affects of climatic changes



Step1



Step2



Step3



Step4

Web link: <https://video.nationalgeographic.com/video/101-videos/0000015d-3cb1-d1cb>

(or) scan the QR Code

*Pictures are indicative only



B359_8_SCIENCE_EM



UNIT

6

MICROORGANISMS



Learning Objectives

After completing this chapter, the students will be able to:

- ◆ Understand the different types of microorganisms.
- ◆ Differentiate the various microorganisms based on their shape and occurrence.
- ◆ Know the role of microbes in various fields such as medicine, agriculture industry and daily life.
- ◆ Know the effects of harmful microorganisms.
- ◆ Understand the role of microbes in food process.
- ◆ Understand the relationship between man and microbes
- ◆ Know the effect of prions and virions on human health.



Introduction

Microorganisms are too small in size that they cannot be seen through naked eye. These organisms can be seen only with the help of a microscope, therefore they are also known as microbes. The science that deals with the study of microorganisms is known as **microbiology**.

Microorganisms occur everywhere. They are found in air, water (ponds, lakes, rivers and oceans), soil and even inside our bodies. Some of them can even survive in severely adverse conditions, such as hot springs, deserts, snow and deep oceans. They remain inactive under unfavourable conditions and become active during favourable conditions.

Microorganisms can be studied under five categories. They are:

- Virus
- Fungi
- Protozoa
- Bacteria
- Algae

6.1 VIRUS

A virus is a tiny, particle made up of genetic material and protein. They are intermediate between living and non living things. Virus means 'poison' in Latin. Viruses are intracellular obligatory parasites. The study of virus is called '**virology**'. Viruses are 10,000 times smaller than bacteria. Viruses have different shapes. They can be rod shaped, spherical or of other shapes.

6.1.1 Virus structure

A virus contains a core DNA or RNA. Surrounding that core is a protein coat. In some viruses, the protein coat is covered by an envelope made of proteins, lipids, and carbohydrates. The envelope has spikes that help the virus particles attach to the host cells.

Virus shows both living and non living characters:

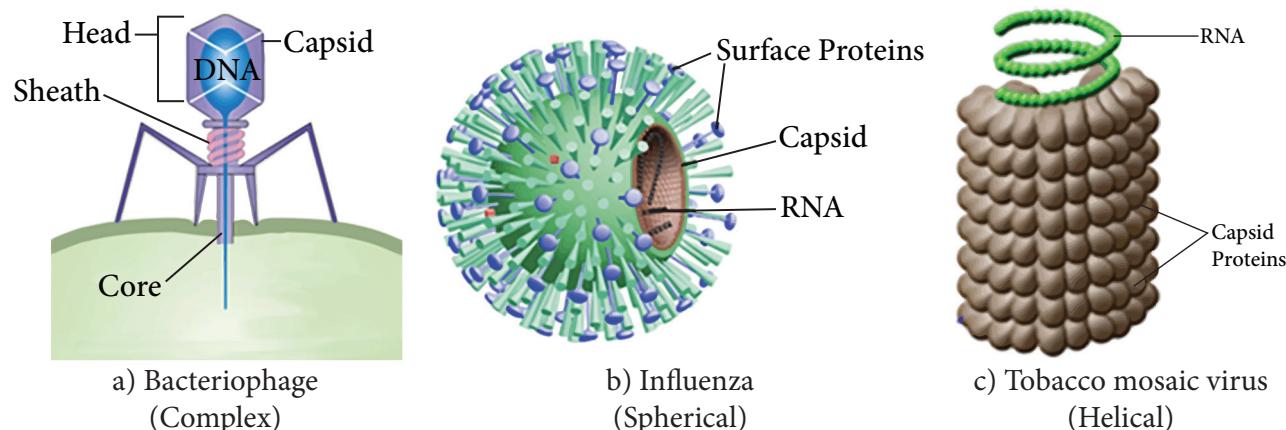


Fig 6.1 Different shapes of virus

6.1.2 Living characters

- They respond to heat, chemicals and radiations.
- They reproduce inside the host cells and produce copies of themselves.
- They show irritability.



6.1.3 Non-Living characters:

- They are inactive when present freely in the environment.
- They can be crystallized and stored for a very long time, like other non-living things.
- The metabolic machinery, cytoplasm is absent.

Viruses cause many diseases to plants, animals and human beings.

6.2.1 Cell structure:

A bacterium has an outer covering known as the cell wall. Nuclear material is represented by a nucleoid without nuclear membrane. An extra chromosomal DNA called plasmid is present in the cytoplasm. Protein synthesis is carried out by 70S ribosomes. Other cell organelles (mitochondria, Golgi body endoplasmic reticulum etc.,) are absent. Flagella aids in locomotion.

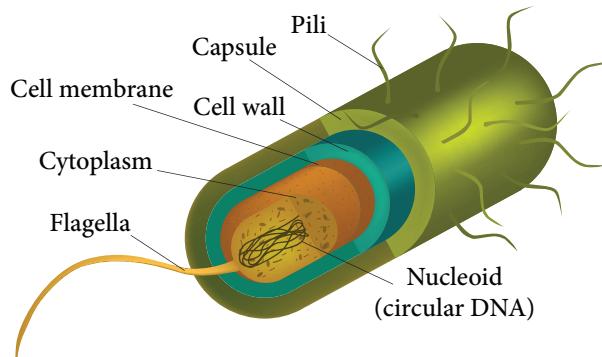


Fig 6.2 Bacteria cell structure

Bacteria are described according to the shape of their cells. They are:

- Bacilli - Rod shaped bacteria. Eg. *Bacillus anthracis*
- Spirilla - Spiral shaped bacteria. Eg. *Helicobacter pylori*
- Coccis - Spherical or ball shaped bacteria. They can stick together in pairs (diplococcus); form a chain (streptococcus) eg. *Streptococcus*

6.2 BACTERIA

Bacteria are single-celled prokaryotes (cells without nuclei). They are considered to be the first living organisms on earth. Bacteria are grouped under the kingdom Monera. The study of Bacteria is called Bacteriology. The size of bacteria range from $1\mu\text{m}$ to $5\mu\text{m}$ (micrometer). Bacteria are of two types based on respiration

- Aerobic bacteria (requires oxygen).
- Anaerobic bacteria (Does not require oxygen).



- pneumoniae* or occur in bunches (staphylococcus).
- Vibrio - comma shaped bacteria. Eg. *Vibrio cholera*.

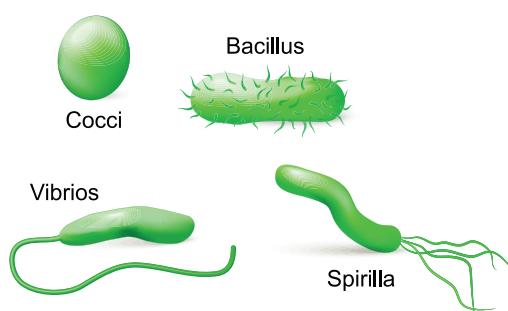


Fig 6.3 3 Shapes of Bacteria

Bacteria are also classified according to the number and arrangement of flagella, which are as follows:

- Monotrichous - Single flagella at one end.
Eg. *Vibrio cholera*
- Lophotrichous - Tuft of flagella at one end.
Eg. *Pseudomonas*.
- Amphitrichous - Tuft of flagella at both ends. Eg. *Rhodospirillum rubrum*.
- Peritrichous - Flagella all around. Eg. *E.coli*.
- Atrichous - Without any flagella. Eg. *Corynebacterium diphtheriae*.

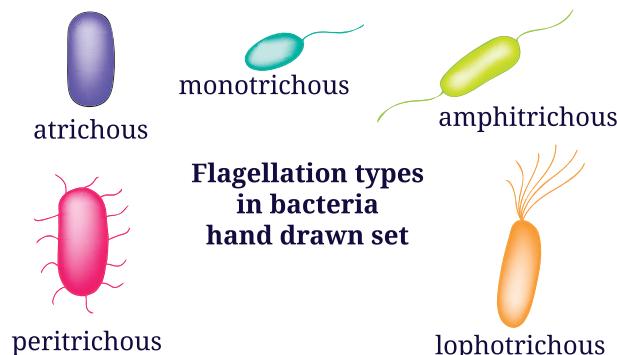


Fig 6.4 Different types of Bacteria based on the arrangement of flagella.

Bacteria get their food in many ways. Photosynthetic bacteria make their own food. (Eg. Cyanobacteria). Bacteria that live in harsh environment use chemicals (Ammonia, hydrogen sulphide) to produce their food

instead of utilizing energy from the sun. This process is called chemosynthesis. Some bacteria exhibit symbiotic relationship (eg. E.coli lives in the intestine of man). Bacteria reproduces by fission (binary and multiple fission).

Activity 1

Take one or two drops of butter milk on a slide and spread it. Heat the slide slightly on a lamp (3 – 4 seconds). Add a few drops of crystal violet, leave it for 30 to 60 seconds and wash the slide gently with water. Observe the slide under the compound microscope.

6.3 FUNGI

Fungi are group of eukaryotic organisms that lack chlorophyll. They grow in dark environments. They may be either unicellular (eg. Yeast) or multicellular (eg. Penicillium). They are found in all kinds of habitats. They are included under kingdom Fungi. The study of fungi is called mycology. Some fungi are macroscopic (eg. Mushroom). There are around 70,000 species of fungi, living in the world.

6.3.1 Cell structure:

Unicellular fungi (eg. Yeast)

Yeast are found freely in the atmosphere. Yeast grows in all kinds of media containing sugar. The cell is ovoid in shape, containing cell

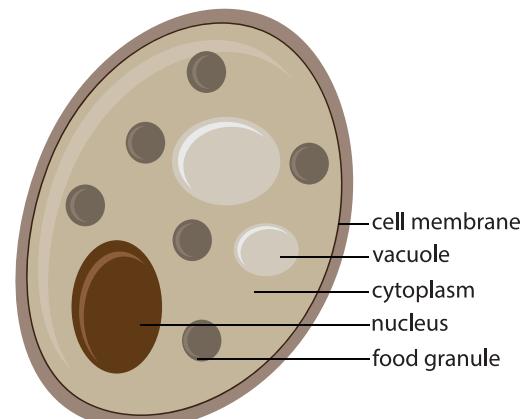


Fig 6.5 Structure of Yeast



wall and a nucleus. The cytoplasm is granular, and has vacuoles, organelles, glycogen and oil globules. Yeast aids in fermentation with the help of the enzyme zymase. Yeast respires anaerobically. Yeast reproduces by budding.

Multicellular fungi (eg. Mushroom)

Mushrooms are found growing on wet soil in shaded places during the rainy season, such as at the roots of the trees. The umbrella shaped structure that grows above the soil is known as the fruiting body. There are small slit like structures under the umbrella which are known as gills. The gills contain spores.

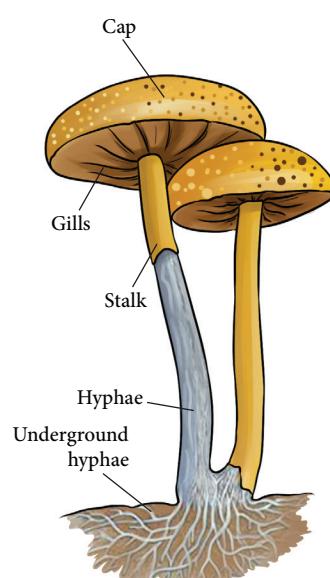


Fig 6.6 Multicellular Fungi – a mushroom

The mycelium is located underneath the fruiting body, in the top layer of the soil. Mycelium in turn is made up of thread-like structures called hyphae. Walls of the hyphae are made up of chitin and cellulose. Hyphae help in transport of nutrients for the growth of mushroom. Reproduction is by the method of fragmentation and spore formation.

Fungi are either saprophytes (i.e., derives nutrition from the remains of dead and decomposing plants and animals) eg. *Rhizopus*, *Penicillium*, *Agaricus*, or parasites (i.e. derives nutrition from the living cells of the host) eg. *Puccina*, *Albugo*, *Ustilago*, or symbionts (i.e., fungus in the roots of vascular plant) eg. *Mycorrhiza*.

Activity 2

Take some rotten part of vegetable or black spoiled part of bread or coconut with the help of a needle on a slide. Put a drop of glycerine, place a cover slip on it and observe it under the microscope.

6.4 ALGAE

Algae are very simple plant like eukaryotic organisms. Algae are found in moist habitats. Algae are rich in chlorophyll and can be seen as thin film on the surface of lakes and ponds, therefore they are known as 'grass of water'. They are autotrophic and manufacture their own food with the help of chloroplast. Chloroplast contain chlorophyll (green) pigments for photosynthesis. The study of algae is called algology (phycology).

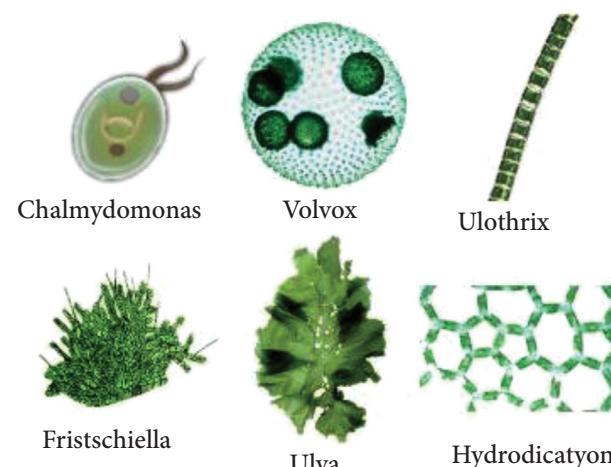


Fig 6.7 Different types of Algae

Their size varies from 1 micron to 50 meter. Algae may be unicellular, microscopic (eg. *Chlamydomonas*) or multicellular and macroscopic (eg. *Sargassum*). Unicellular algae exhibits variety of shapes (i.e., spherical, rod, spindle), whereas multicellular algae are in the form of filaments and branches.

6.4.1 Cell structure (Eg. *Chlamydomonas*)

Chlamydomonas is a simple, unicellular, motile fresh water algae. They are oval, spherical or pyriform in shape. The pyriform (pear shape) is a common one found in ponds, ditches and water tanks. They have a narrow anterior end and a broad posterior end.

The cell is surrounded by a thin and firm cell wall made of cellulose. The cytoplasm

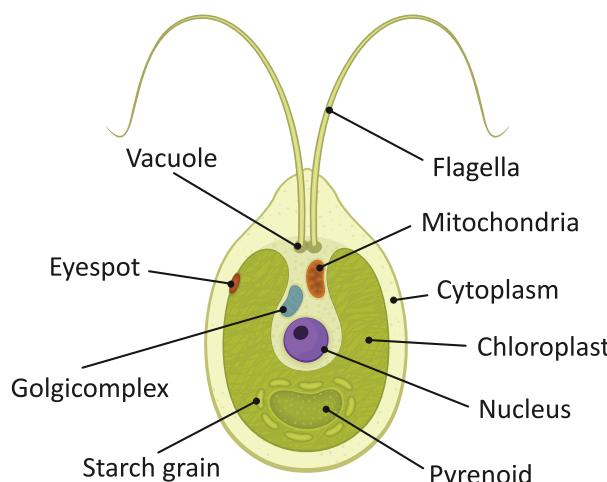


Fig 6.8 Structure of *Chlamydomonas*

is seen in between the cell membrane and the chloroplast. The cell contains large dark nucleus lying inside the cavity of the cup shaped chloroplast. The anterior part of the cell bears two flagella which helps in locomotion. Two contractile vacuoles are seen at the base of each flagellum. The anterior side of the chloroplast contains a tiny red coloured eyespot. *Chlamydomonas* exhibits sexual and asexual modes of reproduction.

Some algae have other photosynthetic pigments like fucoxanthin (brown), xanthophylls (yellow), phycoerythrin (red), phycocyanin (blue).



Fig. 6.9 *Spirogyra*

Activity 3

Collect pond water in a small bottle. Take one or two drops of collected greenish pond water on a slide. Cover it with a cover slip and observe through microscope.

6.5 PROTOZOA

A protozoan (in Greek protos = first and zoon = animal) is a single-celled eukaryote. They are included under the kingdom **Protista**. The study of protozoa is called **Protozoology**. They are found in ponds, ocean, in moist soil, and in the cells and tissues of plants and animals causing diseases. They range from 2-200 microns. Protozoans have specialized organelles. These organelles are used for movement, feeding, and other functions. The types of protozoans are as follows:

- Ciliates - presence of cilia for locomotion (eg. *Paramecium*)
- Flagellates - presence of flagella for locomotion (eg. *Euglena*)
- Pseudopods - presence of pseudopodia for locomotion (eg. *Amoeba*)
- Sporozoans - parasites(eg. *Plasmodium*)

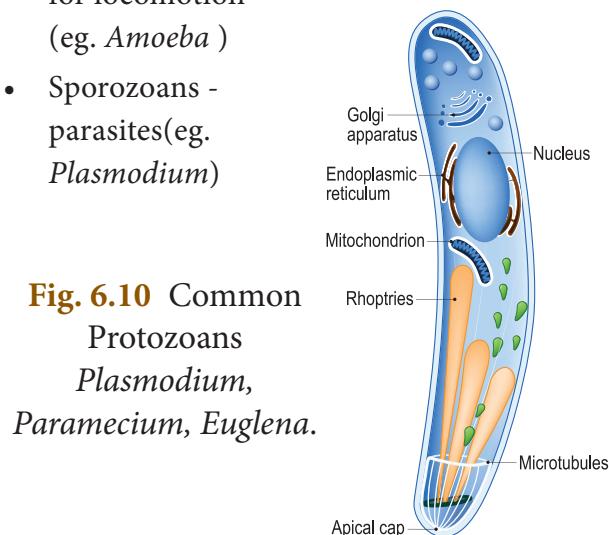
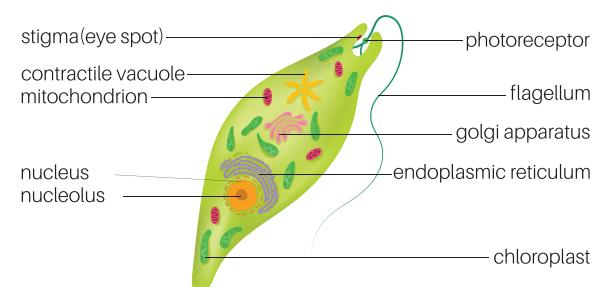
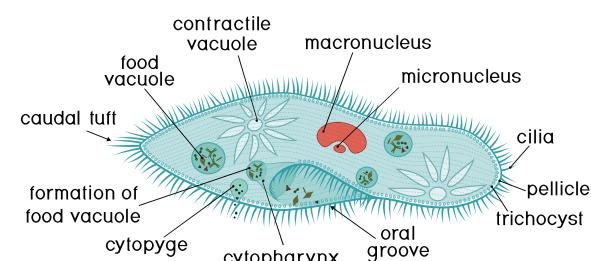


Fig. 6.10 Common Protozoans *Plasmodium*, *Paramecium*, *Euglena*.





Activity 4

Take one or two drops of hay (in tamil: vaikol) decoction on a slide and observe it under the microscope.

6.5.1 Cell structure (Eg. Amoeba)

Amoeba is a unicellular microscopic organism. It is found in ponds. *Amoeba* is irregular in shape. It has cell membrane, cytoplasm and nucleus. It is a protozoan that move by means of pseudopodia (in Latin, "false feet.") Pseudopodia are the extended part of cell membrane. It helps to catch its prey (algae). The body 'flows' around the food particle and engulfs it forming food vacuoles. Contractile vacuoles are seen in the cytoplasm that help in excretion. *Amoeba* reproduces by means of fission and sporulation.

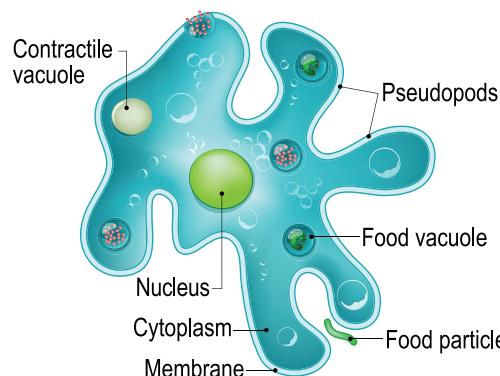


Fig.6.11 Amoeba

6.6 USES OF MICROORGANISMS IN MEDICINE, AGRICULTURE, INDUSTRY AND DAILY LIFE

6.6.1 Medicine

We obtain antibiotics and vaccines from microbes.

1. Antibiotics

The word 'Anti' means 'against'. Antibiotic is a substance produced by living organisms which is toxic for other organisms. Sir

Alexander Fleming was the first person to discover the antibiotic Penicillin in the year 1928. The antibiotic Penicillin was obtained from the fungi *Penicillium chrysogenum*. It is used to treat diseases such as tetanus, diphtheria. Antibiotic Streptomycin is obtained from *Streptomyces* bacteria to cure various bacterial infections eg. Plague.



Fig 6.13 *Penicillium chrysogenum*

More to know

Scientists discovered a new antibiotic pseudouridimycin. The new antibiotic is produced by a microbe found in a soil sample collected in Italy. The new antibiotic kills drug-sensitive and drug-resistant bacteria in a test tube and cures bacterial infections in mice.



2. Vaccines

Vaccines are prepared from dead or weakened microbes. Edward Jenner was the first person to discover small pox vaccine. He coined the term vaccination. When the vaccine is injected to the body of a patient, the body



produces antibodies to fight against the germs. These antibodies remain inside the body and protects from future invasion of the germs. Therefore vaccination is otherwise called as immunization.

Eg. MMR vaccine for Measles, Mumps, Rubella. BCG (Bacille Calmette Guerin) vaccine for Tuberculosis.

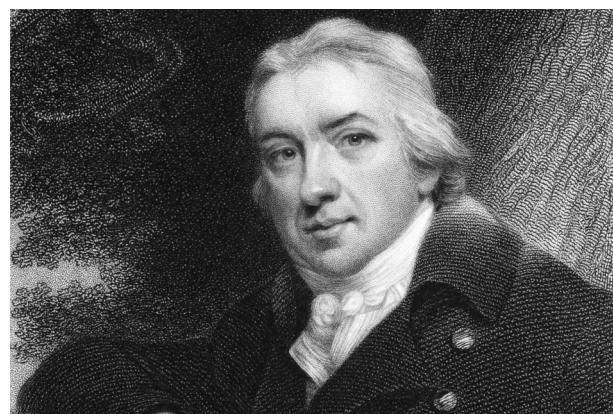


Fig. 6.14 Edward Jenner

6.6.2 Agriculture

1. Natural Fertilizer

Microorganisms are called as decomposers because they act upon degradable wastes. During the process, nitrates and other inorganic nutrients are released into the soil, making the soil fertile. This compost is called as natural fertilizer.

TYPES OF BIOFERTILIZERS

- Bacterial
- Fungal
- Algal
- Aquatic fern
- Earthworms



Fig. 6.15 Types of Biofertilizers

2. Nitrogen Fixation:

Rhizobium bacteria living in the root nodules of leguminous plants enrich the soil

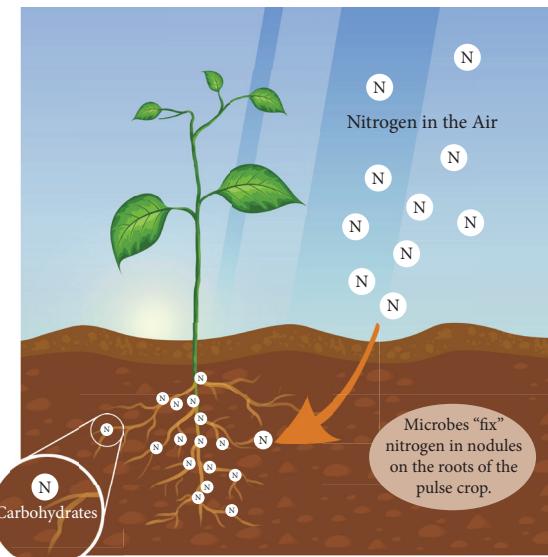


Fig. 6.16 Plant Fixing Nitrogen

by fixing the atmospheric nitrogen as nitrates which are essential for the growth of plants. Some free living bacteria in soil, cyanobacteria *Nostoc* can also fix nitrogen biologically.

3. Biocontrol Agents:

Microbes are used to protect the crops from pests. For example,

- *Bacillus thuringiensis* (Bt cotton) helps to control insects.
- *Trichoderma* (Fungi) helps to protect roots and control plant pathogens.
- *Baculoviruses* (Virus) attack insects and other arthropods.

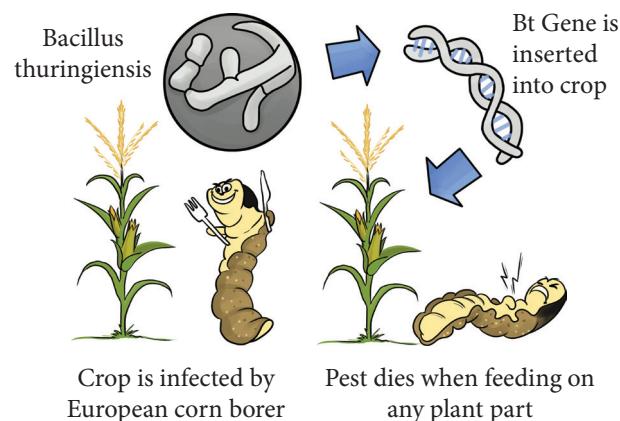


Fig. 6.17 The activity of Biocontrol agents on the insects



6.6.3 INDUSTRY

1. Sewage Treatment

Aerobic microbes are allowed to grow in the primary effluent during the secondary stage of waste water treatment. These microbes consume the major part of the organic matter in the effluent eg. Nitrobacter sps. In the anaerobic treatment of sewage Methanobacterium is used.

2. Production of Biogas

Human and animal faecal matter and plant wastes are broken down by anaerobic bacteria to produce methane (biogas) along with carbon dioxide and hydrogen. These bacteria are called as methanogens.

3. Production of Alcohol and Wine

Alcoholic drinks are prepared by fermentation process using yeast. Sugars in grapes are fermented by using yeast. Beer is produced by the fermentation of sugars in rice and barley.

4. Microbes in Retting and Tanning Process

A. Retting

Flax plants are tied in bundles and kept in water. Bacteria loosen the supporting fibres of the stem by acting on the stem tissues. This process is known as retting. Linen thread is made from these fibres eg. *Pseudomonas aeruginosa*.

B. Tanning

In Tanning industry bacteria act upon the skin of animals and makes it soft and therefore it becomes pliable.

6.6.4 In Daily Life

1. Making of Bread

Yeast is used in bakeries to make bread and cakes. They are added to the dough to produce carbon dioxide which makes the dough rise. Bread and cakes are soft due to carbon dioxide gas. *Chlorella* (green algae) is rich in proteins and vitamins is added to the dough which enrich the bread with nutrients.

2. Preparation of Curd and Cottage Cheese



Lactose in the milk gets turned into Lactic acid by the action of *Lactobacillus* (bacteria). Therefore the milk becomes thick (curd). It gives the sour taste. When curd is processed cottage cheese (paneer) is obtained.

3. In Human Intestine

- *Lactobacillus acidophilus* that lives in the human intestine helps in digestion of food and fight against harmful disease causing organisms.
- *E.coli* bacteria in human intestine help in synthesizing vitamin K and vitamin B complex.

More to Know

Lactobacillus acidophilus are acid-loving bacteria. These are found in buttermilk, yogurt, sour cream, and frozen desserts. They convert sugar and carbohydrates into lactic acid, and hence are called "lactic acid bacteria."

6.7 HARMFUL MICROORGANISMS

A few microorganisms are harmful to humans, animals and plants. They cause diseases and hence they are called as pathogens. Pathogens enter into the body through cuts and wounds in the skin, mouth or nose and cause diseases. Viruses causing 'flu' are spread through air. When the patient sneezes droplets containing viruses spread in air and it gets entered to another person when he breathes. Let us study about some of the diseases caused by the microorganisms in humans, animals and plants.



6.7.1 Diseases Caused By Microorganisms In Humans

Sl. No.	Human Diseases	Causative microorganisms	Mode of transmission	Symptoms	Preventive measures/ Treatment
1.	Tuberculosis	<i>Mycobacterium tuberculosis</i> (Bacteria)	Through air and sputum of infected person	Persistent cough, blood mucus, loss of weight, breathlessness	BCG Vaccine
2.	Cholera	<i>Vibrio cholera</i> (Bacteria)	By flies and by contaminated food and water	Watery diarrhoea, vomiting, rapid dehydration.	Anticholera vaccine, maintaining personal hygiene.
3.	Common cold	<i>Influenza</i> (virus)	Through air	Running nose, sneezing	Isolation of patient
4.	Rabies	<i>Rhabdo viridae</i> (virus)	Animal bite	Fever, hallucination, paralysis inability to swallow	Anti-rabies vaccine.
5.	Amoebic dysentery	<i>Entamoeba histolytica</i> (Protozoa)	Food water and flies	Severe diarrhea and blood in stool	Proper sanitation to be followed and metronidazole antibiotic to be administered
6.	Malaria	<i>Plasmodium</i> (Protozoa)	Female Anopheles mosquito	Nausea, vomiting High fever	Antimalarial drugs like quinine, chloroquine to be taken and also usage of mosquito repellents and nets.

6.7.2 Diseases Caused By Microorganisms In Animals

Animal Diseases	Causative microorganisms	Mode of transmission	Symptoms	Preventive measures/Treatment
Anthrax (cattle) also affects humans	<i>Bacillus anthracis</i> (Bacteria)	Through contaminated soil and food	Difficulty in breathing, unconsciousness, loss of appetite	Anthrax Vaccine
Foot and mouth disease	<i>Aphthovirus</i> (virus)	Through air and animal vectors	Fever, blisters in mouth, weight loss, decreased milk production	FMD vaccine

6.7.3 Diseases Caused By Microorganisms In Plants

Plant Diseases	Causative micro organisms	Mode of transmission	Symptoms	Preventive measures/ Treatment	
Citrus canker	<i>Xanthomonas axonopodis</i> (Bacteria)	Air, water	Lesions on leaves, stems and fruit	Copper based bactericides can be used	
Potato blight disease	<i>Phytophthora infestans</i> (Fungi)	Air	Brown lesions on the surface of tubers	Fungicides are used	



MORE TO KNOW

African sleeping sickness, which is spread by the bite of the tsetse fly, is caused by the flagellate protozoan *Trypanosoma*.



6.8 MICROBES IN FOOD PROCESS

For food processing, commonly used microorganisms are yeast, bacteria, and moulds. Fermentation process which is carried out by microorganisms results in the production of organic acids, alcohol and esters. They help to preserve food and generate distinctive new food products.

1. Food Preservation:

Two techniques are followed in food preservation. They are;

- Traditional techniques
- Modern techniques

A) Traditional techniques:

***Fermentation:** Fermentation is the microbial conversion of starch and sugars into alcohol. It makes foods more nutritious and palatable.

* **Pickling:** Pickling is a method of preserving food in an edible antimicrobial liquid. It is of two types:

a) **Chemical pickling:** Food is placed in an edible liquid that kills bacteria and other microorganisms. Eg. Vinegar, alcohol, vegetable oil. (pickling agents)

B) **Fermentation pickling:** Bacteria in the liquid produce organic acid as preservation

agent that produces lactic acid due to the presence of *Lactobacillus*.

***Boiling:** Boiling liquid food items kill all the microbes. Eg. Milk and Water.

***Sugaring:** Sugar is used to preserve fruits in an antimicrobial syrup with fruit such as apples, pears, peaches, plums or in a crystallized form, therefore the product is stored in dry condition.

B) Modern techniques:

***Pasteurization:** It is a process for preservation of liquid food. This method was invented by Louis Pasteur in 1862. Milk is heated up to 70°C to kill the bacteria and it is cooled to 10°C to prevent the growth of remaining bacteria. Then milk is stored in sterilized bottles in cold places.

2. Food Production:

***Probiotics:** Probiotics are live food supplements used in yoghurt and other fermented milk products. Eg. *Lactobacillus acidophilus* and *Bifidobacterium bifidum*. These bacteria improve the microbial spectrum in the gut and thus contribute to the following effects:

- Decrease the risk of colon cancer
- Decrease cholesterol absorption

More to Know

Scientists discovered a particular strain of probiotic *Bifidobacterium bifidum* can help to repair stomach ulcers caused by *Helicobacter pylori*. Another probiotic in this genus, *Bifidobacterium breve*, is useful in the treatment of childhood constipation.





- Prevent diarrhoeal diseases by increasing the immunity power.

6.9 RELATIONSHIP BETWEEN MAN AND MICROBES- BALANCES, IMBALANCES AND USES

Thousands of bacteria, fungi and other microbes that live in our gut are essential contributors to a good health. They break down toxins, manufacture some vitamins and essential amino acids and form a barrier against invaders. Gut microbes are the bacteria in human gut. It is one of the most important allies in our overall health and well being. Gut ensures that the body is absorbing all the important nutrients, to function at its highest level. Many different aspects of health are attached to it.

6.10 PRIONS

The word prion is derived from "proteinaceous infectious particle". Prions have neither DNA or RNA to transmit infection. A prion is a mutated form of a usually harmless protein. Prions cause diseases by affecting brain or neural tissue. Eg. Creutzfeldt-Jakob disease. Another example is Kuru- associated with cannibalism.

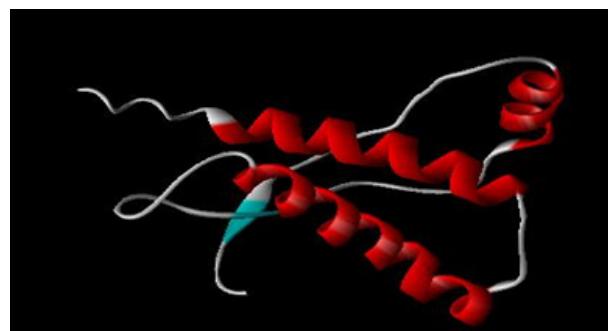


Fig. 6.18 Structure of Prion

6.11 VIRIONS

Virion is an entire virus particle consisting of an outer protein shell called a capsid and an inner core of nucleic acid (RNA or DNA). If the virus is found outside the cell (extracellular) it is known as virion. Virion has the capacity to infect the living tissue.

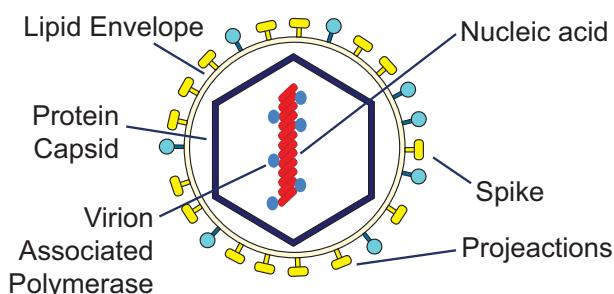


Fig. 6.19 Structure of a Virion

Points to remember

- Micro organism: The organism which can seen only with the help of microscope.
- Virus: Virus show both living and non living characteristics.
- Bacteria: A prokaryotic, single celled organism.
- Fungi: A eukaryotic, non-photosynthetic, spore-forming organism. They range from single celled organisms to very complex multicellular organisms.
- Algae: A single-celled or multicellular eukaryotic, photosynthetic organism.
- Protozoa: A eukaryotic, single celled organism that usually lacks chlorophyll.



TEXT BOOK EXERCISES



I. Multiple choice questions.

1. Micro organisms are measured in _____.
a) cm b) mm c) micron d) meter.
2. _____ shows both living and nonliving characteristics.
a) Protozoa b) virus c) bacteria d) Fungi
3. _____ is a prokaryotic micro organisms.
a) Virus b) algae c) fungi d) bacteria
4. Based on shape, the bacteria are classified into _____ types.
a) 2 b) 3 c) 4 d) 5
5. The plant body of algae is called as _____.
a) stem b) thallus c) leaf d) root

II. Fill in the blanks.

1. _____ is prepared from a mould called Penicillium.
2. _____ are the infectious protein particles.
3. The infact virus particle found outside the host cell is _____.
4. Micro organism can be seen with the help of a _____.
5. Bacteria, which have a flagellum at one end is classified as _____.

III. Match the following:

- | | | |
|-----------------------------|---|---------|
| 1. Nitrogen fixing bacteria | - | Vaccine |
| 2. Tuberculosis | - | Prion |

- | | | |
|------------------|---|---------------------------|
| 3. Kuru | - | Lactobacillus acidophilus |
| 4. Probiotics | - | Bacteria |
| 5. Edward Jenner | - | Rhizobium |

IV. True or False.

1. Diseases causing micro organisms are called pathogens.
2. Female anopheles mosquito is a carrier of dengue virus.
3. Chicken pox is a communicable disease.
4. Citrus canker is transmitted by insects.
5. Yeast is used in the large scale production of alcohol.

V. Assertion & Reason.

1. Direction: In each of the following questions, a statement of Assertion is given and a corresponding statement of Reason is given just below it. Of the four statements, given below, mark one as the correct answer.
- (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) If both Assertion and Reason are true and Reason is not the correct explanation of Assertion.
- (c) If Assertion is true but Reason is false.
- (d) If both Assertion and Reason are false.
1. Assertion: Malaria is caused by Protozoa.
Reason: The disease is transmitted by mosquito.
 2. Assertion: Algae are heterotrophic.
Reason: They don't have chlorophyll.



VI. Very short answer type:

1. Write the name of any nitrogen fixing bacteria.
2. Name the bacteria used in the production of vinegar.
3. Write the names of any three protozoans.
4. Who discovered penicillin?
5. Which diseases can be prevented by vaccination?

VII. Short answer type

1. Write the four types of bacteria, based on their shape.
2. What are antibiotics?
3. What are pathogens?
4. How diseases causing micro organisms enter into human beings?
5. Why micro organisms are essential for agriculture?

VIII. Long answer type.

1. Write a short note on bacteria and its structure.
2. How micro organisms are useful in the field of medicine?
3. Write a short note on common human diseases caused by micro organisms.
4. How can we improve the beneficial bacterial count in human beings?
5. Write a short note on Probiotics.



REFERENCE BOOKS

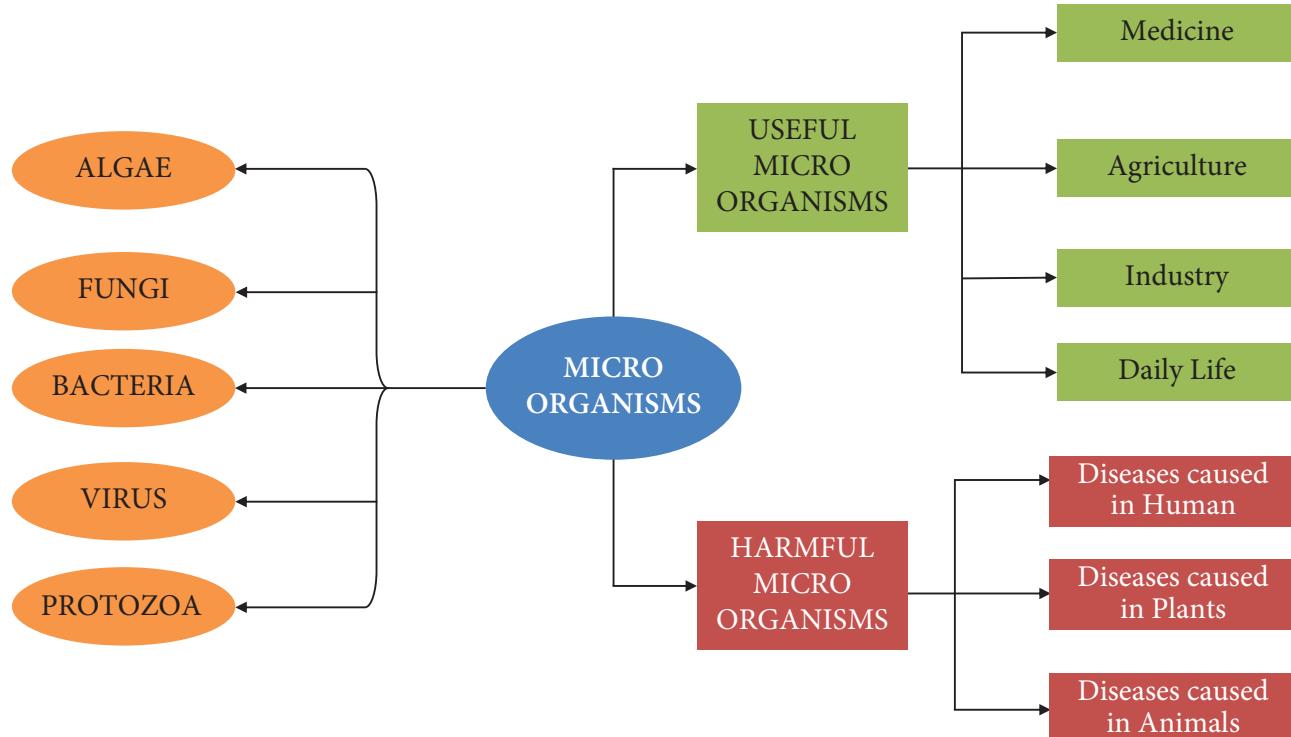
1. Ananthnarayan and Panicker's Textbook of Medical Microbiology Edited by C.K.J.Panicker.
2. Essential Microbiology by Stuart Hogg.
3. Textbook of Microbiology by Surinder Kumar.

A-Z GLOSSARY

Antibiotic	A chemical that kills or inhibits the growth of micro organism and is used to treat infections.
Bacteria	A prokaryotic, single celled organism.
Capsid	The protein coat surrounding a virus.
Fermentation	The conversion of organic compounds such as carbohydrate into simpler substances by microbes, usually under anaerobic conditions (with no oxygen present).
Hyphae	A very fine thread that is the basic structure of fungi.
Micro-organism (microbe)	A small living thing. The group includes bacteria, protozoa, algae, fungi and viruses.
Pathogen	An organism that causes disease.
Vaccine	A special type of medicine that is given to both people and animals to artificially increase immunity to a particular disease and to prevent an infectious disease from developing.



Mind Map





ICT CORNER

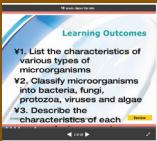
This activity enables the students to know about the Classification of Micro organisms

MICRO ORGANISMS



Steps

- Open the Browser and type the given URL (or) Scan the QR Code.
- Options will be given. Select the “Classification of Microorganisms”
- Click and touch the button slides one by one
- To know about the “Classification of Microorganisms”



Step1



Step2



Step3



Step4

Web link: <https://www.slideshare.net/mgcnkedahsc/11-classification-of-microorganisms>

(or) scan the QR Code

*Pictures are indicative only





UNIT

7

PLANT KINGDOM



Learning Objectives

At the end of this lesson, students will be able to:

- ◆ understand that plants are named with two words (Binomial name).
- ◆ study the Bentham and Hooker's classification of seeded plants.
- ◆ differentiate the types of algae based on the pigmentation.
- ◆ know the salient features of fungi, mode of nutrition, classification and their uses.
- ◆ differentiate Bryophytes from Pteridophytes.
- ◆ differentiate Monocot from Dicot plants.
- ◆ know the importance of medicinal plants and their uses.
- ◆ understand the classes of Angiosperms and their characters.



Introduction

The living organisms found on the earth are different in their structures, habit, habitat, mode of nutrition and physiology. The estimated number of species on the earth is 8.7 million. Among them 6.5 million (1 million = 10 lacks) species are living on land, 2.2 million species in the ocean. In these 4,00,000 species are flowering plants. The living organisms show lot of similarities and differences so that they can be arranged into many groups systematically. The plant kingdom includes thallophytes, bryophytes, pteridophytes, gymnosperms and angiosperms.

7.1 Taxonomy

Taxonomy is the branch of biology that deals with the study of identification, classification, description and nomenclature of living organisms. The word **taxonomy** is derived from two Greek words (**Taxis**: arrangement and

Nomos: laws.) The word 'Taxonomy' was first coined by **Augustin-Pyramus de Candolle**.

Classification:

Plants are arranged into different groups and categories on the basis of similarities and differences are called classification.

Types of classification:

There are four types of classification.

1. Artificial system of classification
2. Natural system of classification
3. Phylogenetic system of classification
4. Modern system of classification

7.1.1 Artificial system of classification

This is the earliest system of classification in plants. Plants are classified on the basis of one or few morphological characters. The most famous artificial system of classification is Linnaeus classification which was proposed by **Carolus Linnaeus** in **Species plantarum**.



7.1.2 Natural system of classification

In this system, plants are classified on the basis of several characters. Bentham and Hooker's classification is an example of Natural System of Classification. This system of classification is based on morphological and reproductive characters of the seeded plants.

This classification is widely used in many Herbaria (herbarium is defined as the collection of pressed, dried plants pasted on a sheet and arranged according to any one of the accepted systems of classification) and botanical gardens all over the world.

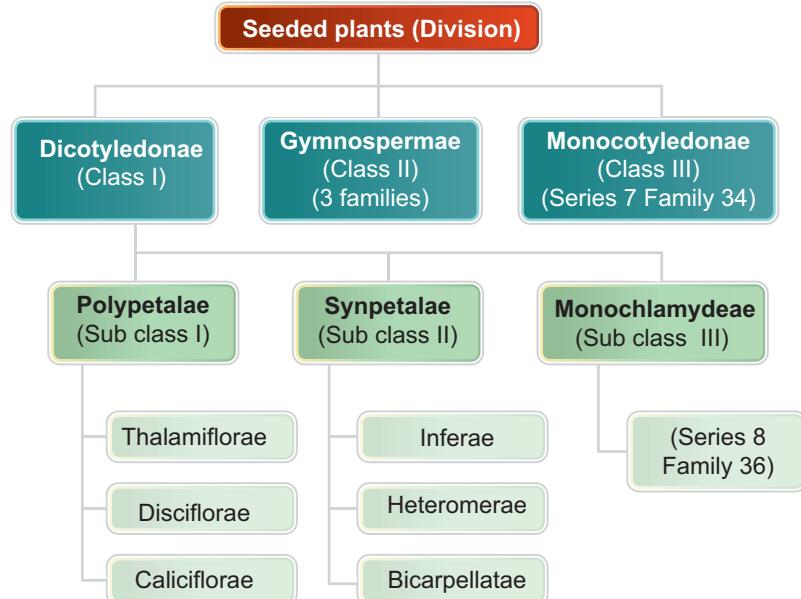
Bentham and **Hooker** published their Natural system of Classification in their book named **Genera Plantarum** in 3 volumes.

7.2 OUTLINE OF BENTHAM AND HOOKER'S SYSTEM OF CLASSIFICATION

The division spermatophyta are divided into 3 classes:

- Dicotyledonae
- Gymnospermae
- Monocotyledonae

Outline of Bentham and Hooker's system of Classification



Class I - Dicotyledonae

- Seed has two cotyledons.
- Leaves have reticulate venation
- Tap root system is present.
- Flowers are tetramerous or pentamerous.

Class II - Gymnospermae (Naked seed plants)

- Plants of this class have no fruit.
- It has three families, they are
 1. Cycadaceae
 2. Coniferae
 3. Gnetaceae

Class III - Monocotyledonae

- Seed has single cotyledon.
- Leaves have parallel venation.
- Fibrous root system is present
- Flowers are Trimerous

7.3 Binomial Nomenclature

The naming of an organisms with two words are known as Binomial Nomenclature. For example, the binomial name of mango is *Mangifera indica*. Here the first word *Mangifera* refers to the genus name and the second word *indica* to the species name.



Binomial system had been properly made used by **Linnaeus** in his book, “**Species Plantarum**.”

The system of naming the plants on scientific basis is known as **Botanical nomenclature**. Binomial name was first introduced by **Gaspar Bauhin** in the year of 1623.



Largest Herbarium of India is in Kolkata, which has more than 10,00,000 (one million) species of herbarium specimens.

7.4 Salient features of Algae

- Algae are chlorophyll bearing simple, primitive plants and are autotrophs.
- Algae belongs to thallophyta, and the plant body of algae are called thallus. i.e. the plant body is not differentiated into root, stem and leaf.
- Most of the algae are living in aquatic region. It may be fresh water or marine water. Very few algae can survive in terrestrial conditions.
- Some algae are very minute and float on the surface of the water. These algae are called Phytoplankton.

- Some of the algae are symbionts (algae living with fungi and they both are mutually benefitted.) e.g. Lichen.
- A few species of them are epiphytes (growing on another plants).

Various forms of Algae:

- Plant body of the algae are unicellular or multicellular
- Unicellular motile (*Chlamydomonas*), non-motile. (*Chlorella*)
- Multicellular unbranched filaments (*Spirogyra*) and branched filaments (*Cladophora*).
- Some algae are giant kelp – *Macrocystis*.
- Some algae are living as colonial form – *Volvox*.
- Alga like *Chara* resembles largest plant body and it possess well developed sex organs.

Reproduction of Algae:

- Three types of reproduction are seen in algae.
- Vegetative reproduction by fragmentation e.g. *Spirogyra*.
- Asexual reproduction by spore formation e.g. *Chlamydomonas*.
- Sexual reproduction by means of fusion of gametes e.g. *Spirogyra*, *Chara*

Info bits

The rules and recommendations regarding binomial nomenclature were found in ICBN (International Code of Botanical Nomenclature) now it is known as ICN (International Code of Nomenclature).

Activity 1

Collect some plants which are growing inside the school area, write their vernacular name, binomial name and classify them into dicotyledons or monocotyledons in the given table 7.1.

Table 7.1

S. No.	Vernacular name of the plant	Binomial name of the plant	Monocotyledons/Dicotyledons
1			
2			
3			
4			
5			



7.4.1 Classification of algae based on pigments (Fritsch – 1935)

Table 7.2

S. No.	Class	Types of Pigments	Reserve food material	Example
1	Bluegreen algae (Cyanophyceae)	Phycocyanin	Cyanophycean Starch	Oscillatoria
2	Green algae (Chlorophyceae)	Chlorophyll	Starch	Chlamydomonas
3	Brown algae (Phaeophyceae)	Fucoxanthin	Laminarian starch and Manitol	Laminaria
4	Red algae (Rhodophyceae)	Phycoerythrin	Floridian Starch	Polysiphonia



The largest herbaria of the world is Museum National d'Historie Naturelle in Paris, France

7.4.2 Economic Importance of algae:

1. Food:

Algae are consumed as food by the people in Japan, England and also in India. e.g. *Ulva*, *Spirulina*, *Chlorella* etc..

Some algae are used as a food for domestic animals. e.g. *Laminaria*, *Ascophyllum*.



UTRZWX

2. Agriculture

Some of the blue green algae are essential for the fixing of atmospheric nitrogen into the soil, which increases the fertility of the soil. e.g. *Nostoc*, *Anabaena*.

3. Agar Agar

Agar Agar is extracted from some red algae, namely *Gelidium*, *Gracilaria*, etc., which is used to prepare growth medium in laboratories.

4. Iodine

Iodine is obtained from brown algae like *Laminaria* (kelp).

5. Algae in space Travel

Chlorella pyrenoidosa is used in space travel to get rid of CO₂ and decompose human wastes.



Table 7.3

S. No.	Name of the organisms	Plants	Animals
1			
2			
3			
4			
5			

6. SCP (Single Cell protein)

Some of the single cell algae and blue green algae are used to produce protein. e.g. *Chlorella*, *Spirulina*.

Activity 2

Collect some pond or lake water and place a drop of water on a slide. With the help of your teacher, observe the slide and write down what you have seen in the microscope. Then write the name of the organism and classify them as plant or animal by using a tick mark in the given Table 7.3.

called **chitin**. The reserve food materials of fungi are glycogen and oil. They have no starch because they have no chlorophyll pigments. So, they are heterotrophs. Heterotrophs are of three types called **parasites**, **saprophytes** and **symbionts**.

Parasites

Parasites absorbs food from the living organisms with the help of special root called haustoria. e.g. *Cercospora personata*. It affects groundnut plants and cause Tikka disease.



Figure 7.1 Tikka disease in groundnut leaves

Saprophytes:

Saprophytes grow up on the dead and decay matters and get food from them. e.g. *Rhizopus*.



7.5 Fungi

7.5.1 General characters of fungi

Fungi (singular – fungus) belongs to thallophyta because the plant body is not differentiated into root, stem, and leaves.

The plant body of fungus consists of filament like structures called as **hyphae**. Several hyphae arranged in the form of network called **mycelium**. There are two types of mycelium found in fungi, namely septate mycelium and aseptate mycelium. If the cross wall is seen between the cell, it is called **septate mycelium**. If the cross wall is not seen, it is called **aseptate mycelium**. When aseptate mycelium contains many nuclei it is called as **coenocytic mycelium**.

The cells of fungi are multicellular and **eukaryotic** organisation. Some species of fungi like yeast is unicellular and eukaryotic cell. Cell wall of fungi is made up of a chemical substance

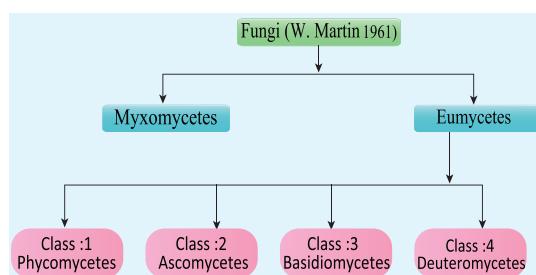


Symbionts:

Some species of fungi living with algae and are mutually benefitted. e.g. *Lichen*.

Some fungi live symbiotically with higher plants roots called *Mycorrhizae*

7.5.2 Classification of fungi (W.Martin 1961)



7.5.3 Economic Importance of Fungi:

1. Antibiotic:

Penicillin (*Penicillium notatum*), Neomycin, Gentamycin, Erythromycin are some antibiotics obtained from fungi, which cure variable diseases.



Figure.7.3 *Penicillium notatum*

2. Food:

Mushroom contains rich protein and minerals. The most common edible mushroom is *Agaricus*. (Button mushroom).



Figure.7.4 *Agaricus*

3. Vitamins:

Fungus like *Ashbya gossypii* and *Erymophyllum ashbyii* are used to produce vitamin B₂ (riboflavin).



Figure.7.5 Yeast

4. Alcohol:

Fungus like yeast contain enzymes invertase and zymase, which ferment the sugar molasses into alcohol.

Info bits

Fungi placed as third kingdom in RH Wittekars five kingdom of classification because absence of chlorophyll and starch.

7.5.4 Harmful Effects of Fungi



Table 7.3 Diseases caused by Fungi in Plants

S. No.	Pathogen	Name of the Disease
1	<i>Fusarium oxysporum</i>	Wilt disease of cotton
2	<i>Cercospora personata</i>	Tikka disease of ground nut
3	<i>Colletotrichum falcatum</i>	Red rot of sugar cane
4	<i>Pyricularia oryzae</i>	Blast disease of paddy
5	<i>Albugo candida</i>	White rust of radish

More to Know

Claviceps purpurea is the hallucinogenic fungi causes greatest damages to the frustrated youth by giving unreal, extraordinary lightness and hovering sensations

Aspergillus species cause allergy to children while *Cladosporium* protects against allergy.



Fig.7.6 Wilt disease of Cotton



Fig.7.7 Red rot of Sugar cane



Fig 7.8 Blast disease of Paddy



Fig.7.9 White rust of Radish

Table 7.6 Differences between algae and fungi

S. No.	ALGAE	FUNGI
1	Algae are autotrophs.	Fungi are heterotrophs.
2	It has pigments.	It has no pigments
3	Reserve food material is starch.	Reserve food materials are glycogen and oil.
4	Some algae are prokaryotic in nature eg: <i>Cyanobacteria</i> (<i>Nostoc, Anabena</i>)	All are eukaryotic nature. eg: <i>Agaricus</i>

Table 7.5 Diseases caused by Fungi in Human

S. No.	Name of the Fungi	Name of the Disease
1	<i>Trichophyton sp.</i>	Ring worm (Circular rash on the skin) 
2	<i>Microsporum furfur</i>	Dandruff 
3	<i>Tinea pedis</i>	Athletes foot 

7.6 Bryophytes

7.6.1 General Characters of Bryophytes

- Bryophytes are the primitive and simplest group of land plants.
- These are terrestrial and non-vascular cryptogams (they have no vascular tissues like xylem, phloem).



Queen of medicine is Penicillin, discovered by Sir Alexander Fleming in 1928.

Activity 3

Collect some fungi from dead and decay matters of coconut, pickle, fruits and bread. Spread the fungi on the slide and observe them through microscope. Classify the fungi and note it down.

Take a piece of bread and pour some water on it and cover it for 4 days. After 4 days place the bread on a slide and observe it through microscope. What will you see? Name the organisms which you have seen in the slide.

- Water is essential to complete their life cycle, so these plants are called **amphibians** of the Plant Kingdom.
- Bryophytes have distinct alternation of generation. gametophytic is dominant and sporophytic generation is small and depends on the gametophytic generation.
- The gametophytic plant can be either thalloid (liverworts) or leafy (mosses).
- The plant remains fixed to the substratum with the help of root like structure called rhizoid.



- Sexual reproduction is oogamous type
- They have well developed sex organs like antheridia and archegonia.
- The male sex organ is antheridium, which produces antherozoid. The female sex organ is archegonium which contains an egg.
- Antherozoid swims and reaches the archegonium, fertilizes the egg and form zygote ($2n$).
- Zygote is the first cell which develops into sporophytic generation and produce haploid spore (n) by meiosis.
- Spore is the first cell of the gametophytic generation.

- Protonemal stage is present.
- Sporophytes is differentiated into foot, seta, and capsule

7.6.3 Economic Importance of Bryophytes:

1. Bryophytes prevent the soil erosion.
2. *Sphagnum* can absorb large amount of water. Hence, it is used by the gardeners in nursery.
3. Peat is a valuable fuel like coal obtained from *Sphagnum*.

Activity 4

Visit a nearby nursery and observe how *Sphagnum* is used in horticulture make a note on it.

7.6.2 Classification of Bryophytes

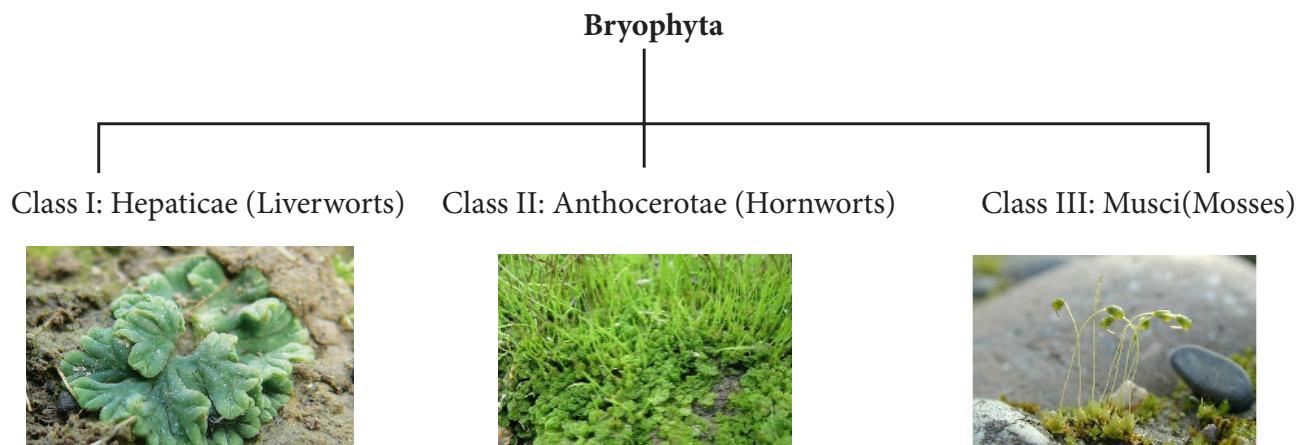


Fig.7.10 Riccia

Fig.7.11 Anthoceros

Fig 7.12 Funaria

Class I Hepaticae (e.g. *Riccia*)

- These are lower forms of bryophytes. They are simple in structure than moss.
- Protonemal stage is absent. Sporophyte is very simple and short lived.

Class-II Anthocerotae (e.g. *Anthoceros*)

- Gametophyte is undifferentiated thallus, rhizoids are unicellular and unbranched.
- Protonemal stage is absent. Sporophyte is differentiated into foot and capsule only.

Class-III Musci (e.g. *Funaria*)

- These are higher forms in which the gametophytes is differentiated into stem like, leaf like parts.

More to Know

Sphagnum moss was once used in disposable diapers, because it soaks liquid well.

7.7 Pteridophytes

7.7.1 General Characters of Pteridophyte:

- ◆ Pteridophytes are the first true land plants with xylem and phloem. Hence it is called vascular cryptogams.
- ◆ Pteridophytes also exhibit alternation of generation. The diploid sporophytic phase



7.7.2 Classification of Pteridophytes:

Table 7.7

Psilopsida (class I)	Lycopsida (class II)	Sphenopsida(class III)	Pteropsida (class IV)
e.g. <i>Psilotum</i>	e.g. <i>Lycopodium</i>	e.g. <i>Equisetum</i>	e.g. <i>Nephrolepis</i>

alternates with the haploid gametophytic phase.

- ◆ The main plant body is sporophytes, which is the dominant phase, differentiated into true root, stem and leaves.
- ◆ Sporophytes reproduce by means of spores. Spores are produced in sporangium.
- ◆ The sporangia bearing leaves are called sporophyll.
- ◆ Most of the plants produce only one type of spore, it may be either microspore or megaspore (homosporous).
- ◆ In some plants two types of spores are produced. They are microspore and megaspore(heterosporous).
- ◆ Spores give rise to gametophytic generation called prothallus, which is short lived and independent.
- ◆ The gametophytes produce the multicellular sex organs, Antheridium which produces antherozoid (male gamete) and archegonium which contains an egg. (female gamete)
- ◆ The antherozoid fertilizes with egg and form diploid zygote. It develops into an embryo which grow differentiate into sporophyte.

- The sporocarp of *Marsilea* (water fern) is used as food by tribal people.

More to Know

1. *Lycopodium*, is known as club moss.
2. *Equisetum* is known as horse tail.

7.8 Differences between Bryophytes and Pteridophytes

Table 7.8

S. No.	Bryophytes	Pteridophytes
1	Plant body cannot be differentiated into root, stem and leaf.	Plant body can be differentiated into root, stem and leaf.
2	Bryophytes are amphibians.	Pteridophytes are land plants.
3	Vascular tissues are absent.	Vascular tissues are present.
4	The dominant phase of the plant body is gametophyte.	The dominant phase of the plant body is sporophyte.
5	Sporophytic generation depends on the gametophytic generation. e.g. <i>Riccia</i>	Gametophytic generation does not depend on sporophytic generation. e.g. <i>Selaginella</i>

7.7.3 Economic Importance of Pteridophytes:

- Ferns are used as ornamental plants.
- The rhizome and petioles of the *Dryopteris* yield the vermifuge drug.



7.9 Gymnosperms

7.9.1 General Characters of Gymnosperms

- Gymnosperm are naked seed plant, i.e. the ovule is not enclosed by ovary.
- Gymnosperms have two phases in its life cycle. (Sporophytic and Gametophytic)
- Plant body is sporophyte dominant which is differentiated into root, stem and leaf.
- They have well developed vascular tissues. (xylem and phloem)
- The water conducting tissue is tracheid. Food conducting tissue is sieve cell.
- They have cone on which sporangia and spores are produced.

7.9.2 Economic Importance of Gymnosperms

- Woods of many conifers are used in the paper industries. e.g. *Pinus*, *Agathis*
- Conifers are the sources of soft wood for construction, packing and plywood industry e.g. *Cedrus*, *Agathis*

7.9.3 Classification of Gymnosperms

Cycadales eg: <i>Cycas</i> spp	Ginkgoales eg: <i>Ginkgo biloba</i>	Coniferales eg: <i>Pinus</i> spp	Gnetales eg: <i>Gnetum</i> spp
Palm like small plants (erect and unbranched)	<i>Ginkgo biloba</i> is the only living species in the group.	Evergreen trees with cone like appearance.	Small group of plants.
Leaves are pinnately compound forming a crown.	It is a large tree with fan shaped leaves.	Needle like leaves or scale leaves.	It possesses advanced characters like Angiosperm
Tap root system and Coralloid root. 	They produce unpleasant smell. 	Seeds are winged and produced in female cone. 	Ovules are naked but, developed on flower like shoot.

- Turpentine is an essential oil used for paint preparation extracted from the resin of *Pinus*. It is also used medicinally to get relief from pain and bronchitis etc.,
- Seeds of *Pinus gerardiana* are edible.
- Ephedrine is an alkaloid extracted from *Ephedra*. It cures asthma and respiratory problems.
- Araucaria bidwillii* is an ornamental plant.

7.10 Angiosperms (Closed seeded plants)

7.10.1 General Characters of Angiosperms

- The term 'Angiosperm' is derived from two Greek words, i.e. 'Angio' which means box or closed and 'sperma' which means seed.
- Angiosperms are called flowering plants. In this group more than 4,00,000 living species are found.
- They occupy every habitat on earth except extreme environment. (extreme hot and cold conditions).



- Habit of the plants may be herb, (*Solanum melongena*) shrub, (*Hibiscus rosasinensis*) and tree – *Mangifera indica* (Mango)
- They have well developed conducting tissues. (Vascular bundles)
- Xylem contains vessel, tracheid, xylem parenchyma and xylem fibre.
- Phloem contains sieve tubes, phloem parenchyma, companion cells and phloem fibres.

7.10.2 Classification of Angiosperms

Angiosperms are divided into two classes, They are:

- Monocotyledons
- Dicotyledons

7.10.3 Characteristic features of monocotyledons

- Seed has only one cotyledon.
- Plants have fibrous root system, leaves with parallel venation.
- Flowers are trimerous and not differentiated in to calyx and corolla.
- Pollination occurs mostly by wind.
- E.g. Grass, Paddy, Banana.

7.10.4 Characteristic features of Dicotyledons

- Seed has two cotyledons.
- Plants have tap root system, leaves with reticulate venation.

Activity 5

Collect some flowering plants from your surroundings and classify them as monocot (or) dicot based on their root system and venation in the given Table 7.11.

- Flowers are tetramerous or pentamerous. Calyx and corolla are well differentiated.
- Pollination occurs mostly by insects.
- E.g. Bean, Mango, Neem

7.11 Uses of Medicinal plants

7.11.1 *Acalypha indica* (Kuppaimeni)



Fig 7.13 *Acalypha indica*

- It belongs to the family Euphorbiaceae.
- The paste obtained from the leaves of this plant is used to cure the burns on the skin.
- The juice of this plant leaves is mixed with lemon juice to cure ringworm



Table 7.11

S. No.	Plants Name	Root system	Venation	Dicot/ Monocot
1	Hibiscus	Tap root	Reticulate venation	Dicot
2				
3				
4				
5				



7.11.2 *Aegle marmelos* (Vilvam)



Fig.7.14 *Aegle marmelos*

- It belongs to the family Rutaceae.
- The unripe fruit of this tree is used to treat indigestion.
- It is used to cure chronic, diarrhoea and dysentery.

7.11.3 *Solanum trilobatum* (Thoodhuvalai)



Fig.7.15 *Solanum trilobatum*

- It belongs to the family Solanaceae.
- The leaves and fruits of this plant cure cough and cold.
- It is widely used in the treatment of tuberculosis and bronchial asthma.

7.11.4 *Phyllanthus amarus* (Keezhanelli)



Fig. 7.16 *Phyllanthus amarus*

- It belongs to the family Euphorbiaceae.
- The entire plant is used for the treatment of jaundice.
- It gives additional strength to human liver and used to treat other liver disorders.

7.10.5 *Aloe vera* (Sothu Katrazhai)



Fig.7.17 *Aloe vera*

- It belongs to the family Liliaceae.
- Leaves of this plant is used to cure piles and inflammations on the skin.
- It cures peptic ulcer.

Points to remember

- Scientific method of naming the plants with two words are known as Binomial Nomenclature.
- Algae are chlorophyll bearing, simple primitive plants and are autotrophs.
- Algae like *Chara* has well developed sex organs.
- Parasites have special roots called haustoria.
- Bryophytes are the primitive and simplest group of land plants.
- Pteridophytes are the first true land plants.
- Gymnosperms are the naked seeded plants.
- Angiosperms are the closed seeded plants (ovules are enclosed by the ovary)
- Angiosperms are divided in to two classes, namely monocotyledons and dicotyledons.
- The paste obtained from the leaves of *Acalypha indica* cure the burns on the skin.
- The leaves, flowers and fruits of *Solanum trilobatum* cure the cough and cold.



A-Z GLOSSARY

Polypetalae:	free petal.
Gamopetalae:	united petal
Monochlamydeae:	flower with single whorl ,which can not be differentiated in to calyx and corolla.
Vascular tissues:	conducting tissues namely xylem and phloem.
Epiphytes:	Plants growing up on the other plants.
Autotrophs:	organisms which prepare their own food.
Heterotrophs:	organisms which depends the other organisms for their nutrition
Isogametes:	gametes are similar.
Haustoria:	special roots present in parasites.
Mycorrhiza:	symbiotic association of fungi with higher plant roots



TEXT BOOK EXERCISES

I Fill in the blanks:

1. The word ‘Taxonomy’ is derived from _____
2. Binomial Nomenclature was first introduced by _____
3. The book “**Genera Plantarum**” was written by _____
4. Monocotyledon seeds bear only _____ cotyledon.
5. Brown algae belongs to _____ class.
6. Agar Agar is obtained from _____ algae.
7. The reserve food material of fungi are _____ and _____
8. The first true land plant is _____
9. Xylem and phloem are absent in _____ plants.
10. Reticulate venation is present in _____ plants.

II. Choose the correct answers:

1. *Solanum trilobatum* is the binomial name of Thoothuvalai. Here the word ‘**Solanum**’ refers to

- a) Species
- b) Genus
- c) Class
- d) Orders

2. _____ is an example for colonial form of algae.
 - a) *Oscillatoria*
 - b) *Nostac*
 - c) *Volvox*
 - d) *Chlorella*
3. Floridian starch is a reserve food material of _____
 - a) Chlorophyceae
 - b) Phaeophyceae
 - c) Rhodophyceae
 - d) Cyanophyceae
4. The edible mushroom is _____
 - a) *Polyporus*
 - b) *Agaricus*
 - c) *Pennicillium*
 - d) *Aspergillus*
5. Soil erosion is prevented by _____ plants.
 - a) Algae
 - b) Fungi
 - c) Bryophytes
 - d) Pteridophytes
6. The first vascular cryptogams in land plants are _____
 - a) Bryophytes
 - b) Pteridophytes
 - c) Gymnosperm
 - d) Angiosperm





7. The well-developed sporophytic plant body is seen in
 - a) Bryophytes
 - b) Pteridophytes
 - c) Gymnosperms
 - d) Angiosperms
8. Binomial Nomenclature was first introduced in the year of _____
 - a) 1970
 - b) 1975
 - c) 1978
 - d) 1623
9. Penicillin is an antibiotic, which is extracted from _____
 - a) Algae
 - b) Fungi
 - c) Bryophytes
 - d) Pteridophytes

III True or False

1. In polypetalae, the petals are free.
2. Binomial name should contains more than two words.
3. Artificial system of classification is based on the vegetative characters of the plant.
4. Cell wall of fungi is made up of chitin.
5. Pinus is a closed seeded plant.
6. All bryophytes are hydrophytes.
7. Dicotyledons have well developed characters than the monocotyledons.
8. Mosses are the well developed plant in bryophytes.
9. The dominant phase of the bryophytes is sporophytes.
10. The dominant phase of the pteridophytes is diploid($2n$).
11. Seeds of angiosperm are produced inside the ovary.
12. In gymnosperms ovules are developed from the flowers.

IV Match the following

1. Which of the following pairs are in correct?

- | | | |
|---------------------|---|----------------|
| <i>Laminaria</i> | - | Iodins |
| <i>Nostoc</i> | - | N_2 fixation |
| <i>Polysiphonia</i> | - | Green algae |
| <i>Rhodophyceae</i> | - | Fucoxanthin |
- i) a, b, c 2) c,d c) a, c, d d) a ,b ,c, d

2. Find out the correct pairs:

- | | | |
|---------------------------|---|---------------|
| <i>Phyllanthus amarus</i> | - | Euphorbiaceae |
| <i>Solomum trilobatum</i> | - | Solanaceae |
| <i>Acalypha indica</i> | - | Malvaceae |
| <i>Aegle marmelos</i> | - | Rutaceac |
- ii) a,b ii) c,d iii) a,b,c d) a,b,d

3. Which of the following characters are not suitable to angiosperm?

- a) Reticulate / parallel venation, closed seeded plants, sieve tubes are present in phloem.
 - b) Seeds are open, ovary is not present, gametes are produced in cones.
 - c) Tracheids are the conducting cells, companion cells not are present in phloem.
 - d) Trimerous or tetramerous, closed seed, seed with seed coat, bears fruit.
- 1) a,b 2) b,c 3) e,d 4) a,d

4. Which of the following sequences are correct

- a) In Bryophytes – Gametophytes - Sex organ – Gamete fusion – Zygote - Spore mother cell – spore – Thallus.
 - b) In Angiosperm – pollination – fertilization – zygote – new plant.
 - c) In Gymnosperm – male cone, and female cone – microspore and megasporangium – Zygote – new sporophytes plant.
 - d) In pteridophytes – pollination by wind, fertilization in the presence of water – zygote prothallus, new plant.
- 1) a, b, c 2) a, b 3) c, d 4) b, d

5. Match column I with column II

Column I	Column II
A. <i>Penicillium chrysogenum</i>	1) Blast disease of paddy.
B. <i>Ginko biloba</i>	2) Ornamental plants
C. <i>Araucaria bidwilli</i>	3) Athlet foot.
D. <i>Tinea pedis</i>	4) Penicillin
E. <i>Pyricularia oryzae</i>	5) Living fossil
a) A-4, B-5, C-2, D-3, E-1	c) A-3, B-2, C-4, D-5, E-1
b) A-4, B-5, C-1, D-2, E-1	d) A-4, B-2, C-1, D-5, E-3



V Answer the following questions shortly.

1. Define Thallus.
2. What is mean by Binomial Nomenclature? give example.
3. Write any two characters of dicotyledons.
4. Seeds of gymnosperm plants are naked. Why?
5. Write any two economic importance of fungi.

VI Answers the following questions in brief.

1. Write short notes about natural system of classification.
2. Write any three economic importance of algae.
3. Write the differences between algae and fungi.
4. How many classes are there in Bryophytes? What are they?
5. Write any four characters of pteridophytes.

VII Answers the following questions in detail.

1. Draw the outline of Bentham and Hookers system classification.
2. Write any five differences between monocot and dicot plants.
3. Write differences between Gymnosperm and Angiosperm.
4. Write the economic importance of Gymnosperms.
5. Write the names of medicinal plants and explain their uses.

VIII Assertion and Reason

1. **Assertion (A):** Penicillin is an antibiotic extracted from *Penicillium notatum*.

Reason (R): It can kill (or) inhibits the growth of the other micro organism.

- 1) Both A and R True, R explains A
- 2) A only correct, R doesn't explain A
- 3) A True, R explains A
4. Both A and R False.

2. **Assertion(A):** Artificial system of classification is otherwise called sexual system of classification.

Reason(R): Artificial system of classification is based on the nature of the vegetative characters.

- a) Both A and R correct
- b) Both A and R incorrect
- c) A is correct R is incorrect
- d) A is incorrect and R is correct

3. **Assertion(A):** Bryophytes are called Amphibians of the plant kingdom.

Reason(R): Bryophytes are land plants but they need water for the completion of their life cycle.

- a) A correct R correct
- b) A incorrect R correct
- c) A and R correct R explain A
- d) A and R incorrect



REFERENCE BOOKS

1. Algae by A.V.S.S Sambamurty, published by I.K International publishing house.
2. Bryophyta by Afroz Alam, published by I.K International publishing house.
3. Pteridophyta by O.P.Sharma, published by Mc Graw Hill Educations.
4. Gymnosperms by S.P.Bhatnagar, published by New Age Publishers.
5. Taxonomy of Angiosperms by B.P.Pandey, published by S.Chand
6. Plant Kingdom by Theresa Greenaway, published by Hodder Wayland.

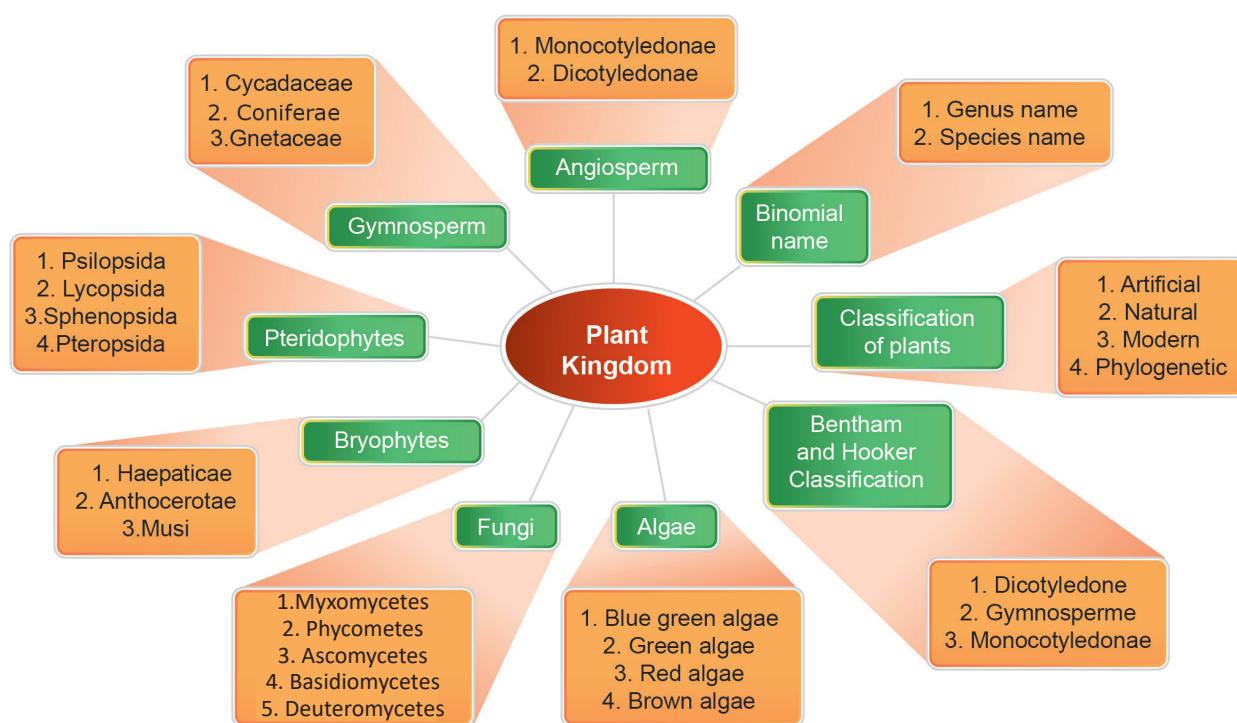


INTERNET RESOURCES

1. <https://www.topper.com/guides/biology>
2. <https://www.britannica.com/science>
3. <https://topper.com/plant-kingdom>
4. <https://merriam-webster.com/binomial>



MIND MAP



ICT CORNER

Plant Kingdom

Through this activity the students will learn about Medicinal plants and their uses

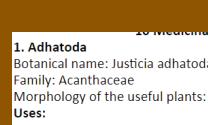


Steps

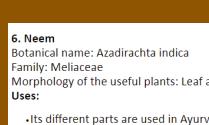
- Open the Browser and type the URL link (or) Scan the QR Code.
- Click the title “Medicinal plants and their uses”
- Select and view the images of Medicinal plants and their uses
- Through this image u can identify the uses of medicinal plants



Step1



Step2



Step3



Step4

Web link : <https://www.plantscience4u.com/2018/08/10-medicinal-plants-and-their-uses-with.html#.XHZnyogzaM8>

(or) scan the QR Code

*Pictures are indicative only





UNIT

8

ORGANIZATION OF LIFE



Learning Objectives

At the end of this lesson, students will be able to

- ◆ Understand the different levels of organization seen in the animal world
- ◆ Learn about each level of organization briefly
- ◆ Learn about the structure of eye as an example for organ level of organization
- ◆ Learn about the respiratory system as an example for system level of organization
- ◆ Understand the various functions of organizational setup with reference to homeostasis, diffusion, osmosis, osmoregulation, cellular respiration and metabolism



Introduction

If you look around your school premises or in your countryside, you will be able to observe numerous varieties of animals. There are animals like amoeba which cannot be seen by our naked eye. There are animals like blue whale and elephants which are of huge size. The variations are not only seen size but also in the complexity of their cells, tissues of the body structure. This is called **organization of life**.

The biological organization are arranged from cellular level to organism level. It goes like tissue, organ, organ system and organisms. Each of this represents a level of organization and hierarchy. These organizations are of two levels, they are lower levels and higher levels of organism.

Irrespective of the level, they exhibit and can perform all the life activities like growth, metabolism, reproduction etc., In this lesson, let us learn different levels of organizations of living organism with suitable example.

8.1 ORGANIZATION OF CELLS AND TISSUES

Cell is the smallest structural and functional unit of living organisms and it is capable of performing specific function. It is also called the building blocks of life. Single-celled organisms like Amoeba are able to carry out all the processes of life, like higher organisms. The body of Amoeba looks like a single cell, while higher animals are made up of billions of cells. Bacteria, yeasts and Amoeba have a single cell body and are called as **unicellular organisms**. Organisms such as human beings, cows and trees are made of a large number of cells and are called **multicellular organisms**. Thus the body has different levels of organisation. **Cells** make up **tissues**, tissues make up **organs**, and organs make up **organ systems**.

Prokaryotes and Eukaryotes

Based on the structural organization, organism can be classified into prokaryotes



and eukaryotes. In some of the organisms like bacteria, cyanobacteria and mycoplasma, no true nucleus is seen. These organisms are called prokaryotes. However in the cells of amoeba, animals and plants, a well-defined nucleus, covered by membrane is seen. These organisms are called eukaryotes.

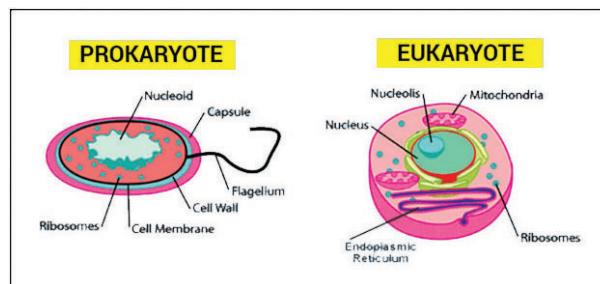


Fig 8.1 Structure of Prokaryote and Eukaryote

Biological levels of organization

The biological organization shows the hierarchy in organization levels from simplest to more complex: atoms, to molecules, cells, tissues, organs, organ systems, organisms, populations, communities, ecosystem and finally biosphere. The pictorial representation of biological organization is given below. Though atoms and molecules make up the cells, they are considered as non living. Whereas population, community, ecosystem and biosphere are of ecological importance. Hence we restrict our study from cells to organism.

Activity 1

Boil a hen's egg. Remove the shell. What do you observe? A white material surrounds the yellow part. White material is albumin which solidifies on boiling. The yellow part is yolk. It is a part of the single cell. You can observe this single cell without any magnifying devices.

8.1.1 CELL

Cell is the **structural and functional unit of life**. Cells are often called as "building blocks of life". The study of cells is called **cell biology**. Cells consist of cytoplasm enclosed within a membrane, which contains many biomolecules such as proteins and nucleic acids. Cells vary widely in shape and size. There is a central spherical **nucleus** and a variety of cytoplasmic living **cell organelles** like the endoplasmic reticulum, mitochondria, Golgi bodies, centrioles, ribosomes, lysosomes, etc., present in an animal cell. Each cell organelle performs a specific function.

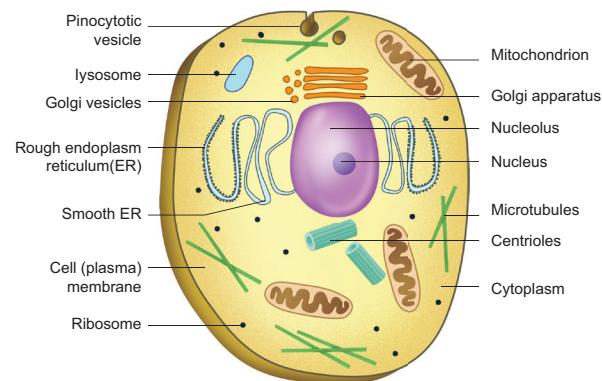


Fig.8.3 Animal cell

Cell ▶ tissue ▶ organ ▶ organ system ▶ organism

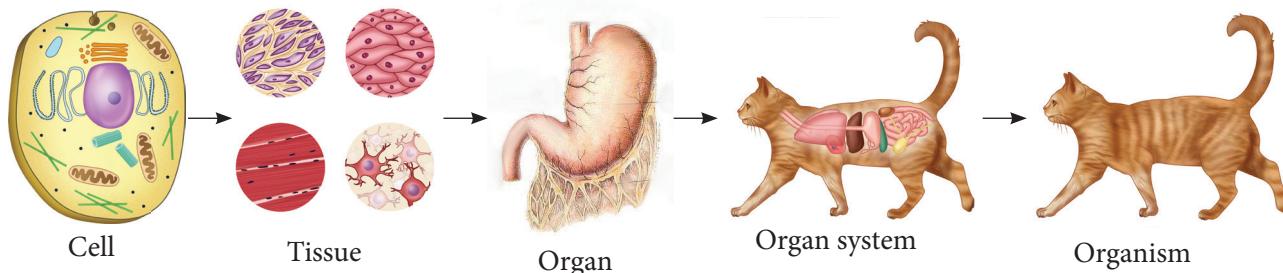


Fig 8.2 Different levels of organization



The size of cells varies in different animals which are measured in units of micron (μm). (**1cm = 10 mm: 1 mm = 1000 microns.**) The average cell size varies from 0.5 to 20 μm in diameter. The cells of bacteria are the smallest in size (1-2 μm). In human body, the smallest cell is RBC (7 μm in diameter), the longest one is the nerve cell which reaches a length of about 90 -100 cm and the human egg (ovum) is 100 μm in size . Among multicellular animals, the largest cell is, egg of an ostrich. It measures about 170 mm \times 180mm in diameter. It is about 25,000 times bigger than a red blood cell. Mycoplasma with a diameter of 0.0001 mm is the smallest bacterium.

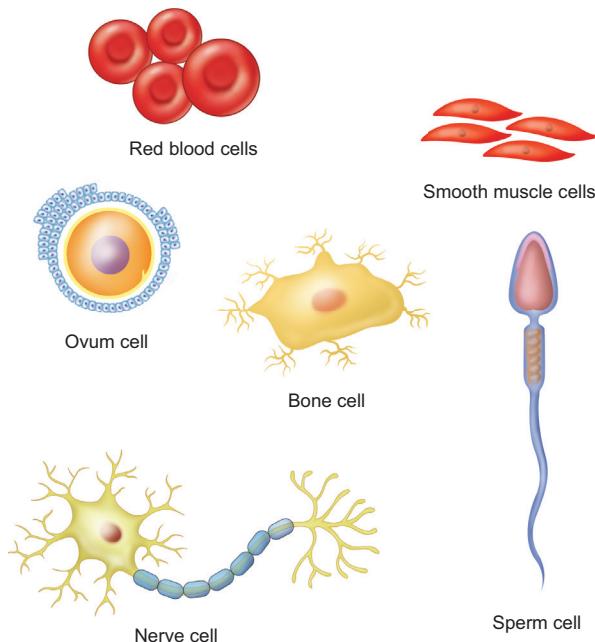
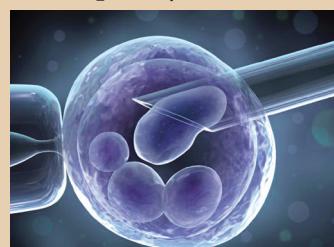


Fig.8.4 Different shapes and sizes of some cells

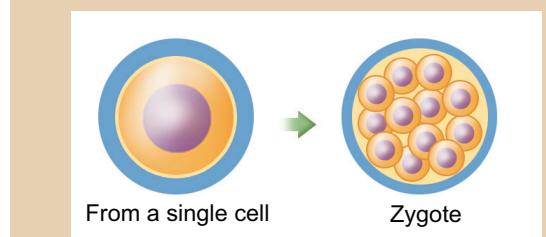


Stem cell

A stem cell is essentially a 'blank' cell, capable of becoming another more differentiated cell type in the body, such as a skin cell, a muscle cell, or a nerve cell. They are microscopic in size. Stem cells can be used to replace or even heal the damaged tissues in the body. They can serve as a built-in repair system for the human body, replenishing other cells as long as a person is still alive.



Our body is developed from a single cell called zygote. The zygote undergoes continuous mitotic division and forms the foetus consisting multitude of cells of different shape, size and content. Foetal cells gradually attain change in structure and function. This process is known as cell differentiation.



Shape

Cells are of different shapes. Normally they are correlated with their functions. Some cells are oval or round, while certain others are elongated. Some cells are long and pointed at both ends. They exhibit a spindle shape. Cells are sometimes quite long. Some are branched like the nerve cell or a neuron. Some of our WBC cells are Amoeba like with irregular boundaries.

8.1.2 Tissues

Tissues are groups of cells that have a similar structure and act together to perform a specific function. They are of two type's **simple** and **complex tissues**. Simple tissues are made up of cells of same type or kind e.g. glandular tissue and complex tissues are made up of different kind of tissues e.g. tissues of dry skin. Hence, simple tissue is homogeneous and complex tissue is heterogeneous.

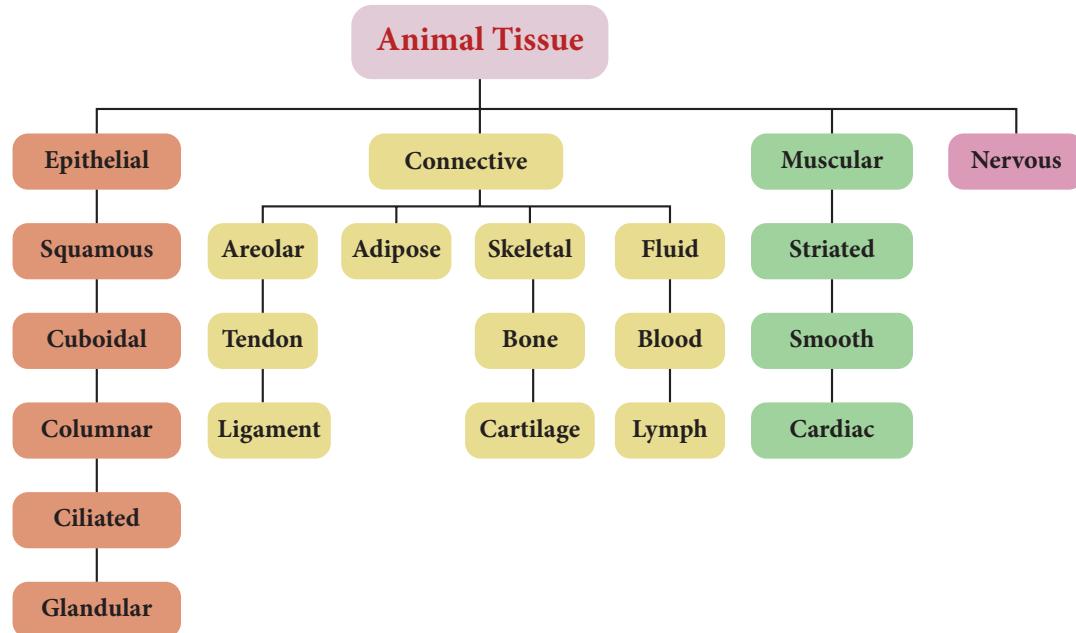


Fig. 8.6. Classification of Animal Tissues

Types of Tissues

Depending on the basis of their structure and function, tissues can be classified into four types—**Epithelial** (covering) tissue for protection, **Muscular** (contractile) tissue for movements and locomotion, **Connective** (supporting) tissue for binding different structures of body and **Nervous** tissue for conduction of nerve impulses. All the complex organisms consist of only four basic types of tissues.

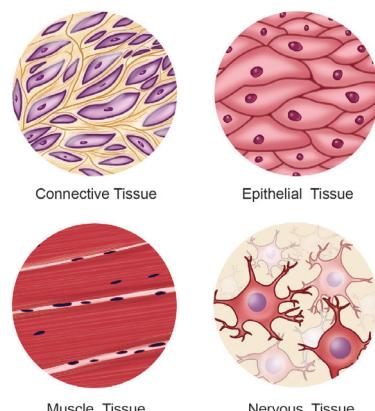


Fig. 8.5 Types of Animal tissues

8.1.3 Organ

Organs are structures made up of two or more types of tissues, organized to carry out a particular function. Example: Brain, heart, lungs, kidney, liver etc., each of which has

specific functions. Most organs are made of all four types of tissue. The intestine, for example, is made of epithelial tissue as the inner lining, which helps in enzyme secretion and nutrient absorption. Epithelial tissue is covered by layers of muscle tissue, which help in peristaltic movements to move the food. The intestine is also supplied by blood tissue (connective tissue) which helps in transporting nutrients absorbed by the intestine, and is connected to the brain through the nerve tissue, which conveys instructions from the brain.

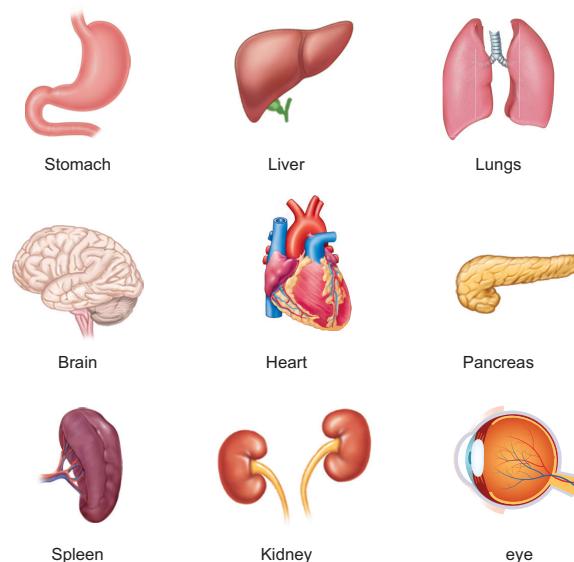


Fig. 8.7 Different types of organs present in the human body

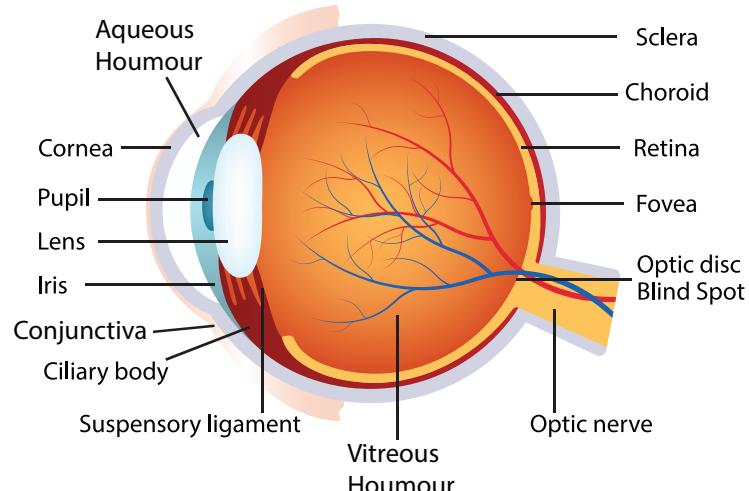


Fig.8.8 Structure of Human Eye

Now let us study in detail about the structure of an eye.

The eyes - Photoreceptor

The eye is one of the important sensory organs in the human body. It is composed of muscular tissue, connective tissue, neural tissue and mainly responsible for **vision, differentiation of color** (the human eye can differentiate approximately 10 – 12 million colors) and **maintaining the biological clock of the human body**. The human eye can be compared to a camera as both functions by gathering, focusing, and transmitting the light through the lens for creating an image of an object.

To understand more in detail about our eye and how our eye functions, we need to look into the structure of the human eye.

Structure and Functions of Human Eye

The human eyes are the most complicated sense organ in the human body, with several parts fixed together form a spherical structure. Every part of the human eye is mainly responsible for a certain action. The structure of a human eye can be broadly classified into the external structure and internal structure.

The External Structure of an Eye

The parts of the eye that are visible externally comprise of the external structure of the eye-

Sclera: It is a tough and thick white sheath that protects the inner parts of the eye. We know it as the '**White of the eye**'.

Conjunctiva: It is a thin transparent membrane that is spread across the sclera. It keeps the eyes moist and clear by secreting small amounts of mucus and tears.

Cornea: It is the transparent layer of membrane that is spread over the pupil and the iris. The main role of the cornea is to refract the light that enters the eyes.

Iris: It is a pigmented layer of tissues that make up the colored portion of the eye. Its primary function is to control the size of the pupil, depending on the amount of light entering it.

Pupil: It is the small opening located at the middle of the Iris. It allows light to come in.

The Internal Structure of an Eye

The internal structure of the eye includes the following parts:

Lens: It is a transparent, biconvex, and an adjustable part of an eye, made up of protein. The lens with the help of the cornea refracts light focused on the retina, therefore creating images on it.

Retina: It is the layer present at the back of the eye where all the images are formed. It is the third and inner most coat of the eye which is very sensitive to light because of the presence of



Photoreceptors (rods and cone cells). The retina functions by converting the light rays into impulses and sending the signals to the brain through the optic nerve.

Optic nerve: It is located at the end of the eyes, behind the retina. The optic nerve is mainly responsible for carrying all the nerve impulses from the photoreceptors to the human brain, without which vision would not be possible.

Aqueous Humour: It is a watery fluid that is present in the area between the lens and the cornea. It is responsible for the nourishment of both the lens and the cornea.

Vitreous Humour: it is a semi-solid, transparent, jelly-like substance that covers the interior portion of the eyes. It plays an important role in maintaining the shape of the eye and also causes refraction of light before it reaches the retina.

8.1.4 Organ system

A group of organs form the organ system, and together they perform a particular function. The heart and the blood vessels together make the cardiovascular system. Organs such as nose, pharynx, trachea, lungs and diaphragm work together as the respiratory system. The mouth, esophagus, stomach, duodenum, and the intestines together form the digestive system. Other examples of organ system include the endocrine system, integumentary system, muscular system, reproductive system, skeletal system, urinary system, immune system, etc.

Let us see the respiratory system as an example for organ system elaborately.

The Respiratory System

Our respiratory system consists of organs like trachea, bronchus and lungs which are responsible for exchange of air between the atmosphere and the blood. Together, these organ form what is called the respiratory tract. Let us see the organs of the respiratory tract in detail.

The nose

We inhale air through the nostrils, which lead to the nasal cavity. The inner surface of this cavity is lined with cilia and mucus producing cells, which make it sticky and moist. The cilia and mucus trap dust and germs and prevent them from going deeper into the respiratory tract. The blood vessels in the nose help to warm the inhaled air.

The windpipe

After passing through the nasal cavity, the air enters the pharynx. Then it goes into the trachea or the windpipe which is an elastic tube extending down the length of the neck and partly into the chest cavity. Between the pharynx and the trachea lies a small air passage called the larynx commonly known as the “voice box”. The larynx has fold of tissue which vibrate with the passage of air to produce sound.

Bronchi

The trachea divides into two branches called **bronchi** (**singular: bronchus**). Each bronchus leads to a lung, where it divides and redivides to finally form air passages called bronchioles.

Lungs

The lungs are organs in the chest cavity that allow our body to take in oxygen from the air. They also help to remove carbondioxide from the body. The lungs lie on either side of the breast bone and fill the inside of the chest cavity. The left lung is slightly smaller than the right lung to allow room for the heart. Within the lungs, each bronchiole leads to a bunch of air sacs called alveoli (**singular: alveolus**).

The lungs are two spongy elastic bags, on each side of the thoracic cavity. The thoracic cavity is bound dorsally by the vertebral column and ventrally by the sternum, laterally by the ribs and on the lower side by the dome shaped diaphragm.



Alveoli

Alveoli are tiny air sacs in the lungs that take up the oxygen we breathe in and keep your body going. Although they are microscopic, alveoli are the workhorses of your respiratory system. You have about 480 million alveoli, located at the end of bronchial tubes. The total area of the air sacs in the lungs above 2000 square feet or more than one hundred times the body's surface area. Alveoli, is meant for the exchange of oxygen and carbon dioxide.

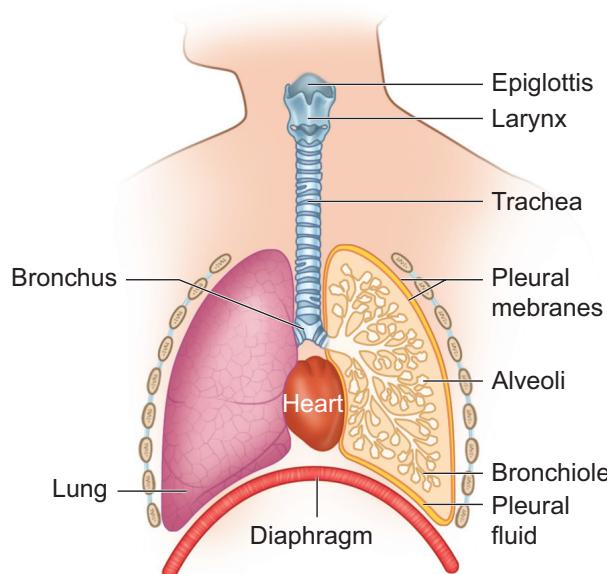


Fig.8.9 Human respiratory system

DO YOU KNOW? On an average, an adult human being at rest breathes in and out 15 – 18 times in a minute. During heavy exercise, the breathing rate can increase upto 25 times per minute

Smoking damages lungs. Smoking is also linked to cancer. It must be avoided.

When you sneeze, you should cover your nose so that the foreign particles you expel are not inhaled by others.

Mechanism of Breathing

Inpiration (Inhalation)

The process of taking air into the lungs is called **inspiration** or inhalation. During inspiration, the sternum is pushed up and

outward and the diaphragm is pulled down. This increases the volume of the thoracic cavity and the pressure decreases. The air outside the body flows into the lungs. Here exchange of gases takes place between the air and the blood.

Expiration (Exhalation)

The process of expelling air from the lungs is called **expiration or exhalation**. Upon exhalation, the lungs recoil to force the air out of the lungs. The intercostal muscles relax, returning the chest wall to its original position. During exhalation, the diaphragm also relaxes, moving higher into the thoracic cavity. This increases the pressure within the thoracic cavity relative to the environment. Air rushes out of the lungs due to the pressure gradient. This movement of air out of the lungs is a passive event.

Exchange of gases in the Alveoli:

The content of oxygen in the inhaled air in alveoli is more than the blood flowing through the capillaries. So, the oxygen moves into the blood by simple **diffusion**. **Haemoglobin** in the blood combines with **oxygen** to form **oxyhaemoglobin**. The blood carrying oxygen reaches the heart through blood vessels. The heart pumps it to all the tissue in the body. The tissue releases carbon-dioxide which is carried back to alveoli by the blood. Carbon-dioxide diffuses from the blood to the air in the alveoli and is sent out of the body when the air is exhaled.

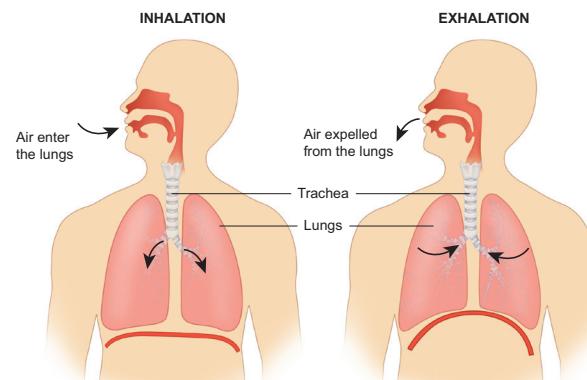


Fig 8.10 Demonstrating (a) inhalation and (b) exhalation



Activity 2

Constructing a model of lungs

Materials required: Y shaped tube, a large balloon, two small balloons, a one litre plastic bottle, cork.

Method of Construction:

1. Cut off the plastic bottle in the middle.
2. Fix two small balloons in the both ends of the Y-tube. Make a hole in the cork and fix the y-tube. Make a small hole in the cork and fix the y-tube through the hole as shown in the picture.
3. Cut a large balloon into two halves and fix one half tightly around the open part of the bottle.



Method of working:

Hold the large balloon in the middle and pull it slowly downwards as shown in the picture, observe the change in the balloons inside the bottle. Now leave the balloon free.

Answer the Question:

1. What do you understand from the demonstration?

Activity 3

What is happening in your body during breathing?

Stand erect and wave your hands in side wards. Take a deep breath and feel your rib movements. Then run some 100 metres and observe the rib movements?

Compare your result with your friends.

Table 8.1 Differences between inhalation and exhalation

Inhalation	Exhalation
The muscles of the diaphragm contract.	The muscles of the diaphragm relax.
The diaphragm goes downward.	The diaphragm goes upward.
The ribs move upwards and outwards.	The ribs move downwards.
The volume of thoracic (chest) cavity increases.	The volume of thoracic (chest) cavity decreases.
Air enters the lungs through the nose.	Air goes out of the lungs through the nose.

8.2 Homeostasis

Homeostasis is a property of a human biological system where the **self-regulating** process tends to maintain the balance for the survival. The regulation takes place in a defined internal environment. Mammals are capable of maintaining a constant body temperature despite the changes in the external temperature. Behavioural and physiological responses are two important regulating mechanisms that maintain the stability of Homeostasis.

In simple terms, it could be referred as a balance in a system to maintain a stable internal environment for the survival of the animal. If the homeostasis regulates successfully, life continues or if unsuccessful, death or disaster occurs.

All the processes of integration and co-ordination of function are mediated by nervous and hormonal system. The liver, kidneys, and brain (hypothalamus), autonomic nervous system and the endocrine system help to maintain homeostasis.

Maintenance of body fluid concentrations, body temperature are done by various bio-



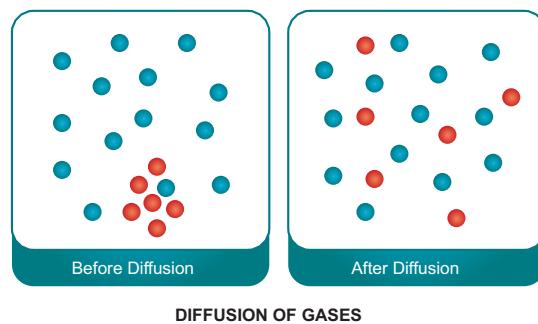
physical and bio-chemical methods. Human beings are warm blooded in nature i.e, they maintain their body temperature as constant. When the body temperature raises sweat is produced to bring the temperature down. When the body temperature lower heat is produced by the muscular work by shivering. This is an example for homeostasis.

The control of blood glucose level is another example in which insulin hormone is secreted whenever the blood glucose level raises and glucagon hormone is secreted whenever the blood glucose level reduces.

8.3 Diffusion

Diffusion is the movement of particles from an area of **higher concentration to lower concentration**. The overall effect is to equalize concentration throughout the medium.

Examples for diffusion include, perfume filling a whole room and the movement of small molecules across a cell membrane. One of the simplest demonstrations of diffusion is adding a drop of ink to water.



DIFFUSION OF GASES

Fig.8.11 Diffusion of gases

What will happen when an incense stick is lit up in a room? How do we feel? The fragrance spreads the entire room. The movement of molecules (ions) from a region of higher concentration to lower concentration.Eg. You can smell incense stick after lighting because the smoke diffuses in the air and makes its way to your nose.

Let us think of the following.



Fig.8.12 Diffusion of smoke through air medium

More to know

1. The mixing of foodstuffs and digestive juices in the gut occurs by diffusion.
2. Exchange of respiratory gases, (oxygen and carbon dioxide) between blood and tissue fluids and between tissue fluid and cells occurs by diffusion.

How does the smell spread in the entire room?

Does the smell spread uniformly in the entire room ?

Can you give any other examples ?

There are other processes in which substances move in water medium. Let us study another such process by the following activity.



Fig.8.13 A tea bag placed in a cup of hot water – diffusion through water medium



8.4 Osmosis

Osmosis is the movement of solvent particles across a semipermeable membrane from a dilute solution into a concentrated solution. The solvent moves to dilute the concentrated solution and equalize the concentration on both sides of the membrane.

The movement of liquids in and out cells is dependent on the concentration of the solution surrounding it. There are 3 types of situations in which this could vary:

1. Isotonic: Here the concentration of external and internal solution of the organism are the same.

2. Hypotonic: Here the external solution concentration is less compared to the concentration of the inner solution of an organism. In this case water will rush into the organism.

3. Hypertonic: Here the external solution concentration is greater than the concentration of the inner solution of an organism. In this case the water will rush out of the organism.

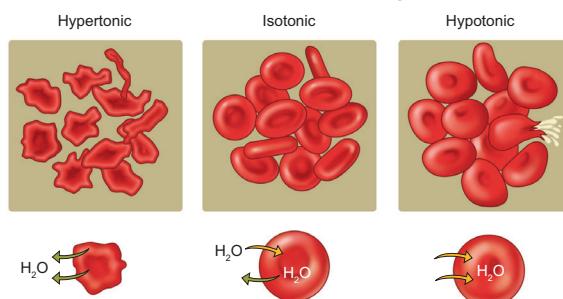
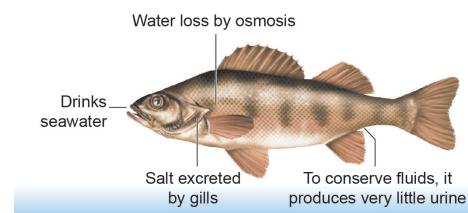


Fig.8.14 Osmosis affects red blood cells in hypertonic, isotonic and hypotonic solutions

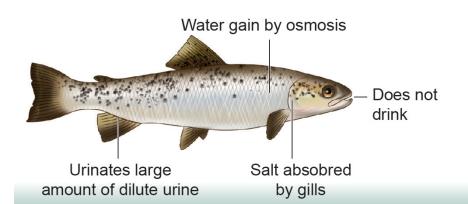
8.5 Osmoregulation

The term osmoregulation was coined by HOBER in 1902. Osmoregulation is the process by which an organism regulates the water balance in its body and maintains the homeostasis of the body. It includes controlling excess water loss or gain and maintaining the fluid balance and the osmotic concentration, that is, the concentration of electrolytes. It

ensures that the fluids in the body do not get too diluted or concentrated



Osmoregulation by a marine fish



Osmoregulation by a fresh water fish

Fig.8.15 Osmoregulation by a freshwater fish

There are two major types of Osmoregulation:

Osmoconformers These organisms try to maintain the osmolality of their body matching with their surroundings. Most of the invertebrates, marine organisms are osmoconformers.

Osmoregulators These organisms maintain their internal osmolality, which can be extremely different from that of the surrounding environment, through physiological processes

8.6 Cellular respiration

Cellular respiration is the process by which organisms break down glucose into a form that the cell can use as energy. This energy is then made available to living cells in the form of ATP. Cellular respiration takes place in the cytoplasm and mitochondria of the cells. The Cellular respiration is classified into two types: **aerobic** respiration and **anaerobic** respiration.

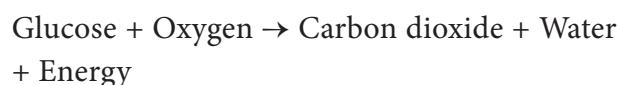
Aerobic respiration

In this type of respiration, the food substances are completely oxidized into H_2O and CO_2 with the release of energy. It requires



atmospheric oxygen and all higher organisms respire aerobically. This reaction releases a large amount of energy.

It can be written as the following equation:



Anaerobic respiration:

In this type of respiration, partial oxidation of food takes place and the organisms release energy in the absence of oxygen. This type of respiration occurs in organisms like yeast. Ethyl alcohol and carbon dioxide are the by-products of this process. This reaction releases very little energy because glucose is not completely oxidized.

For example: yeast cells convert glucose into carbon dioxide and ethanol, with the release of energy, without using oxygen.



Table 8.2 Differences between aerobic and anaerobic respiration

AEROBIC	ANAEROBIC
1) Aerobic respiration takes place in the presence of oxygen	1) Anaerobic respiration takes place in the absence of oxygen
2) The end products of aerobic respiration are carbon dioxide and water	2) The end products of anaerobic respiration are CO_2 and ethanol or lactic acid
3) Common in all higher plants and animals	3) Common in certain micro organisms and human muscle cell

8.7 Metabolism

Metabolism is the sum of chemical reactions by which living organisms sustain their life.

Metabolism consists of anabolism (the buildup of substances) and catabolism

More to know

1. Aerobic respiration releases 19 times more energy than anaerobic respiration from the same amount of glucose
2. In aerobic respiration each glucose molecules produce 36 ATPs.

Yeast makes bread soft, puffy when added to wheat flour in the bakery due to the release of CO_2 .

(the breakdown of substances). The term metabolism is commonly used to refer specifically to the breakdown of food and its transformation into energy, cellular products and waste elimination.

Anabolism

Anabolism or constructive metabolism, is all about building and storing: It supports the growth of new cells, the maintenance of body tissues, and the storage of energy for use in the future. During anabolism, small molecules are changed into larger, more complex molecules of carbohydrate, protein, and fat.

For example,

$\text{Glucose} \rightarrow \text{Glycogen}$ and other sugars
Amino acids \rightarrow Enzymes, hormones, proteins

Fatty acids \rightarrow Cholesterol and other steroids

Catabolism

Catabolism or destructive metabolism, is the process that produces the energy required for all activity in the cells. In this process, cells break down large molecules (mostly carbohydrates and fats) to release energy. This energy release provides fuel for anabolism, heats the body, and enables the muscles to contract and the body to move. As complex chemical units are broken down into more simple substances, the waste products released in the process of catabolism are removed from the body through the skin, kidneys, lungs, and intestines. The following are examples for catabolism.



Carbohydrates → Glucose

Glucose → CO₂, Water and heat

Protein → Amino acid

The repeated anabolism and catabolism reactions maintain the homeostatic condition in the organism. The metabolic process is the cause for maintaining ionic balance in the body. It is also responsible for movement, growth, development, maintenance and repair of the cells, tissues and the human body. These metabolic reactions occur in different organs of living species.

More to know

Basal metabolism refers to the minimum energy required to maintain the normal activities of the body during complete rest in a warm atmosphere 12 – 18 hours after the intake of food

Points to remember

- Cell is the basic structural and functional unit of living organisms. All living organisms are made up of cells.
- Cells vary in shapes and size .The size of a cell is measured in micrometers. (μm)
- Cells are combined together to form tissues. The tissues are combined together to form organs. Many organs are combined together to form the organ system.
- The sense organ eye is concerned with vision.

- Respiration is the process in which energy is released while food is oxidised. It consists of external respiration and internal respiration (or) cellular respiration.
- There are two types of respiration depending upon the availability of oxygen namely aerobic respiration and anaerobic respiration.
- Selective permeability of plasma membrane enables the cell to maintain homeostasis.
- Diffusion involves movement of molecules from the region of their higher concentration to the region of their lower concentration which can occur without a semi permeable membrane.
- Osmosis involves movement of solvent molecules from the region of their higher concentration to the region of their lower concentration which can take place through a semi permeable membrane.
- Homeostasis is the maintenance of a constant internal environment of the body.
- The sum total of the biochemical reactions metabolism involves in release and utilisation of energy or energy exchange within the organisms. It can be divided into two categories namely anabolism and catabolism.
- The repeated anabolic and catabolic reactions in the metabolic process maintain the homeostatic condition of the body.

A-Z GLOSSARY

Alveoli	Many tiny air sacs of the lungs which allow for rapid gaseous exchange.
Eukaryotic	An organism having cells each with a distinct nucleus within which the genetic material is contained.
Organelles	any of the specialized structures within a cell that perform a specific function.
Micron	It is a small unit of measurement that measures length which is one thousand of a millimeter.
Haemoglobin	Iron containing red pigment of RBCs of vertebrates, gives red colour to blood.
Prokaryotic	Typically unicellular microorganism that lack of a distinct nucleus and membrane bound organelles.
Diaphragm	The muscle that separates the chest(muscle) cavity from the abdomen.
Pleura	Protective covering of the lungs.
Metabolism	The sum of all chemical reactions by which living organisms sustain their life.



TEXT BOOK EXERCISES



32E4C7

I. Choose the best answer.

1. _____ is tough and thick white sheath that protect the inner parts of the eye.
a) sclera b) conjunctiva
c) cornea d) iris
2. Maintenance of constant internal environment of the body is known as _____
a) Homeostasis b) Homeophytes
c) Homeokinesis d) Homeophilics
3. In the absence of oxygen, glucose is broken down in to _____
a) Lactic acid b) Citric acid
c) Acetic acid d) Nitric acid
4. _____ cells are specialised cells that can be transformed into any kind of cells.
a) Nerve b) Stem
c) Heart d) Bone
5. The process of air passing in and out the lungs is called _____.
a) Inhalation b) Exhalation
c) Breathing d) None of these
6. Osmosis is the movement of water molecules from a _____.
a) Higher concentration to a region of lower concentration.
b) Lower concentration to a region of higher concentration.
c) Both of these
d) None of these
7. The erythrocyte is placed in _____ solution which has lesser concentration of solutes and greater concentration of water than in the cytoplasm.
a) Hypotonic b) Hypertonic
c) Neutral d) Acidic

II. Fill in the blanks.

1. _____ is the structural and functional unit of living organisms.
2. The largest cell is egg of an _____.
3. _____ is a good example for anaerobic respiration.
4. _____ nerve is located at the end of the eyes behind the retina.
5. The size of the cells are measured in units of _____

III. Write true or False. If false, give the correct answer.

- 1) In hypotonic condition, concentration of the external and the internal solution of the organism are same .
- 2) Diffusion is the movement of particles from an area of lower concentration to higher concentration .
- 3) Human beings are warm blooded in nature.
- 4) The larynx has fold of tissue which vibrate with the passage of air to produce .
- 5) Aqueous humour plays an important role in maintaining the shape of the eye.

IV. Match the following.

- I Match the following examples for catabolism.
1. Carbohydrates - CO_2 , water and heat
 2. Glucose - amino acid
 3. Protein - glucose
- II. Match the following examples for anabolism:
1. Glucose - cholesterol and other steroid
 2. Amino acids - glycogen and other sugars
 3. Fatty acids - enzymes, hormone, protein



V. Arrange the following words in correct sequence.

Tissues, organ system, organism, cell, organ

VI. Answer in brief.

1. What is cell differentiation?
2. State different types of tissues.
3. Mention the function of 'Alveoli'?
4. Name the processes by which air enters and comes out of our lungs?
5. Differentiate between Osmoconformers and Osmoregulators?
6. Define Metabolism?

VI. Answer in few words.

1. Define Prokaryotic cell?
2. Define Eukaryotic cell?
3. Tabulate the difference between aerobic and anaerobic respiration.
4. State different types of epithelial cells?
5. Why the human eye is compared with camera?
6. Which organ and organ system help to maintain homeostasis?

VII. Answer in detail.

1. Draw the V.S of human eye and label its parts.
2. Explain Osmosis with an example.
3. Differentiate between inhalation and exhalation.
4. Explain about the types of metabolism with an example.
5. Explain the mechanism of breathing.
6. Read the given paragraph about human eye carefully and correct the mistakes.

Our eye is cylindrical shaped. The wall of the eyeball is composed of five layers. The outermost layer is cornea. The innermost layer is called sclera. The eyeball consists of elastic nerves and

biconcave lens. The pupil attaches lens to iris. Iris has rod and cone shaped cells. Aqueous humour is present between lens and retina. The vitreous humour is present between cornea and lens. The brain changes the light into nerve impulses and sends them to retina.

VIII. HOT Questions.

1. Why do we need instant energy? Does glucose give that energy? Explain.
2. How are they preparing pickles? What are the causes involved in that?

IX. Value Based Questions.

1. Dr. Usha is a pulmonologist (Doctor for respiratory diseases). One day, a school student named Arjun, met her with respiratory problems. After diagnosis, the doctor advised him to go playground daily and play football or basketball. She also advised to do *pranayamam* in the morning.
 - a) Why did the doctor advised him to go to the playground?
 - b) What is the use of *pranayamam*?
4. Explain why are you not able to breathe normally when you are in closed and crowded places?
5. Shylesh is a school going kid studying standard VIII. He is crazy about playing video games in mobile phones. After couple of months, his eyes turned red and he felt severe pain in his eyes. His science teacher enquired about this and advised his parents to take him to consult an eye doctor.
 - i) How does excessive usage of mobile phone affect our eyes?
 - ii) What are the values shown by the teacher?



REFERENCE BOOKS

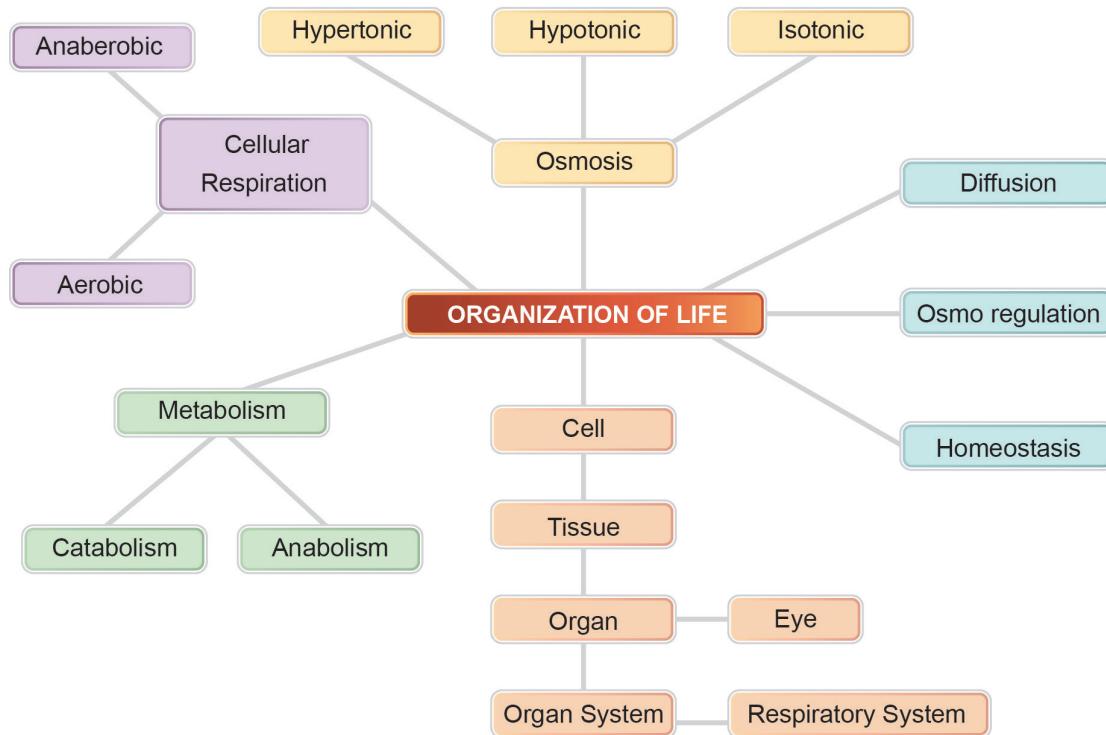
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MIND MAPS





UNIT

9

INTRODUCTION TO THE INFORMATION AGE



Learning Objectives

At the end of this lesson students will be able to:

- ◆ To know about the computer.
- ◆ To know the history of computer.
- ◆ To identify Software and Hardware of a computer
- ◆ To know the Input unit, CPU and the Output unit.
- ◆ To distinguish the features of Hardware and software



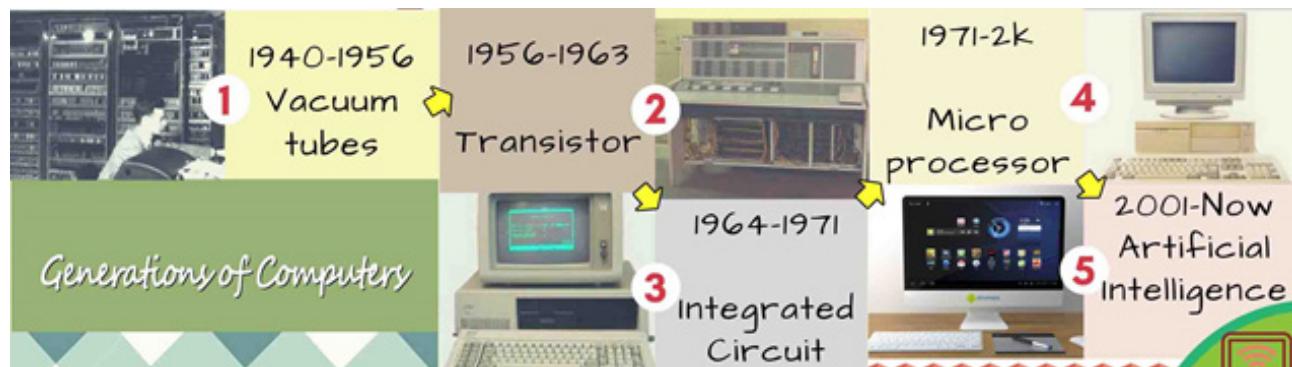
Generation of Computers

A Computer is an electronic machine that accepts data, stores and processes data into information. Computer follow instructions, called programs which determine the tasks the computer will perform, the computer is able to work because there are instructions in its memory directing it. In the beginning of 19th century, Charles Babbage, a professor in Mathematics has designed an analogue computer. He is known as the father of computer



Generation of Computers

SN	GENERATION	PERIOD	MAIN COMPONENT USED
1.	First generation	1942-1955	Vacuum tubes
2.	Second generation	1955-1964	Transistors
3.	Third generation	1964-1975	Integrated Circuits(IC)
4.	Fourth generation	1975-1980	Microprocessor
5.	Fifth generation	1980 – till date	Artificial Intelligence



Parts of a Computer

- Input Unit
- Central Processing Unit (CPU)
- Output Unit



Input Unit

The input unit helps to send the data and commands for the processing.

The hardware devices that are used to input data are called input devices. Keyboard, Mouse, Scanner, Barcode reader, Microphone-Mic, Web camera, Light Pen, Joy stick is some of the input devices.

Mouse

Mouse is an essential part of the computer. The standard Mouse has two buttons and a scroll ball in the middle. The mouse is used to move the pointer on a computer screen. Right button is used to select files and to open the folder. Left button is used to carry out corrections in the file. The page on the monitor can be moved up and down using the scroll ball.

Keyboard

A keyboard is an input device, as is a mouse. A keyboard delivers data in the form of letters, numbers and symbols to the computer. The keys used to type the keys with numbers are called number keys and key with letters are called alphabet keys. Numbers 0,1,2,3,4,5,6,7,8,9 are called number keys and keys with letters A to Z are called Alphabet Keys.

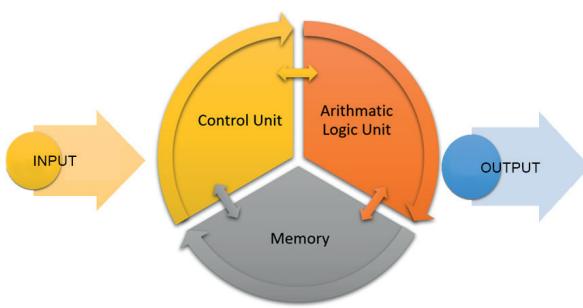




Central Processing Unit (CPU)

CPU is the brain of the Computer. The data is processed in the CPU. The CPU has namely three parts.

1. Memory Unit; 2. Arithmetic Logic -Unit (ALU); 3. Control Unit



Control Unit

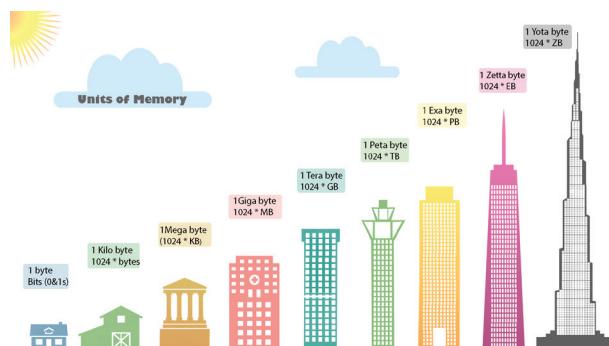
The control unit controls the functions of all the parts of the computer.

Arithmetic Logic Unit

Arithmetic and Logic unit performs all the arithmetic computations like addition, subtraction, multiplication and division.

Memory Unit :

The memory unit in the computer saves all data and information temporarily. We can classify memory unit into two types namely primary and secondary memory. Memory can be expanded externally with the help of Compact Disk (CD), Pendrive, etc.



Output Unit

The output unit converts the command received by the computer in the form of binary signals into easily understandable characters. Monitor, Printer, Speaker, scanner are some of the output devices.

Classification of Computer

The computers can be classified based on their design, shape, speed, efficiency, working of the memory unit and their applications.

Mainframe Computer

Mini Computer

Micro or Personal Computer

Super Computer



Mainframe



Mini computer



Micro personal computer



Super computer

Personal computer and its types

Personal computer comes under the microcomputer category. Based on the memory and efficiency they can be classified as

1. Desktop; 2. Laptop; 3. Tablet



Desktop



Laptop



Tablet

Hardware

Hardware is the parts of a computer which we can touch and feel. Hardware includes Input and Output devices, Cabinet, Hard Disk, Mother Board, SMPS, CPU, RAM, CD Drive and Graphics Card.





Software

Hardware is lifeless without software in a computer. Softwares are programmed and coded applications to process the input information. The software processes the data by converting the input information into coding or programmed language. Touching and feeling the software is not possible but we can see the functions of the software in the form of output.



Types of Software

The software is divided into two types based on the process. They are

1. System Software (Operating System)
2. Application software

System Software

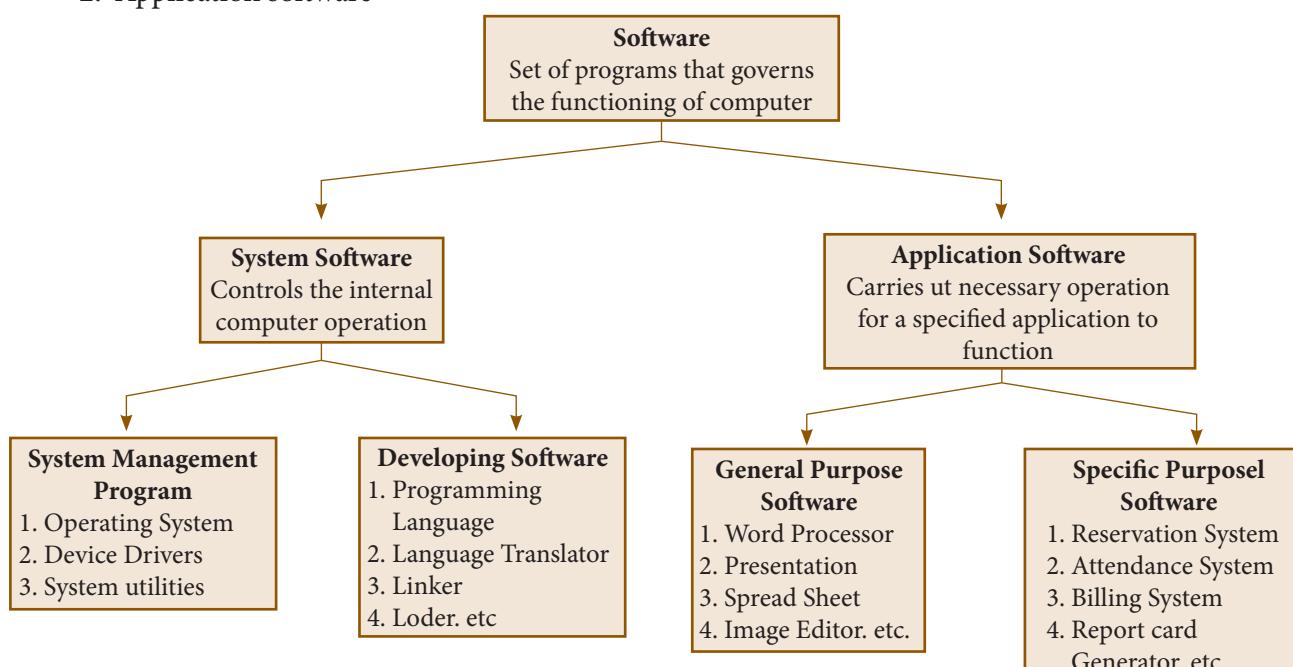
System Software (Operating system) is software that makes the hardware devices to process the inputted data and to display the result on the output devices like Monitor. Without the operating systems, computer cannot function on its own. Some of the popular operating system are Linux, Windows, Mac, Android etc.

APPLICATION SOFTWARE V/S SYSTEM SOFTWARE



Application Software

Application software is a program or a group of programs designed for the benefit of end user to work on computer. The application programs can be installed in the hard disk for the usage on a particular computer. This type of application program completes one or more than two works of the end user. The following are the examples of application program: Video player, Audio player, Word processing software, Drawing tools, Editing software, etc.





TEXT BOOK EXERCISES



I. Choose the correct answer

1. Who is the father of computer?
 - a) Martin Luther King
 - b) Graham Bell
 - c) Charlie Chaplin
 - d) Charles Babbage
2. Which one of the following is an output device?
 - a) Mouse
 - b) Keyboard
 - c) Speaker
 - d) Pendrive
3. Which one of the following is an input device?
 - a) Speaker
 - b) Keyboard
 - c) Monitor
 - d) Printer
4. Pen drive is _____ device.
 - a) Output
 - b) Input
 - c) Storage
 - d) Connecting cable

5. Fifth generation computer has _____ Intelligence.

- a) Transistors b) Integrated Circuits
 c) Microprocessor d) Artificial Intelligence

II. Match the following :

Column A	Column B
Keyboard	RAM
Fourth generation Computer	Input device
Hardware	Integrated Circuits
Third generation Computer	Drawing tools
Application Software	Microprocessor

III. Give short answer :

1. What is a Computer?
2. Name the parts of a computer
3. What is Hardware and Software?



Science – Class VIII

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STANDARD EIGHT

**TERM - I
VOLUME - 3**

SOCIAL SCIENCE



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STANDARD EIGHT

HISTORY GEOGRAPHY



Unit - 1

Advent of The Europeans



Learning Objectives

- ▶ To know about the kinds of sources of modern India
- ▶ To understand the Portuguese trade interests in India
- ▶ To understand the impact of Portuguese and Dutch presence in India
- ▶ To know the colonial settlements of Denmark
- ▶ To know the arrival and settlement of English and French East India Companies



Introduction

Many of the foreign travelers, traders, missionaries and civil servants who came to India in the 18th and 19th centuries have left accounts of their experiences and their impressions of various parts of the country. To know the events of modern period, we have abundant sources at the international, national, and regional level.

Sources of Modern India

The sources for the history of modern India help us to know the political, socio-economic and cultural developments in the country. From the very beginning, the Portuguese, the Dutch, the French, the Danes, and the English recorded their official transactions in India on state papers. Well preserved records are very valuable to know about their relations in India. The archives at Lisbon, Goa, Pondicherry and Madras were literally store



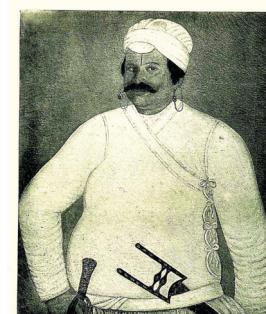
houses of precious historical informations. All these sources must, however, be critically evaluated before they are used for historical writing.

Kinds of Sources

We can write history with the help of sources like written sources and material sources.

Written Sources

After the advent of the printing press, numerous books were published in different languages. Hence, people began to acquire knowledge easily in the fields like art, literature, history and science. The Europeans came to know about the immense Wealth of India from the accounts of Marco Polo and similar sources. The wealth of India attracted Europeans to this country. Ananda



Ananda Rangam



Rangam is a name to conjure with in the annals of Tamil history. He was a Dubash (Translator) in Pondicherry to assist French trade in India. He recorded the events that took place in French India. His diaries contain the daily events from 1736 to 1760, which are the only written secular record available during that period. His diaries reveal his profound capacity for political judgment, and is a most valuable source of history. Written sources include Literatures, Travel Accounts, Diaries, Auto Biographies, Pamphlets, Government Documents and Manuscripts.

Archives

This is the place where historical documents are preserved. The National Archives of India (NAI) is located in New Delhi. It is the chief storehouse of the records of the government of India. It has main source of information for understanding past administrative machinery as well as a guide to the present and future generations related to all matters. It contains authentic evidence for knowing the political, social, economic, cultural and scientific life and activities of the people of India. It is one of the largest Archives in Asia.

DO YOU KNOW?

George William Forrest can rightly be called as the Father of National Archives of India.

Tamil Nadu Archives

The Madras Record Office, presently known as Tamil Nadu Archives (TNA) is located in Chennai. It is one of the oldest and largest document repositories in Southern India. The most of the records in the Tamil Nadu archives are in English. The collections include series of administrative records in Dutch, Danish, Persian and Marathi. Few documents are in French, Portuguese, Tamil and Urdu.



Tamil Nadu Archives

Tamil Nadu Archives has 1642 volumes of Dutch records which relate to Cochin and Coromandal coast. These records cover the period from 1657 – 1845. The Danian records cover the period from 1777 – 1845. Dodwell prepared with great effort and the first issue of the calendar of Madras records was published in 1917. He was highly interested in encouraging historical researches. He opened a new chapter in the History of Tamil Nadu Archives.

Material Sources



St. David Fort (Cuddalore)

Many paintings and statues are the main sources of modern Indian history. They give us a lot of information and the achievement of national leaders and historical personalities. Historical buildings like St. Francis Church at Cochin, St. Louis Fort at Pondicherry, St. George Fort in Madras, St. David fort in Cuddalore, India Gate, Parliament House, President House in New Delhi, etc are different styles and techniques of Indian architecture. Other objects and materials of religious, cultural and historical value are collected and preserved in Museums. These museums help



to preserve and promote our cultural heritage. The national museum in Delhi is the largest museum in India which was established in 1949.

Coins are a good source to know about administrative history. The first coinage in modern India under the crown was issued in 1862. Edward VII ascended after Queen Victoria and the coins issued by him bore his model. The Reserve Bank of India was formally set up in 1935 and was empowered to issue Government of India notes. The first paper currency issued by RBI in January 1938 was 5 rupee notes bearing the portrait of King George VI.



In 1690, Fort St. David's was built by the British in Cuddalore.

Advent of the Europeans

After the capture of Constantinople by the Turks in A.D (CE) 1453, the land route between India and Europe was closed.

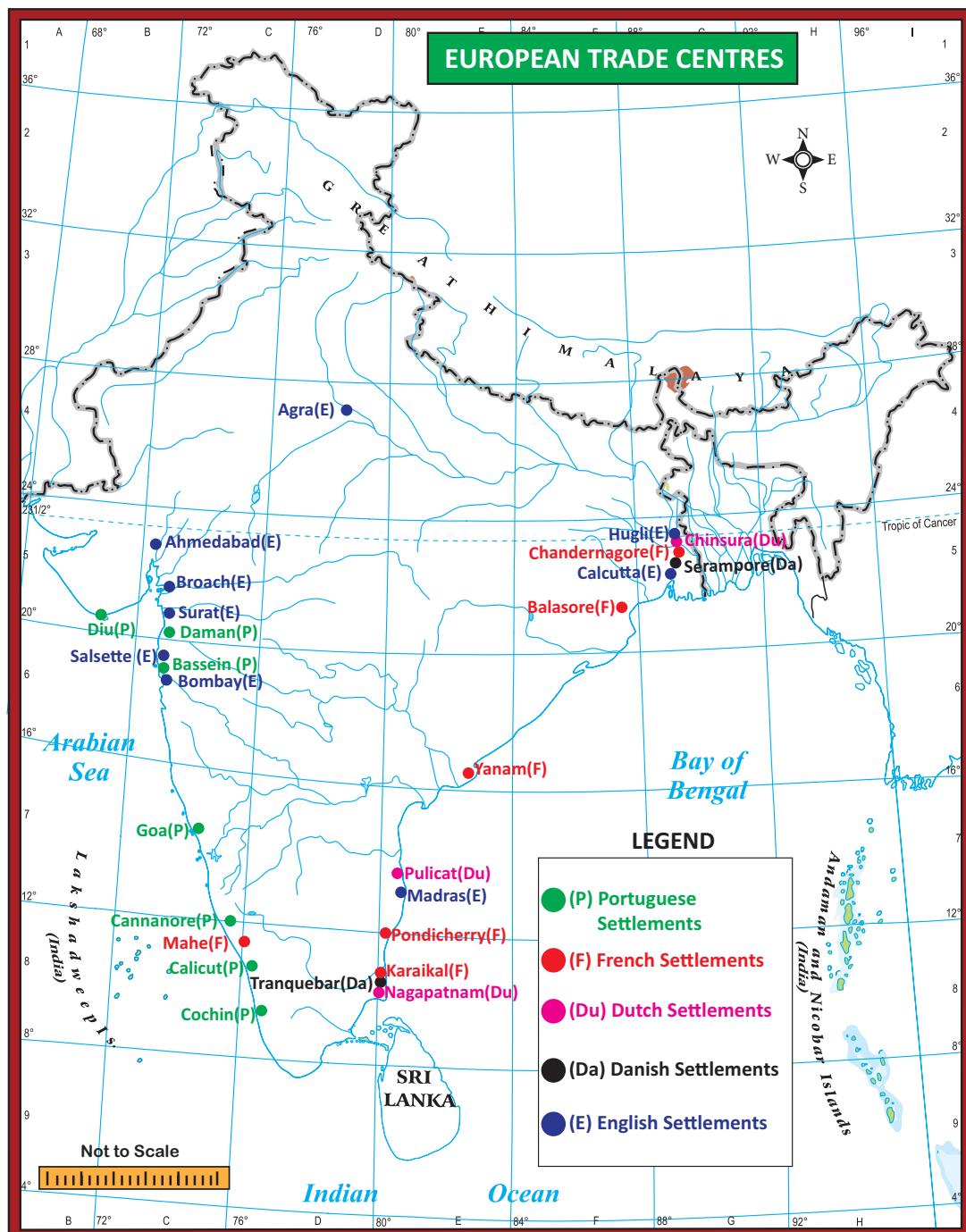
The Turks penetrated into North Africa and the Balkan Peninsula. It became imperative on the part of the European nations to discover new sea routes to the East.

Audio-visual means possessing both a sound and a visual component, such as slide-tape presentations. Audio-visual service providers frequently offer web streaming, video conferencing and live broadcast services. Television, films, internet are called 'Audio-visual media'.

Portugal

Amongst the entire European nations Portugal was the foremost to make a dynamic attempt to discover a sea route to India. Prince Henry of Portugal, who is commonly known as the "Navigator", encouraged his countrymen to take up the adventurous life of exploring the unknown regions of the world. Bartholomew Diaz, a Portuguese sailor reached the southern-most point of Africa in 1487. He was patronized by the King John II.





Vasco da Gama

Vasco da Gama, another Portuguese sailor reached the southern-most point of Africa and he continued his journey to Mozambique from where he sailed to India with the help of an Indian pilot. In A.D



Vasco da Gama

(CE) 1498, he reached Calicut, where he was cordially received by King Zamorin, the ruler of Calicut. A second Portuguese navigator, Pedro Alvares Cabral, sailed towards India, following the route discovered by Vasco da Gama with 13 ships and a few hundred soldiers in 1500. On his arrival at Calicut, there arose conflicts between the Portuguese and king Zamorin.

Vasco da Gama came to India for the second time in 1501 with 20 ships and



founded a trading centre at Cannanore. One after another, they established factories at Calicut and Cochin. King Zamorin attacked the Portuguese in Cochin, but was defeated. Cochin was the first capital of the Portuguese East India Company. The third voyage of Vasco da Gama was in 1524. He soon fell ill, and in December 1524 he died in Cochin.

Francisco de Almeida (1505-1509)

In 1505, Francisco de Almeida was sent as the first Governor for the Portuguese possessions in India. Almeida had the aim of developing the naval power of the Portuguese in India. His policy was known as the “Blue Water Policy”.

As Portuguese tried to break the Arab's monopoly on Indian Ocean trade, it negatively impacted on the trade interests of Egypt and Turkey. Sultans of Bijapur and Gujarat were also apprehensive of the expansion of Portuguese control of ports which led to an alliance between Egypt, Turkey and Gujarat against Portuguese invaders. In a naval battle fought near Chaul, the combined Muslim fleet won a victory over the Portuguese fleet under Almeida's son who was killed in the battle. Almeida defeated the combined Muslim fleet in a naval battle near Diu, and by the year 1509, Portuguese claimed the naval supremacy in Asia.

Alfonso de Albuquerque (1509-1515)

The real founder of the Portuguese power in India was Alfonso de Albuquerque. He captured Goa from the Sultan of Bijapur in November 1510. In 1515, he established the Portuguese authority over Ormuz in Persian Gulf. He encouraged the marriages of the Portuguese with Indian women. He maintained friendly relations with Vijayanagar Empire.

Nino de Cunha (1529-1538)

Governor Nino de Cunha moved capital from Cochin to Goa in 1530. In 1534, he acquired Bassein from Bahadur Shah of

Gujarat. In 1537, the Portuguese occupied Diu. Later, they wrested Daman from the local chiefs of Gujarat. In 1548, they occupied Salsette.

Thus during the 16th century, Portuguese succeeded in capturing Goa, Daman, Diu, Salsette, Bassein, Chaul and Bombay on the western coast, Hooghly on the Bengal coast and San Thome on the Madras coast and enjoyed good trade benefits. The Portuguese brought the cultivation of tobacco to India. Due to the influence of Portuguese Catholic religion spread in certain regions on India's western and eastern coasts. The printing press was set up by the Portuguese at Goa in 1556. A scientific work on the Indian medicinal plants by a European writer was printed at Goa in 1563. In 17th century, the Portuguese power began to decline to the Dutch and by 1739 the Portuguese pockets became confined to Goa, Diu and Daman.

The Dutch

The Dutch followed the Portuguese into India. In 1602, the United East India company of Netherlands was formed and it received the sanction of their government to trade in East India. After their arrival in India, the Dutch founded their first factory in Masulipatnam, (Andhra Pradesh) in 1605. This company captured Amboyna from the Portuguese in 1605 and established its supremacy in the Spice Islands. They captured Nagapatnam near Madras from the Portuguese and made this place as their strong hold in South India. At first, Pulicat was their headquarters. Later, they shifted it to Nagapatnam in 1690.

The most important Indian commodities traded by the Dutch were silk, cotton, indigo, rice and opium. They monopolized the trade in black pepper and other spices. The important factories in India were Pulicat, Surat, Chinsura, Kasim bazaar, Patna, Nagapatnam, Balasore and Cochin.

The English East India Company remained engaged in rivalry with the



Portuguese and the Dutch throughout the 17th century. In 1623, the Dutch cruelly killed ten English traders and nine Javanese in Amboyna. This incident accelerated the rivalry between the two Europeans companies. Their final collapse came with their defeat by the English in the Battle of Bedera in 1759. The Dutch lost their settlements one by one to the English and was completely wiped out by the year 1795.

Dutch in Tamil Nadu

The Portuguese who established a control over Pulicat since 1502 were overthrown by the Dutch. In Pulicat, the Dutch built the fort Geldria in 1613. This fort was once the seat of Dutch power.



Geldria Fort (Pulicat)

The Dutch established their settlement at Pulicat in 1610. Diamonds were exported from Pulicat to the western countries. The other Dutch colonial forts and possessions were Nagapattinam, Punnakayal, Porto Novo, Cuddalore and Devanampatinam;

The British

On 31st December 1600, Elizabeth, the Queen of England granted a charter to the governor and company of Merchants of London to trade with East Indies. The Company was headed by a Governor and a court of 24 directors. Captain Hawkins visited Jahangir's court in 1608 to get certain concessions for the company. He secured permission to raise

a settlement at Surat. However, the Emperor cancelled the permission under pressure from the Portuguese.

In 1612, the English Captain Thomas Best, inflicted a severe defeat over the Portuguese in a naval battle near Surat. The Mughal Emperor Jahangir permitted the English to establish their factory in 1613 at Surat, which initially became the headquarters of the English in western India. Captain Nicholas Downton won another decisive victory over the Portuguese in 1614. These events enhanced the British prestige at the Mughal court. In 1615, Sir Thomas Roe was sent to Jahangir's court by King James I of England. He remained at Agra for three years and succeeded in concluding a commercial treaty with the emperor. Before the departure of Sir Thomas Roe, the English had established their trading centres at Surat, Agra, Ahmadabad and Broach.

On the coastline of the Bay of Bengal, the English established their first factory in 1611 at Masulipatam, an important port in the territory of the kingdom of Golconda. In 1639, the English merchant, Francis Day, obtained Madras as a lease from Chennappa Nayaka, the ruler of Chandragiri. The East India Company built its famous factory known as Fort St. George in Madras, which became their headquarters for the whole of the eastern belt and first fort built by British.

King Charles II of England received the island of Bombay as a part of his dowry from the Portuguese King, on the occasion of his marriage with Catherine. In 1668, the East India Company acquired the island at an annual rent of £ (pounds) 10 from Charles II.

In 1690 a factory was established at Sutanuti by Job Charnock. The Zamindari of the three villages of Sutanuti, Kalikata and Govindpur was acquired by the British in 1698. These villages later grew into the city of Calcutta. The factory at Sutanuti was fortified in 1696 and this new fortified settlement was named as 'Fort William' in 1700.



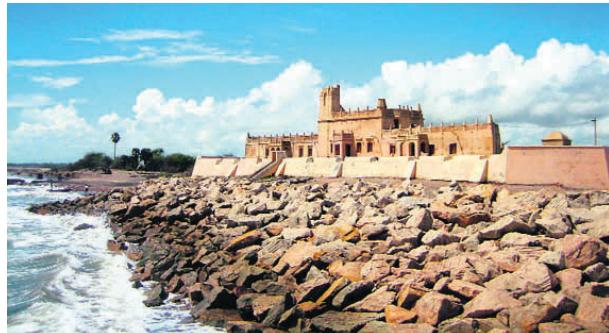
After the Battle of Plassey in 1757 and the Battle of Buxar in 1764, the Company became a political power. India was under the East India Company's rule till 1858 after it came under the direct administration of the British Crown.

Danish

On March 17, 1616 the King of Denmark, Christian IV, issued a charter and created a Danish East India company. They established settlement at Tranqueber (Tamilnadu) in 1620 and Serampore (Bengal) in 1676. Serampore was their headquarters in India. They failed to strengthen themselves in India and they sold all their settlement in India to the British in 1845.

DO YOU KNOW?

- Danish called Tranqueber as Danesborg. The king of Denmark sent Ziegenbalg to India. Ziegenbalg set up a printing press at Tranqueber (Tarangambadi).



Tranquebar Danish Fort

The French

The French East India Company was formed in 1664 by Colbert, a Minister of King Louis XIV. In 1667, a French expedition came to India under Francois Caron. France was the last European country to come India as traders. Caron founded the first French factory in India at Surat. In 1669, Marcara founded second French factory at Masulipatam by securing a patent from the Sultan of Golkonda.

In 1673, the settlement of Pondicherry was founded by Martin under a grant from Sher Khan Lodi, the ruler of Bijapur. Pondicherry became the most important and prosperous French settlement in India. A fort known as St. Louis was built by Francois Martin in Pondicherry. In 1673, the French obtained permission from Shaista Khan, the Mughal Subedar (governor) of Bengal to establish a township at Chandranagore, near Calcutta.



Colbert

The French East India Company established factories in different parts of India, particularly in the coastal regions such Mahe, Karaikal, Balasore and Qasim Bazar. These were a few important trading Centers of the French East India Company.

The vision of the French power in India was further reinforced by the appointment of Joseph Francois Dupleix as the Governor of the French East India Company in 1742. He succeeded Dumas as the French governor of Pondicherry.

DO YOU KNOW?

- The Swedish East India Company was founded in Gothenburg, Sweden, in 1731 for the purpose of conducting trade with the Far East. The venture was inspired by the success of the Dutch East India Company and the British East India Company.

Conclusion

Since the Portuguese were eliminated by the Dutch and later extinguished by the English, the French were left to face the English for control over trade and territory. The French neglected trade and entangled themselves in wars with Indian and other European powers. The three "Carnatic



wars” ruined the French and rejuvenated the English to embark on a systematic territorial expansion. The comparative success of the British over the Portuguese, the Dutch, the Danish, and the French was largely due to their commercial competitiveness, spirit of supreme sacrifice, government support, naval superiority, national character and their ascendancy in Europe.

Recap

- Ananda Rangam is a name to conjure with in the annals of Tamil history.
- The Madras Record Office, known as Tamil Nadu Archives (TNA) is

located in Chennai.

- Prince Henry of Portugal, is commonly known as the “Navigator”.
- The “Blue Water Policy” was followed by Almeida.
- The Mughal Emperor Jahangir permitted the English East India Company to establish their factory in 1613 at Surat.
- French East India Company was formed in 1664 by Colbert.
- Pondicherry became the most important and prosperous French settlement in India.

GLOSSARY

Missionaries	religious missions	சமயப்பரப்பு குழுவினர்
Pamphlets	a small booklet	பிரசுரங்கள்
Archives	the place where historical documents and records are kept	ஆவணக்காப்பகம்
Manuscripts	handwritten books or documents	ஈடையமூத்து பிரதிகள்
Repository	a person or thing regarded as a store of information	களஞ்சியம்
Voyage	a long journey especially by ship	கடற்பயணம்
Monopoly	exclusive control or possession of something	முற்றுரிமை
Navigator	in earlier times, a person who explored by ship	கடல்வழி வல்லுநர்/மாலுமி



Evaluation

I. Choose the correct answer.

1. Who laid the foundation of Portuguese power in India?
- a) Vasco da Gama
 - b) Bartholomew Diaz
 - c) Alfonso de Albuquerque
 - d) Almeida



2. Which of the following European Nation was the foremost attempt to discover a sea route to India?
- a) Dutch
 - b) Portugal
 - c) France
 - d) Britain
3. In 1453 Constantinople was captured by _____.
- a) The French
 - b) The Turks
 - c) The Dutch
 - d) The British
4. Sir William Hawkins belonged to _____.
- a) Portugal
 - b) Spain
 - c) England
 - d) France



5. The first fort constructed by the British in India was _____.
a) Fort St. William b) Fort St. George
c) Agra fort d) Fort St. David
6. Who among the following Europeans were the last to come India as traders?
a) The British b) The French
c) The Danish d) The Portuguese
7. Tranquebar on the Tamilnadu coast was a trade centre of the _____.
a) The Portuguese b) The British
c) The French d) The Danish

II. Fill in the blanks.

1. National Archives of India (NAI) is located in _____.
2. Bartholomew Diaz, a Portuguese sailor was patronized by _____.
3. The printing press in India was set up by _____ at Goa in 1556.
4. The Mughal Emperor _____ permitted the English to trade in India.
5. The French East India Company was formed by _____.
6. _____ the King of Denmark issued a charter to create Danish East India company.

III. Match the following.

1.	The Dutch	1664
2.	The British	1602
3.	The Danish	1600
4.	The French	1616

IV. State true or false.

1. Auto biography is one of the written sources.
2. Coins are one of the material sources.
3. Ananda Rangam was a translator served under British.
4. The place where historical documents are preserved is called archives.

V. Consider the following statements and tick (✓) the appropriate answer.

- i) Governor Nino de Cunha moved Portuguese capital from Cochin to Goa.
- ii) Portuguese were the last to leave from India.
- iii) The Dutch founded their first factory at Surat.
- iv) Sir Thomas Roe was sent to Jahangir's court by King James I of England.
- a) i & ii are Correct.
b) ii & iv are Correct.
c) iii is correct.
d) i, ii & iv are correct.

Find out the wrong pair

- | | | |
|--------------------|---|----------|
| 1. Francis Day | - | Denmark |
| 2. Pedro Cabral | - | Portugal |
| 3. Captain Hawkins | - | Britain |
| 4. Colbert | - | France |

VI. Answer the following in one or two sentences.

- Give a short note on Archives?
- Write about the importance of Coins?
- Why Prince Henry is called 'Henry the Navigator'?
- Name the important factories established by the Dutch in India.
- Mention the trading centers of the English in India.

VII Answer the following.

- Give an account of the sources of Modern India.
- How did the Portuguese establish their trading centres in India?
- How did the British establish their trading centres in India?



VIII Map skill

1. On the river map of India, mark the following trading centres of the Europeans.

- | | |
|------------|----------------|
| 1) Calicut | 2) Cochin |
| 3) Madras | 4) Pondicherry |
| 5) Surat | 6) Chinsura |
| 7) Pulicat | 8) Calcutta |

IX HOTS

1. How did the fall of Constantinople affect the European nations?

X Student Activity

Prepare a chart on the kinds of sources of Modern India.



REFERENCE BOOKS

- Bipan Chandra - *History of Modern India*, Orient Blackswan Private Limited 2018
- Sumit Sarkar, *Modern India 1885-1947*, Laxmi Publications; Reprint edition (2008)
- Ishita Banerjee-Dube - *A History of Modern India*, Cambridge University Press 2014



INTERNET RESOURCES

- www.india.gov.in
- www.historynet.com
- www.ducksters.com



ICT CORNER

SOURCES OF MODERN INDIA

Through this activity you will visualize the Sources of Indian History



Oil Painting On Wood, Portrait Of Dom Vasco Da Gama
16th Century AD 1524

Steps

- Open the Browser and type the URL given below (or) Scan the QR Code.
- Click on Timeline, go to left side menu and Select any one (Ex. Paintings)
- Drag the Time line bar to appropriate period (Ex.1500-1600 A.D)

Website URL:

<http://museumsofindia.gov.in/repository/home>



B360_8_SOCIAL_EM



Unit - 2

From Trade to Territory



Learning Objectives

- ▶ To know the rise of the Political Power of English East India Company
- ▶ To know the events and impact of Battle of Plassey and Buxar
- ▶ To know the Carnatic wars and Mysore wars
- ▶ To understand the growth of colonial army and civilian administration
- ▶ To understand the principles of Subsidiary Alliance and Doctrine of Lapse



Introduction

In the 15th Century, Europe witnessed an era of geographical discoveries through land and sea routes. In 1498, Vasco Da Gama of Portugal discovered a new sea route from Europe to India. The main motive behind those discoveries was to maximize profit through trade and to establish political supremacy. The rule of East India Company in India became effective after the conquest of Bengal. The main interest of the company in India was territorial and commercial expansions.

Establishment of Political Power by the English East India Company

Battle of Plassey (1757)

Alivardi Khan, the Nawab of Bengal died in 1756 and his grandson Siraj-ud-daula ascended the throne of Bengal. The British taking advantage of the New Nawab's weakness and unpopularity seized

The Black Hole tragedy (1756)

There was a small dungeon room in the Fort William in Calcutta, where troops of the Nawab of Bengal Siraj-ud-daula, held 146 British Prisoners of war for one night. Next day morning, when the door was opened 123 of the prisoners found dead because of suffocation.

power. So, Siraj-ud-daulah decided to teach them (British) a lesson by attacking over their political settlement of Calcutta. The Nawab captured their factory at Kasimbazar. On 20th June 1756, Fort William surrendered but Robert Clive recovered Calcutta.

On 9th February 1757, Treaty of Alinagar was signed, whereby Siraj-ud-daulah conceded



Battle of Plassey (1757)



practically all his claims. British then captured Chandranagore, the French settlement, on March 1757. The battle of Plassey took place between the British East India Company and the Nawab of Bengal and his French allies. It

was fought on 23 June 1757. The English East India Company's forces under Robert Clive defeated the forces of Siraj-ud-daulah. After the collapse of Bengal, the company gained a huge amount of wealth from the treasury of



Bengal and used it to strengthen its military force. The beginning of the British political sway over India may be traced from the Battle of Plassey. It was the most decisive battle that marked the initiation of British rule in India for the next two centuries.

Battle of Buxar (1764)

After the Battle of Plassey in 1757, the company was granted undisputed right to have free trade in Bengal, Bihar and Orissa. It received the place of 24 parganas in Bengal. Mir Jafar (1757 to 1760) the Nawab of Bengal however fell into arrears and was forced to abdicate in favor of his son in law, Mir Qasim.

Mir Qasim ceded Burdwan, Midnapore and Chittagong. He shifted his capital to from Mursidabad to Monghur. Mir Qasim soon revolted as he was angry with the British for misusing the destakes (free duty passes). However, having been defeated by the British, he fled to Awadh, where he formed a confederacy with Shuja-ud-daulah and Shah Alam.



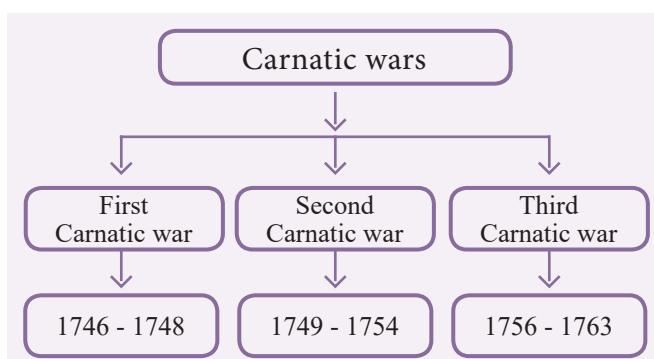
Battle of Buxar (1764)

The Battle was fought on October 22, 1764 at Buxar, a “small fortified town” within the territory of Bihar, located on the banks of the Ganges river about 130 kilometers west of Patna. It was a decisive victory for the British East India Company. Shuja-ud-daulah, Shah Alam and Mir Qasim were defeated by General Hector Munro. Mir Jafar was again placed on the throne. On Mir Jafar’s death, his son Nizam-ud-daulah was placed on the throne and signed Allahabad Treaty on 20th February 1765 by which the Nawab had to disband

most of his army and to administer Bengal through a Deputy Subahdar nominated by the company. Robert Clive concluded two separate treaties with Shuja-ud-daulah and Shah Alam II. Dual System of government started in Bengal.

Carnatic wars

In the 18th century, three Carnatic wars were fought between various Indian rulers, British and French East Indian Company on either side. Traditionally, Britain and France were rival countries in Europe. Their rivalry continued in India over trade and territories. It resulted in a series of military conflicts in the south known as the Carnatic wars which spanned from 1746 to 1763. These wars resulted in establishment of political supremacy of British East Indian Company.



First Carnatic war

On the outbreak of the Austrian war of succession in Europe the English and the French were on opposite camps increased the hostility between these two forces. The echo of this war was felt in India.

Battle of Adayar (1746)

The First Carnatic War is remembered for the battle of San. Thome (Madras) fought between the French forces and the forces of Anwar-ud-din, the Nawab of Carnatic, who appealed the British for help. A small French army under Captain Paradise defeated the strong Indian army under Mahfuz Khan



at San. Thome on the banks of the River Adayar. This was the first occasion when the superiority of the well-trained and well-equipped European army over the Indian army was proved beyond doubt.

Treaty of Aix-la-Chapelle (1748)

The war was ended by the treaty of Aix-la-Chapelle which brought the Austrian War of Succession to an end. Under the terms of this treaty, Madras was returned back to the English, and the French, in turn, got their territories in North America.

Second Carnatic War

The main cause of this war was the issue of succession in Carnatic and Hyderabad. Anwaruddin Khan and Chanda Sahib were the two claimants to the throne of Carnatic, whereas Nasir Jang and Muzaffar Jang were claimants to the throne of Hyderabad. The French supported Chanda sahib and Muzaffar Jang, while the British supported the other claimants with the objective of keeping their interest and influence in the entire Deccan region.

Battle of Ambur (1749)

Finally Dupleix, Chanda Sahib and Muzaffar Jang formed a grand alliance and defeated and killed Anwar-ud-din Khan, the Nawab of Carnatic, on 3 August 1749 in the Battle of Ambur. Muhammad Ali, the son of Anwar-ud-din, fled to Trichinopoly. Chanda Sahib became the Nawab of Carnatic and rewarded the French with the grant of 80 villages around Pondicherry.

In the Deccan, too, the French defeated and killed Nasir Jang and made Muzaffar Jang as the Nizam. The new Nizam gave ample rewards to the French. He appointed Dupleix as the governor of all the territories in south of the river Krishna. Muzaffar Jang was assassinated by his own people in 1751. Salabat Jang, brother of Nasir Jang was raised to the throne by Bussy. Salabat Jang granted

the Northern Circars excluding the Guntur District to the French. Dupleix's power was at its zenith by that time.

Battle of Arcot (1751)

In the meantime, Dupleix sent forces to besiege the fort of Trichy where Muhammad Ali had taken shelter. Chanda Sahib also joined with the French in their efforts to besiege Trichy. Robert Clive's proposal was accepted by the British governor, Saunders, and with only 200 English and 300 Indian soldiers, Clive was entrusted the task of capturing Arcot. His attack proved successful.

Robert Clive defeated the French at Arni and Kaveripak. With the assistance of Lawrence, Chanda Sahib was killed in Trichy. Muhammad Ali was made the Nawab of Arcot under British protection.

The French Government recalled Dupleix to Paris.



Robert Clive

Treaty of Pondicherry (1755)

Dupleix was succeeded by Godeheu who agreed the treaty of Pondicherry. According to it, both the powers agreed not to interfere in the internal affairs of the native states. They were to retain their old positions. New forts should not be built by either power. The treaty made the British stronger.

The second Carnatic war also proved inconclusive. The English proved their superiority on land by appointing Mohammad Ali as the Nawab of Carnatic. The French were still very powerful in Hyderabad. However, the predominant position of the French in the Deccan peninsula was definitely undermined in this war.

Third Carnatic War

The outbreak of the Seven Years' War in Europe led to the third Carnatic war in



India. By this time, Robert Clive established the British power in Bengal by the Battle of Plassey which provided them with the necessary finance for the third Carnatic war.

Count de Lally was deputed from France to conduct the war from the French side. He easily captured Fort St. David. He ordered Bussy to come down to the Carnatic with his army, to make a united effort to push the British out of the Carnatic. Taking advantage of Bussy's departure, Robert Clive sent Colonel Forde from Bengal to occupy the Northern Circars (parts of Andhra Pradesh and Odisha).

Battle of Wandiwash (1760)

The decisive battle of the third Carnatic war was fought on January 22, 1760. The English army under General Eyre Coote totally routed the French army under Lally. Within a year the French had lost all their possessions in India. Lally returned to France where he was imprisoned and executed.

Treaty of Paris (1763)

The Seven Years' War was concluded by the treaty of Paris. The French settlements including Pondicherry were given back to the French. But they were forbidden from fortifying those places. They were not allowed to gather armies. The French dominance in India practically came to an end.

Mysore and its Resistance to British Expansion

The state of Mysore rose to prominence in the politics of South India under the leadership of Haider Ali (1760-82). He and his son Tipu Sultan (1782-99) played a prominent role against the expansion of British Empire in India. Both of them faced the English with undoubted courage. In 1761, he became the de facto ruler of Mysore. He also proved to be the most formidable enemy of the English in India.

The First Anglo-Mysore War

Causes

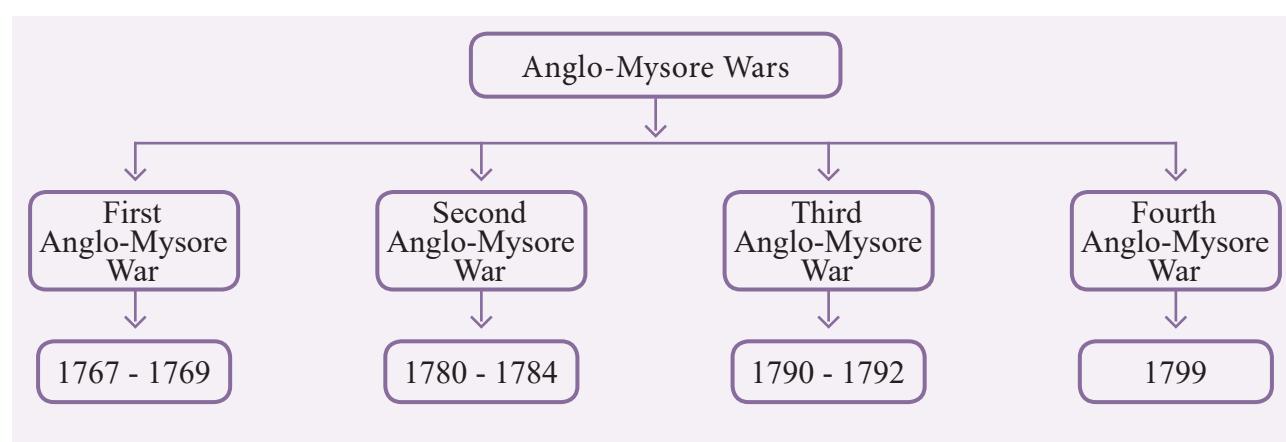
- Haider Ali's growing power and his friendly relations with the French became a matter of concern for the English East India Company.
- The Marathas, the Nizam and the English entered into a triple alliance against Haider Ali.

Course

The Nizam, with the help of British troops under General Joseph Smith, invaded Mysore in 1767. Haider Ali defeated English and captured Mangalore. In March 1769, he attacked Madras and forced the English to sign a treaty on 4 April 1769.

Treaty of Madras (1769)

At the end of the war, the Treaty of Madras was signed between Haider Ali and





British East India Company. Both the parties returned the conquered territories and promised to help each other in case of any foreign attack on them.

The Second Anglo-Mysore War

Causes

- The English did not fulfill the terms of the treaty of 1769, when Haider's territories were attacked in 1771 by Marathas, Haider did not get help from the British.
- British captured Mahe, a French settlement within Haider's Jurisdiction. It led to the formation of an alliance by Haider with the Nizam and Marathas against the English in 1779.

Course

In 1781, the British General Sir Eyre Coote defeated Haider Ali at Porto Novo. The Mysore forces suffered another defeat at Solinger. Haider Ali died of cancer during the course of the war. After the death of Haider Ali in 1782, his son Tipu Sultan, continued the war against the English.

Tipu captured Brigadier Mathews, the supreme commander of the British forces along with his soldiers in 1783. It was a serious loss to Tipu.

Treaty of Mangalore (1784)

On 7th March 1784 the treaty of Mangalore was signed between the two parties. Both agreed to return the conquered territories and also the prisoners of war.

Thus, Warren Hastings saved the newly-established British dominion from the wrath of powerful enemies like Marathas and Haider Ali. When the British lost their colonies in America and elsewhere, Warren Hastings lost nothing in India. Instead, he consolidated the British power in India.

The Third Anglo-Mysore War

Causes

- Tipu was trying to seek alliance of foreign

powers against the English and for that purpose he had sent his ambassadors to France and Turkey.

- Tipu attacked on Travancore in 1789 whose ruler was an ally of the British.
- The English, the Nizam and the Marathas entered into a "Triple Alliance" against Mysore.

Course

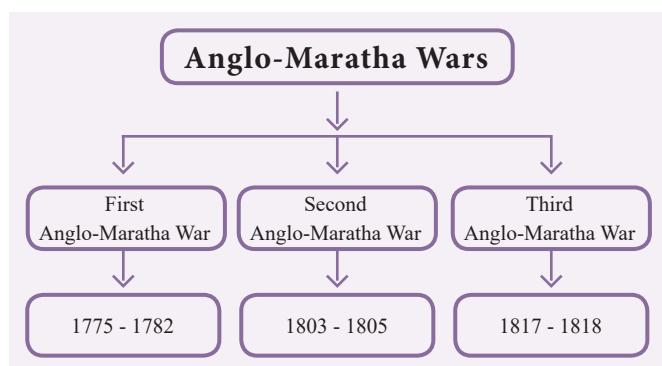
Tipu fought alone which continued for two years. It was fought in three phases. The attack of the English under General Medows failed. Therefore, in December 1790, Cornwallis himself took the command of the army. Cornwallis captured all the hill-forts which obstructed his advance towards Srirangapatnam and reached near its outer wall. Tipu felt desperate and opened negotiations with the English. Cornwallis agreed and the treaty of Srirangapatnam was concluded in 1792.

Treaty of Srirangapatnam (1792)

- Tipu surrendered half of his kingdom to the allies.
- Tipu agreed to pay 3.6 crore of rupees to the English as war indemnity and surrendered two of his sons as hostages to the English.
- The English acquired Malabar, Coorg, Dindigul and Baramahal(Coimbatore and Salem).

The Fourth Anglo-Mysore War

Tipu Sultan did not forget the humiliating treaty of Srirangapatnam imposed upon him by Cornwallis in 1790.





Causes

- Tipu sought alliance with foreign powers against the English and sent ambassadors to Arabia, Turkey, Afghanistan and the French.
- Tipu was in correspondence with Napoleon who invaded Egypt at that time.
- The French officers came to Srirangapatnam where they founded a Jacobin Club and planted the Tree of Liberty.

Course

Wellesley declared war against Tipu in 1799. The war was short and decisive. As planned, the Bombay army under General Stuart invaded Mysore from the west. The Madras army, which was led by the Governor-General's brother, Arthur Wellesley, forced Tipu to retreat to his capital Srirangapatnam. On 4th May 1799 Srirangapatnam was captured. Tipu fought bravely and was killed finally. Thus ended the fourth Mysore War and the whole of Mysore lay prostrate before the British.

Mysore after the War

- The English occupied Kanara, Wynad, Coimbatore, Darapuram and Srirangapattinam.
- Krishna Raja Odayar of the former Hindu royal family was brought to the throne.
- Tipu's family was sent to the fort of Vellore.

Anglo-Maratha Wars

The Marathas managed to overcome the crisis caused by their defeat at Panipat and after a decade recovered their control over Delhi. However the old Maratha Confederacy controlled by the Peshwa had given way to five virtually independent states. Peshwa at Pune, Gaikwads at Baroda, Bhonsle at Nagpur, Holkars at Indore, and Scindias at Gwalior. The Peshwa's government was weakened by internal rivalries, and the other four leaders were often hostile to one another. Despite this, the Marathas were still a formidable power. The internal conflict among the

Marathas was best utilized by the British in their expansionist policy.

First Anglo-Maratha War

In the case of the Marathas, the first British intervention was at the time of dispute over succession to the Peshwaship following the death of Narayan Rao. After the death of Narayan Rao, Raghunath Rao (Raghoba) became the Peshwa, but his authority was challenged by a strong party at Poona under Nana Phadnavis. The party recognised the infant born posthumously to Narayan Rao's wife, Ganga Bai, as the Peshwa and set up a council of regency in his name. Having failed in his bid to capture power, Raghunath Rao approached the British for help. The Treaty of Surat between the English and Raghunath Rao was concluded in 1775. However, the majority of the Supreme British Council in Calcutta was opposed to the Surat treaty, although Warren Hastings himself had no objection to ratifying the treaty. The council sent Colonel Upton to Poona to negotiate a peace with the Poona regency. Accordingly, Upton concluded the Treaty of Purandhar in 1776. The treaty, however, did not take effect due to opposition from the English government in Bombay.

In 1781, Warren Hastings dispatched British troops under Captain Popham. He defeated the Maratha chief, Mahadaji Scindia, in a number of small battles and captured Gwalior. Later on 17th May 1782, the Treaty of Salbai was signed between Warren Hastings and Mahadaji Scindia.

Results

- Raghunath Rao was pensioned off and Madhav Rao II was accepted as the Peshwa.
- Salsette was given to the British.
- The Treaty of Salbai established the British influence in Indian politics. It provided the British twenty years of peace with the Marathas.



The internal affairs of the Marathas

The internal affairs of the Marathas deteriorated further after the close of the first Maratha War. Nana Fadnavis grew fond of power, jealous of Mahadaji Scindia and became progressively inclined to seek the support of the English. The young Peshwa, Madhava Rao II, tried to improve the affairs but could not check the rivalry of the Maratha chiefs. Mahadaji Scindia died in 1794 and was succeeded by his grand nephew Daulat Rao Scindia. His death left Nana Fadnavis supreme at Poona and the English to expand their influence in north India. Peshwa Madhav Rao II committed suicide in 1795, and BajiRao II, worthless son of RaghunathRao, became the Peshwa. The death of Nana Phadnavis in 1800 gave the British an added advantage.

Jaswant Rao Holkar and Daulat Rao Scindia were fighting against each other. The Peshwa supported Scindia against Holkar. The Peshwa and the Scindia agreed to help each other. Holkar marched against the Peshwa. The combined forces of Scindia and the Peshwa were utterly defeated in 1802 and captured the city. BajiRao II approached Lord Wellesley, the then Governor-General of India, for help. Lord Wellesley welcomed the Peshwa and made him sign the Treaty of Bassein, in other words, the Treaty of Subsidiary Alliance, accepting the status of a British subsidiary in 1802. As an immediate to the Treaty of Bassein, the British troops marched under the command of Arthur Wellesley towards Poona and restored the Peshwa to his position. The forces of Holkar vanished from the Maratha capital.

The Second Anglo-Maratha War

After accepted the subsidiary alliance by the Peshwa, DaulatRaoScindia and RaghojiBhonsle attempted to save Maratha's independence. But the well prepared and organised army of the English under Arthur Wellesley defeated the combined armies of Scindia and Bhonsle at Assaye and Argaon.

The English forced them to conclude separate subsidiary treaties namely the Treaty of Deogaon and the Treaty of Surji-Arjungaon respectively in 1803. But, YashwantRaoHolkar (also called as JaswantRaoHolkar) was yet undefeated. He had not participated in the war so far. Holkar plundered the territory of Jaipur and, in 1804, the English declared war against him. YashwantRaoHolkar made an attempt to form a coalition of Indian rulers to fight against the British. But his attempt proved unsuccessful. The Marathas were defeated, reduced to British vassalage and isolated from one another.

Results

- The Maratha power was gradually weakened.
- The English East India Company started becoming the paramount power in India.

The Third Anglo-Maratha War

The Third Anglo-Maratha War was the final and decisive conflict between the British East India Company and the Maratha Empire in India. It began with an invasion of the Maratha territory by British East India Company troops. The troops were led by the Governor General Hastings and he was supported by a force under General Thomas Hislop. The Peshwa BajiRao II's forces, followed by those of Mudhoji II Bhonsle of Nagpur and Malharrao Holkar III of Indore, rose against the British. Daulatrao Scindia of Gwalior remained neutral. The Peshwa was defeated in the battles of Khadki and Koregaon and several minor battles were fought by the Peshwa's forces to prevent his capture. Bhonsle was defeated in the battle of Sitabaldi and Holkar in the battle of Mahidpur.

Results

- The Maratha confederacy was dissolved and Peshwaship was abolished.
- Most of the territory of Peshwa BajiRao II was annexed and became part of the Bombay Presidency.



- The defeat of the Bhonsle and Holkar also resulted in the acquisition of the Maratha kingdoms of Nagpur and Indore by the British.
- The BajiRao II, the last Peshwa of Maratha was given an annual pension of 8 lakh rupees.

The British Administrative Organisation in India

The British Indian administration was run by four principal institutions - Civil Services, Army, Police and Judiciary.

Civil Services

The term 'civil service' was used for the first time by the East India Company to distinguish its civilian employees from their military counterparts. Translating law into action and collecting revenue were the main jobs of the civil service. The civil service was initially commercial in nature but later it was transformed into a public service. In the beginning, the appointment to these services was the sole prerogative of the Court of Directors of the Company. But the nominated civil servants indulged in corruption, bribery and illegal private trade. So, Cornwallis who came to India as Governor-General in 1786, enforced the rules against private trade. He also raised the salary of the Company's servants who became the highest paid civil servants in the world.

Lord Wellesley, who came to India as Governor-General in 1798, introduced the idea of suitable training for the civil servants in India. In 1800, he established the College in Fort William at Calcutta to provide training in literature, science and languages. However, the directors of the Company disapproved of his action and replaced it by their own East India College, established at Haileybury in England in 1806.

The idea of competition for recruitment was introduced first by the Charter Act, 1833.

But the system of competition was these not nominated by the Court of Directors were not eligible to write the competitive examination. Hence, the system was called as nomination-cum-competition system. The system of recruitment on the basis of open competitive examination was introduced in 1853. This system was confirmed by the Government of India Act of 1858. The maximum age for competitors was fixed at 23. Subsequently, East India College at Haileybury was abolished in 1858, and recruitment to civil services became the responsibility of the civil service commission. By the Regulation of 1860 the maximum age was lowered to 22, in 1866 to 21 and in 1876 to 19.

The Indian Civil Service Act of 1861 passed by the British Parliament exclusively reserved certain categories of high executive and judicial posts for the covenanted civil service which was later designated as the Indian Civil Service. Due to the lowering of age limit and holding of examination in London it could be possible only for a very few wealthy Indians to appear at the I.C.S. examination. In 1869, three Indians - Surendra Nath Banerje, Ramesh Chandra Dutt and Bihari Lal Gupta became successful in the I.C.S. examination.



Satyendranath Tagore, the elder brother of poet Rabindranath Tagore, was the first Indian to pass the I.C.S. Examination in 1863.

Later on, the Indians demanded to increase the age limit and to establish centre for examination in India instead of England. In 1892, the minimum age limit for appearing for the Civil Service Examination was raised to 21 and the maximum to 23. In 1912, a Royal Commission on Public Service was appointed. Chaired by Lord Islington, this commission had two Indian members - G.K. Gokhale and Sir Abdur Rahim - besides four Englishmen. The Commission published



its report in 1917. Islington commission's recommendations partly fulfilled the demand for the Indianisation of Civil Service.

In 1918, Montague and Lord Chelmsford recommended that 33% Indian should be recruited in Indian Civil Services and gradually the number should be increased. In 1923, a Royal Commission on Public Services was appointed with Lord Lee of Fareham as chairman. This commission recommended that recruitment to all-Indian services like the Indian Civil Service, the Indian Police Service and the Indian Forest Service should be made and controlled by the Secretary of State for India. The Lee Commission recommended the immediate establishment of a Public Service Commission.

The Act of 1935 also made provisions for the establishment of a Federal Public Service Commission at the Centre and the Provincial Public Service Commissions in the various provinces. Provision was also made for a Joint Public Service Commission in two or more Provinces. Although, the main aim of this measure was to serve the British interests, it became the base of the civil service system in independent India.

Army

The army was the second important pillar of the British administration in India. The East India Company started recruiting its own army, which came to be known as the sepoy (from sipahi or soldier) army. That sepoy army was trained and disciplined according to European military standards and was commanded by European officers in the battlefield. During the early stage of British rule, three separate armies had been organised in three Presidencies of Bengal, Bombay and Madras. Army had a great contribution in the establishment and expansion of British rule in India. Indian soldiers were given less salaries and allowances than English



soldiers. In 1857, the Indians constituted about 86 percent of the total strength of the Company's army. However, the officers of the army were exclusively British. For example, in 1856, only three Indians in the army received a salary of 300 rupees per month. The highest rank an Indian could ever reach was that of a subehdar.

Strength of British Army

- Plassey war (1757): 1950 European infantry, 100 European artillery, 50 English sailors, and 2,100 Indian sepoys, an English army of 6000 troops was maintained in Bengal.
- In 1857, the strength of the army in India was 3,11,400 of whom 2,65,900 were Indians. Its officers were British.

After the revolt of 1857, the important changes were made in the Indian army services in 1858. They increased British troops and reduced Indian troops. Also, only English were appointed in artillery.

Police

When the East India Company took over the diwani in 1765, the Mughal police system was under the control of faujdars, who were in charge of their 'sarkars' or rural districts. The kotwals were in charge of towns, while the village watchmen were paid and controlled by the Zamindars.

The police system was created by Lord Cornwallis. He relieved the Zamindars from police functions and established a regular police force in 1791. Cornwallis established a system of circles or 'thanas' each headed by a 'daroga'. The authority of the daroga extended to village watchmen who performed the police duties in the villages. The hereditary village police became 'chowkidars'. In the big cities, the old office of kotwal was, however, continued, and a daroga was appointed to each of the wards of a city. The daroga system was extended to Madras in 1802.



Before the post of district superintendent of police was created, all the thanas were under the general supervision of the district judge. In 1808, a Superintendent of Police was appointed for each division. Later, the district collector was entrusted with the task of controlling the police force in the districts. The main task of the police was to handle crime and to prevent conspiracy against the British rule.

Judicial system

In 1772, the Dual Government was abolished and the Company took over the direct responsibility for the collection of revenue as well as the administration of justice. Consequently a Diwani Adalat and Faujdari Adalat were established. By the Regulating Act of 1773, a Supreme Court was set up in Calcutta. This court consisted of a chief justice and three puisne judges who were appointed by the Crown. This court decided civil, criminal, ecclesiastical and admiralty cases. On the model of the Supreme Court of Calcutta, a Supreme Court was established in Madras in 1801 and in Bombay in 1823. In 1832, William Bentinck started jury system in Bengal. A Indian Law Commission was established to compile the laws. A rule of law was established for the whole empire. According to the Indian High Courts Act, 1861, three High Courts were set up in Calcutta, Bombay and Madras in place of the old Supreme Courts.

Do YOU KNOW?

Sir Elija Impey was the first Chief Justice of the Supreme Court at Fort William in Bengal. Sir Thiruvarur Muthusamy Iyyar was the first Indian Chief Justice of the Madras High Court.

The Subsidiary Alliance

Lord Wellesley introduced the system of Subsidiary Alliance to bring the princely states

under the control of the British. It was the most effective instrument for the expansion of the British territory and political influence in India. The princely state was called 'the protected state' and the British came to be referred as 'the paramount power'. It was the duty of the British to safeguard the state from external aggression and to help its ruler in maintaining internal peace.

Main Features of Subsidiary Alliance

- An Indian ruler entering into this alliance with the British had to dissolve his own armed forces and accept British Forces.
- A British Resident would stay in his capital.
- Towards the maintenance charges of the army, he should make annual payments or cede some territory permanently to the Company.
- All the non-English European officials should be turned out of his state.
- The native ruler should deal with foreign states only through the English Company.
- The British would undertake to defend the state from internal trouble as well as external attack.

Merits for the British

- The British Company maintained a large army at the expense of the Indian rulers.
- All Frenchmen in the service of native rulers were dismissed, and the danger of French revival was completely eliminated.
- The British Company began to control the foreign policy of the Princely States.
- Wellesley's diplomacy made the British the paramount power in India. He transformed the British Empire in India into the British empire of India.

Defects of the Princely states

The Subsidiary Alliances made the Indian rulers weak, oppressive and irresponsible.



Protected by British arms, they neglected their duty towards their subjects and even exploited them.

The first Indian state to accept the Subsidiary Alliance was Hyderabad (1798). It was followed by Tanjore (1799), Auadh (1801), Peshwa (1802), Bhonsle (1803), Gwalior (1804), Indore (1817), Jaipur, Udaipur and Jodhpur (1818).

Doctrine of Lapse

Lord Dalhousie was one of the chief architects of the British Empire in India. He was an imperialist. He adopted a new policy known as Doctrine of Lapse to extend British Empire. He made use of this precedent and declared in 1848 that if the native rulers adopted children without the prior permission of the Company, only the personal properties of the rulers would go to the adopted sons and the kingdoms would go to the British paramount power. This principle was called the Doctrine of Lapse. It was bitterly opposed by the Indians and it was one of the root causes for the great revolt of 1857.

By applying the Doctrine of Lapse policy, Dalhousie annexed Satara in 1848, Jaipur and Sambalpur in 1849, Baghat in 1850, Udaipur in 1852, Jhansi in 1853 and Nagpur in 1854.

Factors for the success of the British

- greater naval power.
- development of textile.
- scientific division of labour.
- economic prosperity and skilful diplomacy of the British.

- feelings of insecurity among the Indian merchants.
- the inequality and ignorance of the Indian kings.

Conclusion

The Battle of Plassey was the foundation of British dominion in India. The company's administration was not for the interests of people. It was imperialistic, expansionist and exploitative. It brought more Indian territories under British domain through subsidiary Alliance and Doctrine of Lapse. This policy led to a South Indian rebellion (1800-01), Vellore Rebellion (1806) and the Great Rebellion (1857).

Recap

- Siraj-ud-daula ascended the throne of Bengal.
- On 9th February 1757, Treaty of Alinagar was signed.
- The Carnatic wars which spanned from 1746 to 1763.
- Tipu agreed to pay 3.6 crore of rupees to the English as war indemnity.
- Wellesley declared war against Tipu in 1799.
- Cornwallis established a system of circles or 'thanas' each was headed by a 'daroga'.
- Sir Elijah Impey was the first Chief Justice of the Supreme Court at Fort William in Bengal.
- Lord Wellesley introduced the system of Subsidiary Alliance to bring the princely states under the control of the British.
- Lord Dalhousie was one of the chief architects of the British Empire in India.



GLOSSARY

Confederacy	a league or alliance	கூட்டமைப்பு
Ecclesiastical	relating to the Christian Church or its clergy	திருச்சபை தொடர்பான
Entrust	assign the responsibility	ஒப்படைப்பு
Hostility	opposition	எதிர்ப்பு
Negotiation	discussion aimed at reaching an agreement	பேச்சுவார்த்தை
Paramount	supreme	தலையாய்
Predominant	the most powerful	மிகுந்த வலிமை



I. Choose the correct answer.

1. The ruler of Bengal in 1757 was _____.
a. Shuja-ud-daulah
b. Siraj – ud – daulah
c. Mir kasim
d. Tippu Sultan
2. The Battle of Plassey was fought in _____.
a. 1757 b. 1764 c. 1765 d. 1775
3. Which among the following treaty was signed after Battle of Buxar?
a. Treaty of Allahabad
b. Treaty of Carnatic
c. Treaty of Alinagar
d. Treaty of Paris
4. The Treaty of Pondicherry brought the _____ Carnatic war to an end .
a. First b. Second
c. Third d. None
5. When did Hyder Ali crown on the throne of Mysore?
a. 1756 b. 1761 c. 1763 d. 1764



6. Treaty of Mangalore was signed between _____.

- a. The French and Tippu Sultan
 - b. Hyder Ali and Zamorin of Calicut
 - c. The British and Tippu Sultan
 - d. Tippu Sultan and Marathas
7. Who was the British Governor General during Third Anglo-Mysore War?
a. Robert Clive b. Warren Hastings
c. Lord Cornwallis d. Lord Wellesley
 8. Who signed the Treaty of Bassein with the British?
a. Bajirao II
b. Daulatrao Scindia
c. Sambhaji Bhonsle
d. Sayyajirao Gaekwad
 9. Who was the last Peshwa of Maratha empire?
a. Balaji Vishwanath b. Baji Rao II
c. Balaji Baji Rao d. Baji Rao
 10. Who was the first Indian state to join the subsidiary Alliance?
a. Oudh b. Hyderabad
c. Udaipur d. Gwalior



II. Fill in the blanks

1. The Treaty of Alinagar was signed in _____.
2. The commander in Chief of Sirajuddaulah was _____.
3. The main cause for the Second Carnatic war was _____.
4. _____ adopted the policy of Doctrine of Lapse to extend the British Empire in India.
5. Tippu Sultan was finally defeated at the hands of _____.
6. After the death of Tippu Sultan Mysore was handed over to _____.
7. In 1800, _____ established a college at Fort William in Calcutta.

III. Match the following

1.	Treaty of Aix-La-Chapple	First Anglo Mysore War
2.	Treaty of Salbai	First Carnatic War
3.	Treaty of Paris	Third Mysore War
4.	Treaty of Srirangapatnam	First Maratha War
5.	Treaty of Madras	Third Anglo Mysore War

IV. State True or False

1. After the death of Alivardi Khan, Siraj-ud-daulah ascended the throne of Bengal.
2. Hector Munro, led the British forces in the battle of Plassey.
3. The outbreak of the Austrian war of succession in Europe was led to Second Carnatic War in India.
4. Sir Elia Impey was the first Chief Justice of the Supreme Court at Fort William in Bengal.
5. The Police system was created by Lord Cornwallis.

V. Which one of the following is correctly matched?

1. Battle of Adayar – 1748
2. Battle of Ambur – 1754
3. Battle of Wandiwash – 1760
4. Battle of Arcot – 1749

VI. Answer the following in one or two sentences

1. Write a short note on Black Hole Tragedy.
2. What were the benefits derived by the English after the Battle of Plassey?
3. Mention the causes for the Battle of Buxar.
4. What were the causes for the First Mysore War?
5. Bring out the results of the Third Maratha War.
6. Name the states signed into Subsidiary Alliance.

VII. Answer the following in detail.

1. Write an essay on second Carnatic war.
2. Give an account of the Fourth Anglo Mysore war.
3. Describe the policy adopted by Lord Dalhousie to expand the British empire in India.
4. How did Lord Wellesley expand the British power in India?

VIII. HOTs

Explain the causes for the success of the English in India.

IX. Mark the following on the River map of India

1. Plassy 2. Buxar
3. Purandhar 4. Arcot 5. Wandiwash

X. Life skill

Collect pictures, stories, poems and information about Hyder Ali and Tippu Sultan.



XI. Project and Activity

Organize a discussion in your class on the reasons for the defeat of the Indian rulers at the hands of the British.



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<https://www.ducksters.com/>

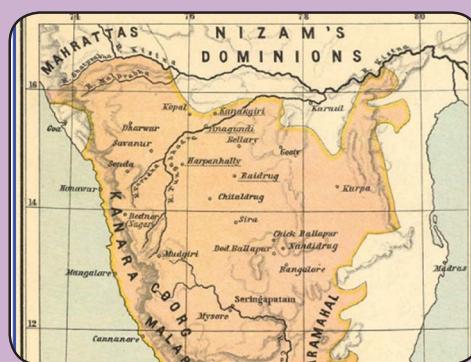
[https://en.wikipedia.org/wiki/Indian_Civil_Service_\(British_India\)](https://en.wikipedia.org/wiki/Indian_Civil_Service_(British_India))



ICT CORNER

FROM TRADE TO TERRITORY / STRUGGLE FOR POWER - RISE OF THE BRITISH

Through this activity you will know about the maps of India (Colonial Period)



Steps

- Open the Browser and type the URL given below (or) Scan the QR Code.
- Scroll down, click any period (ex. COLONIAL MAPS)
- Click the topics one by one and explore the maps (ex. Historical maps, c.1750 to 1800)

Website URL:

<http://ektara.org/magazine/histmaps.html>

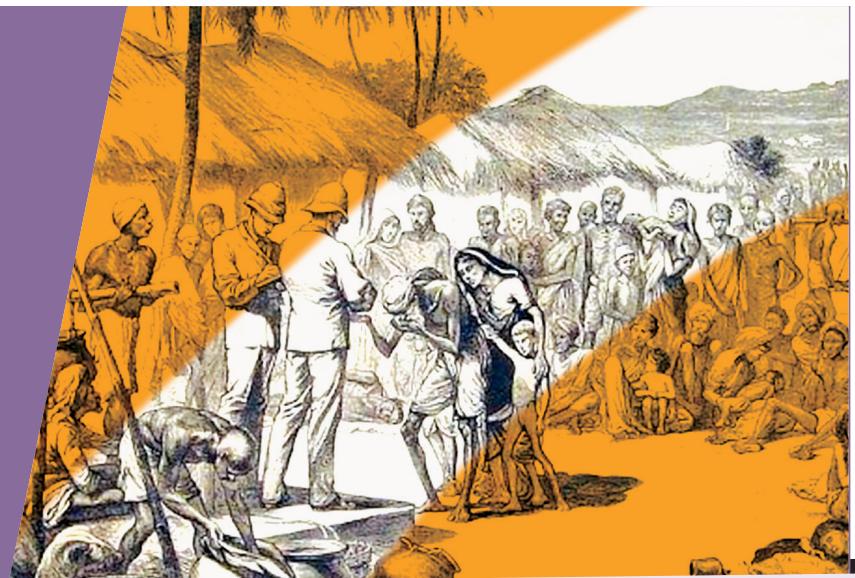


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Unit - 3

Rural Life and Society



Learning Objectives

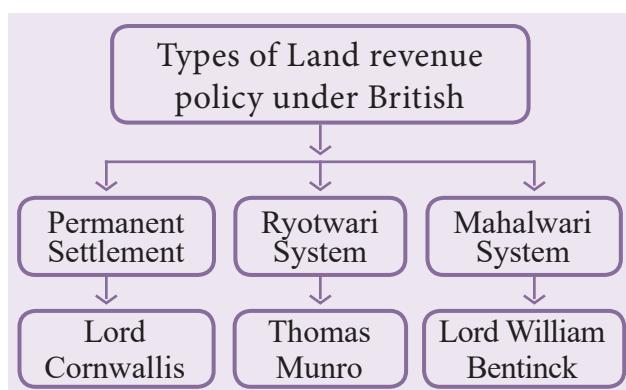
- ▶ To know the land revenue policy under the British Rule
- ▶ To understand the Merits and Demerits of the land revenue policy
- ▶ To know the agrarian crisis and revolts



Introduction

In the pre-colonial period, Indian economy was predominantly an agrarian economy. Agriculture was then the primary occupation of the people and even industries like textiles, sugar, oil, etc. were dependent on it. The British Government in India did not adopt a pro-Indian agriculture and land revenue policy. British Government introduced three major land revenue and tenurial systems in India, namely, the Permanent Settlement, the Mahalwari system and the Ryotwari system. The economic exploitation of the peasants led to the revolt in future.

The Land Revenue Policy under the British



Permanent Settlement

When Robert Clive obtained the Diwani of Bengal, Bihar and Orissa in 1765, there used to be an annual settlement (of land revenue). Warren Hastings changed it from annual to quinquennial (five-yearly) and back to annual again. During the time of Cornwallis, a ten years' (decennial) settlement was introduced in 1793 and it was known Permanent Settlement.

Permanent settlement were made in Bengal, Bihar, Orissa, Varanasi division of U.P., and Northern Karnataka, which roughly covered 19 percent of the total area of British India. It was known by different names like Zamindari, Jagirdari, Malguzari and Biswedari.



Lord Cornwallis

Salient Features of the Permanent Settlement

- The Zamindars were recognised as the owners of land as long as they paid the revenue to the East India Company regularly.
- The Zamindars acted as the agent of the



Government for the collection of revenue from the cultivators.

- The amount of revenue that the Zamindars had to pay to the Company was firmly fixed and would not be raised under any circumstances.
- They gave 10/11 of the revenue collected by them from the cultivator to the Government.
- The Zamindars would grant patta (written agreements) to the ryots. The ryots became tenants since they were considered the tillers of the soil.
- All judicial powers were taken away from the Zamindars.

Merits

- Under this system many of the waste lands and forests became cultivable lands.
- The Zamindars became the owner of the land.
- The Zamindars were made free from the responsibility of providing justice.
- The Zamindars remained faithful to the British Government.
- This system secured a fixed and stable income for the British Government.

Demerits

- The British Government had no direct contact with the cultivators.
- The rights of the cultivators were ignored and they were left at the mercy of the Zamindars.
- The peasants were almost treated as serfs.
- This system was made the Zamindars lethargic and luxurious.
- Many conflicts between the zamindars and the peasants arose in rural Bengal.

Ryotwari system

Ryotwari system was introduced by Thomas Munro and Captain Read in 1820. Major areas of introduction of Ryotwari system included Madras, Bombay, parts of Assam, and Coorg provinces of British India. By Ryotwari system

the rights of ownership was handed over to the peasants. British government collected taxes directly from the peasants. Initially, one-half of the estimated produce was fixed as rent. This assessment was reduced to one-third of the produce by Thomas Munro. The revenue was based on the basis of the soil and the nature of the crop.



Thomas Munro

Rents would be periodically revised, generally after 20 to 30 years. The position of the cultivators became more secure. In this system the settlement was made between the Government and the Ryots. Infact, the Government later claimed that the land revenue was rent and not a tax.

Salient Features of the Ryotwari system

- Revenue settlement was done directly with the ryots.
- Measurement of field and an estimate of produce was calculated.
- Government fixed the demand at 45 to 55 percent of the produce.

Effects of the Ryotwari Settlement

- In most areas the land revenue fixed was excessive; the ryots were hardly left with bare maintenance even in the best of seasons.
- Under this system the government exploited the farmers instead of zamindars.

Mahalwari system

Mahalwari system, a brain child of Holt Mackenzie was modified version of the Zamindari settlement introduced in the Ganga valley, the North-West Province, parts of the Central India and Punjab in 1822. Lord William Bentinck was to



Lord William Bentinck



suggest radical changes in the Mahalwari system by the guidance of Robert Martin Bird in 1833. Assessment of revenue was to be made on the basis of the produce of a Mahal or village. All the proprietors of a Mahal were severally and jointly responsible for the payment of revenue. Initially the state share was fixed two-thirds of the gross produce. Bentinck, therefore, reduced to fifty percent. The village as a whole, through its headman or Lambardar, was required to pay the revenue. This system was first adopted in Agra and Awadh, and later extended to other parts of the United Provinces. The burden of all this heavy taxation finally fell on the cultivators.

Salient Features of the Mahalwari Settlement

- The Lambardar acted as intermediaries between the Government and the villagers.
- It was a village-wise assessment. One person could hold a number of villages.
- The village community was the owner of the village common land.
- The village land belonged to the village community.

Effects of the Mahalwari Settlement

- The Lambardar enjoyed privileges which was misused for their self-interest.
- This system brought no benefit to the cultivators.
- It was a modified version of the Zamindari system and benefited the upper class in villages.

Impact of the British land revenue system on the cultivators

- A common feature of all the settlements was the assessment and the maximize income from land. It resulted in increasing land sales and dispossession.
- The peasants were overburdened with taxation. Due to the tax burden and famines, in general, the people suffered in poverty and burdened with debts. They had to seek the moneylenders who became rich and acquired lands from the peasants.

- The Zamindars, money-lenders and lawyers exploited the poor peasants.
- The stability and continuity of the Indian villages was shaken.
- Cottage industries disappeared on account of the import of British goods and the peasants had nothing to supplement their income.
- The old body of custom was replaced by new apparatus of law, courts, fees, lawyers and formal procedures.
- The British policy proved advantageous only to the government of a privileged section of the society at the cost of the cultivators who were the rightful owners of their lands and claimants of the larger share of the produce.

Peasants Revolts

The British rule in India brought about many changes in the agrarian system in the country. The old agrarian system collapsed and under the new system, the ownership of land was conferred on the Zamindars. They tried to extract as much as they could from the cultivators of land. The life of the peasants was extremely miserable. The various peasant movements and uprisings during the 19th and 20th centuries were in the nature of a protest against of the existing conditions under which their exploitation knew no limits.

The Santhal Rebellion (1855-56)

The first revolt which can be regarded as peasants' revolt was the Santhal Rebellion in 1855-56. The land near the hills of Rajmahal in Bihar was cultivated by the Santhals. The landlords and money-lenders from the cities took advantage of their ignorance and began grabbing their lands. This created bitter resentment among them leading to their armed uprising in 1855. Consequently, under the belief of a divine order, around 10,000 Santals gathered under two Santhal brothers, Siddhu and Kanhu, to free their country of the foreign oppressors and set up a government of their own. The rebellion assumed a formidable shape



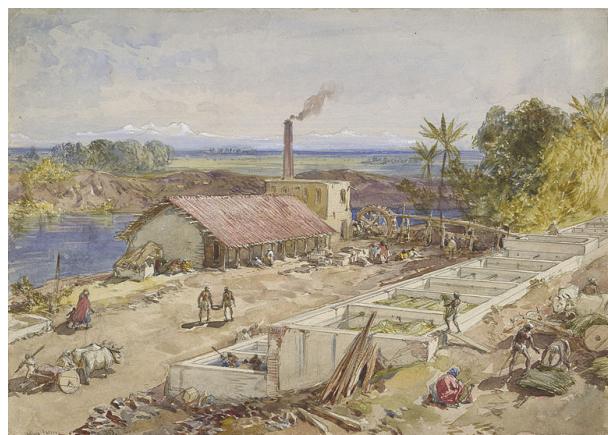
within a month. The houses of the European planters, British officers, railway engineers, zamindars and money-lenders were attacked. The rebellion continued till February 1856, when the rebel leaders were captured and the movement was put down with a heavy hand. The government declared the Parganas inhabited by them as Santhal Parganas so that their lands and identity could be safeguarded from external encroachments.



Santhal Rebellion

Indigo Revolt (1859-60)

The Bengal indigo cultivators strike was the most militant and widespread peasant uprisings. The European indigo planters compelled the tenant farmers to grow indigo at terms highly disadvantageous to the farmers. The tenant farmer was forced to sell it cheap to the planter and accepted advances from the planter that benefitted the latter. There were also cases of kidnapping, looting, flogging and burning. Led by Digambar Biswas and Bishnu Charan Biswas, the ryots of Nadia district gave up indigo cultivation in September 1859. Factories were burnt down and the revolt spread. To take control of the situation, the Government set up an indigo commission in 1860 whose recommendations formed part of the Act VI of 1862. The indigo planters of Bengal, however, moved on to settle in Bihar and Uttar Pradesh. The newspaper, Hindu Patriot brought to light the misery of the cultivators several times. Dinabandhu Mitra wrote a drama, Nil-Darpan, in Bengali with a view to draw the attention of the people and the government towards the misery of the indigo-cultivators.



**Indigo Revolt
Pabna Revolt (1873-76)**

Pabna Peasant Uprising was a resistance movement by the peasants against the oppression of the Zamindars. It originated in the Yusufshahi pargana of Pabna in Bengal. It was led by Keshab Chandra Roy. The zamindars routinely collected money from the peasants by the illegal means of forced levy, abwabs, enhanced rent and so on. Peasants were often evicted from land on the pretext of non-payment of rent.

Large crowds of peasants gathered and marched through villages frightening the zamindars and appealing to other peasants to join with them. Funds were raised from the ryots to meet the costs. The struggle gradually spread throughout Pabna and then to the other districts of East Bengal. Everywhere agrarian leagues were organized. The main form of struggle was that of legal resistance. There was very little violence. It occurred only when the zamindars tried to compel the ryots to submit to their terms by force. There were only a few cases of looting of the houses of the zamindars. A few attacks on police stations took place and the peasants also resisted attempts to execute court decrees. Hardly zamindars or zamindar's agent were killed or seriously injured. In the course of the movement, the ryots developed a strong awareness of the law and their legal rights and the ability to combine and form associations for peaceful agitation.



Deccan Riots (1875)

In 1875, the peasants revolted in the district of Poona, that event has been called the 'Deccan Riots'. The peasants revolted primarily against the oppression of local moneylenders who were grabbing their lands systematically. The uprising started from a village in Poona district when the village people forced out a local moneylender from the village and captured his property. Gradually, the uprising spread over 33 villages and the peasants looted the property of Marwari Sahukars. The uprising turned into violent when the Sahukars took help of the police. It was suppressed only when the army was called to control it. However, it resulted in passing of the Deccan Agriculturists Relief Act' which removed some of the most serious grievances of the peasants.

Punjab Peasant Movement (1890-1900)

The peasants of the Punjab agitated to prevent the rapid alienation of their lands to the urban moneylenders for failure to pay debts. The Government of India did not want any revolt in that province which provided a large number of soldiers to the British army in India. In order to protect the peasants of the Punjab, the Punjab Land Alienation Act was passed in 1900 "as an experimental measure" to be extended to the rest of India if it worked successfully in the Punjab. The Act divided the population of the Punjab into three categories viz., the agricultural classes, the statutory agriculturist class and the rest of the population including the moneylenders. Restrictions were imposed on the sale and mortgage of the land from the first category to the other two categories.



Champaran Satyagraha (1917-18)



Champaran Satyagraha

The European planters of Champaran in Bihar resorted to illegal and inhuman methods of indigo cultivation at a cost which was wholly unjust. Under the Tinkathia system in Champaran, the peasants were bound by law to grow indigo on 3/20 part of their land and send the same to the British planters at prices fixed by them. They were liable to unlawful extortion and oppression by the planters. Mahatma Gandhi took up their cause. The Government appointed an enquiry commission of which Mahatma Gandhi was a member. The grievances of the peasants were enquired and ultimately the Champaran Agrarian Act was passed in May 1918.

Kheda (Kaira) Satyagraha (1918)

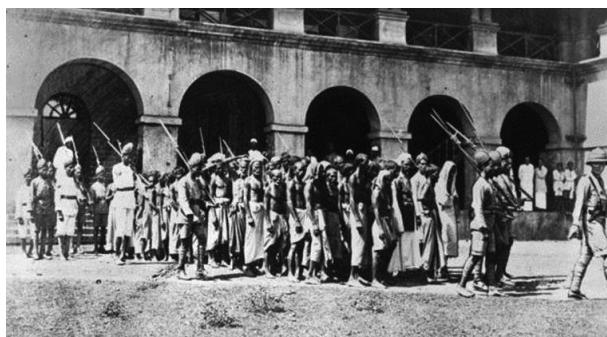
In the Kheda District of Gujarat, due to constant famines, agriculture failed in 1918, but the officers insisted on collection of full land revenue. The local peasants, therefore, started a 'no-tax' movement in Kheda district in 1918. Gandhi accepted the leadership of this movement.

Gandhiji organised the peasants to offer Satyagraha and opposed official insistence on full collection of oppressive land revenue despite the conditions of famine. He inspired the peasants to be fearless and face all consequences. The response to his call was unprecedented and the government had to bow to a settlement with the peasants. Sardar Vallabhbhai Patel emerged as an important leader of the Indian freedom struggle during this period.

Moplah Rebellion (1921)

The Muslim Moplah (or Moplah) peasants of Malabar (Kerala) was suppressed and exploited by the Hindu zamindars (Jenmis) and British government. This was the main cause of this revolt.

The Moplah peasants got momentum from the Malabar District Conference, held in April 1920. This conference supported the tenants' cause, and demanded legislations for regulating landlord-tenant relations. In August 1921, the Moplah tenants rebelled against the oppressive zamindars. In the initial phase of the rebellion, the Moplah peasants attacked the police stations, public offices, communications and houses of oppressive landlords and moneylenders. By December 1921, the government ruthlessly suppressed the Moplah rebellion. According to an official estimate, as a result of government intervention, 2337 Moplah rebels were killed, 1650 wounded and more than 45,000 captured as prisoners.



Moplah prisoners

Bardoli Satyagraha (1929-30)

In 1928, the peasants of Bardoli (Gujarat) started their agitation under the leadership of Sardar Vallabhbhai Patel, in protest against the government's proposal to increase land revenue by 30 percent. The peasants refused to pay tax at the enhanced rate and started no-tax campaign from 12 February 1928. Many women also participated in this campaign.

In 1930, the peasants of Bardoli rose to a man, refused to pay taxes, faced the auction sales and the eventual loss of almost all of their lands but refused to submit to the Government.



However, all their lands were returned to them when the Congress came to power in 1937.



Bardoli Satyagraha

Recap

- The British Government in India did not adopt a pro-Indian agriculture and land revenue policy.
- Lord Cornwallis introduced Permanent Settlement in 1793.

- Ryotwari system was introduced by Thomas Munro and Captain Read in 1820.
- Mahalwari system was a brain child of Holt Mackenzie.
- The land near the hills of Rajmahal in Bihar was cultivated by the Santhals.
- Dinabandhu Mitra wrote a drama, Nil-Darpan, in Bengali.
- In 1875, the peasants revolted in the district of Poona, that event has been called the 'Deccan Riots'.
- The Punjab Land Alienation Act was passed in 1900.
- In August 1921, the Moplah tenants rebelled against the oppressive Zamindars.
- The peasants of Bardoli started their agitation under the leadership of Sardar Vallabhbhai Patel.

GLOSSARY

Apparatus	new system	புதிய அமைப்பு
Claimants	a person making a claim	உரிமை கோருபவர்
Cultivator	a person who cultivates the land	விவசாயி
Encroachment	intrusion on	அத்துமீறல்
Moneylender	a person who lends money to people, at a high rate of interest	கடன் தருபவர்
Predominantly	mainly	முக்கியமாக
Tenants	a person who occupies land rented from a land lord	குத்தகையாளர்/ குடியிருப்பவர்



Evaluation

I. Choose the correct answer

1. Which system was called by different names like Jagirdari, Malguzari and Biswedari etc.?

- a) Mahalwari
- b) Ryotwari



c) Zamindari

d) None of these

2. Under which Governor General did the permanent settlement implemented in Bengal.
- a) Lord Hastings
 - b) Lord Cornwallis
 - c) Lord Wellesley
 - d) Lord Minto



3. What was the Mahal in the Mahalwari system?
a) House b) Town
c) Village d) Palace
4. In which region was the Mahalwari system imposed?
a) Maharashtra b) Madras
c) Bengal d) Punjab
5. Who among the following Governors introduced Mahalwari system?
a) Lord Hastings
b) Lord Cornwallis
c) Lord Wellesley
d) Lord William Bentinck
6. In which region was the Ryotwari system not introduced by the British?
a) Bombay b) Madras
c) Bengal d) None of these
7. The Indigo revolt was led by whom?
a) Mahatma Gandhi
b) Keshab Chandra Roy
c) Digambar Biswas and Bishnu Biswas
d) Sardar Vallabhbhai Patel
8. The Bardoli Satyagraha was led by whom?
a) Sardar Vallabhbhai Patel
b) Mahatma Gandhi
c) Digambar Biswas
d) Keshab Chandra Roy

II Fill in the Blanks

1. _____ is the modified version of the Zamindari system.
2. The Mahalwari system was a Brain child of _____.
3. Indigo Revolt took place in _____.
4. Maplah Rebellion was held in _____.
5. The Champaran Agrarian Act was passed in _____.

III Match the following

1.	Permanent Settlement	Madras
2.	Mahalwari Settlement	Misery of the Indigo cultivators
3.	Ryotwari System	North west province
4.	Nil Darban	Bengal
5.	Santhal Rebellion	First Peasant revolt

IV State true or false

1. Warren Hastings introduced quinquennial land settlement.
2. Ryotwari system was introduced by Thomas Munro.
3. Pabna revolt originated in the Yusufshahi pargana in Gujarat.
4. The Punjab land alienation Act was passed in 1918.

V. Consider the following statement and tick appropriate answer

1. Which of the following statement is not true about Zamindari system?
 - (a) This settlement was introduced in 1793.
 - (b) The Zamindars became the owner of the land.
 - (c) This system secured a fixed and stable income for the cultivators.
 - (d) This practice was applicable to the area of 19% of India.
2. Which of the following statement is correct about Peasants revolt in India?
 - (a) The Santhal rebellion was held in Bengal.
 - (b) Dinabandhu Mitra wrote a drama called Nil Darban.



- (c) The Deccan riots started from a village at Pune in 1873.
- (d) The Moplah peasants rebellion was held in Tamil Nadu.

VI Answer the following in one or two sentences

1. List out any two salient features of the Permanent settlement?
2. What were the salient features of the Ryotwari system?
3. Bring out the effects of the Mahalwari settlement.
4. What was the cause of Indigo Revolt in 1859 – 60?
5. What was the contribution of Mahatma Gandhi on Champaran Satyagraha.
6. Mention the role of Vallabhai Patel in Bardoli Satyagraha.

VII Answer the following in detail.

1. Discuss the merits and demerits of the Permanent settlement.
2. What were the impacts of the British Land Revenue system on the cultivators?
3. Write a paragraph about the Moplah Rebellion?

VIII HOTs

Apart from the exploiting through taxes, how did the British further exploit the land?

IX Project and Activity

1. Point out the influence which shaped Gandhiji's ideas on Ahimsa and Satyagraha.
2. Organize exhibition in your school on the peasants conditions highlight the similarities between past and present.



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3. Vincent .A.Smith - *The Oxford History of India - From the Earliest Times to the end of 1911 – 1919* – Oxford At The Clarendon press



INTERNET RESOURCES

- <https://www.britannica.com>
- <https://www.ducksters.com/>
- https://en.wikipedia.org/wiki/Permanent_Settlement
- <https://en.wikipedia.org/wiki/Ryotwari>
- <https://en.wikipedia.org/wiki/Mahalwari>



Unit - 4

People's Revolt



Learning Objectives

- ▶ To know the Palayakkars (Poligar) system in Tamil Nadu
- ▶ To understand the role of PuliThevar and Kattabomman in the anti-British uprising
- ▶ To know about the South Indian Rebellion
- ▶ To know the causes and effects of Vellore Mutiny
- ▶ To understand the causes and impacts of Revolt of 1857



Introduction

The establishment of political and economic dominance by the British over many parts of India after the Battle of Plassey, 1757 disrupted the political, social and economic order of the country. This led to the divesting many landlords and chieftains of their power and estates. Naturally, many of them revolted against the British. The English assumed the right of collecting the annual tribute from the Palayakkars. The first resistance to the British was offered by the Pulithevar. Since then there had been rebellions by Palayakkars such as the Veerapandiya Kattabomman, Oomathurai, Marudu brothers and Dheeran Chinnamalai.

Origin of Palayam

The Vijayanagar rulers appointed Nayaks in their provinces. The Nayak of Madurai in turn appointed Palayakkars. Viswanatha became the Nayak of Madurai in 1529. He noticed that he could not control the chieftain who wanted more powers in their provinces. So

with the consultation of his minister Ariyanatha Mudaliyar, Viswanatha instituted Palayakkars system in 1529. The whole country was divided into 72 Palayams and each one was put under a Palayakkars. Palayakkars was the holder of a territory or a Palayam. These Palayams were held in military tenure and extended their full co-operation to be need of the Nayaks. The Palayakkars collected taxes, of which one third was given to the Nayak of Madurai another one third for the expenditure of the army and rest was kept for themselves.

Early revolts of South India

Revolt of the Palayakkars

During the 17th and 18th centuries the Palayakkars played a vital role in the politics of Tamil Nadu. They regarded themselves as independent. Among the Palayakkars, there were two blocs, namely the Eastern and the Western blocs. The Eastern Palayams were the Nayaks ruled under the control of Kattabomman and the Western palayams were the Maravas



THE REBEL CONFEDERACY 1799 - 1800



ruled under the control of Pulithevan. These two palayakkars refused to pay the kist (tribute) to the English and rebelled.

The early struggle between the Palayakkars and the East India Company had a strong political dimension. By the Carnatic treaty of 1792, consolidated the English power over the Palayakkars. The English got the right to collect taxes. The result was the outbreak of the revolt of Palayakkars.

Pulithevar

Pulithevar was the pioneer in Tamil Nadu, to protest against the English rule in India. He was the Palayakkarar of the Nerkattumseval, near Tirunelveli. During his tenure he refused to pay the tribute neither to Mohammed Ali, the Nawab of Arcot nor to the English. Further he started opposing them. Hence, the forces of the Nawab of Arcot and the English attacked Pulithevar. But the



combined forces were defeated by Pulithevar at Tirunelveli. Pulithevar was the first Indian king to have fought and defeated the British in India. After this victory Pulithevan attempted to form a league of the Palayakkars to oppose the British and the Nawab.

In 1759, Nerkattumseval was attacked by the forces of Nawab of Arcot under the leadership of Yusuf Khan. Pulithevar was defeated at Anthanallur and the Nawabs forces captured Nerkattumseval in 1761. Pulithevar who lived in exile recaptured Nerkattumseval in 1764. Later, he was defeated by Captain Campell in 1767. Pulithevar escaped and died in exile without fulfilling his purpose, although his courageous trail of a struggle for independence in the history of South India.

Virapandy Kattabomman

The Ancestors of Kattabomman belonged to Andhra. They migrated to Tamil country during the 11th century. As a feudatory under Pandyas, Jagaveerapandiaya Kattabomman ruled Virapandyapuram. Panchalankurichi was its capital. He later became a Poligar during the rule of Nayaks. He was succeeded by his son Veerapandy Kattabomman. His wife was Jakkammal and his brothers were Oomathurai and Sevathaiah.



Virapandy Kattabomman

Nawab of Arot

After the decline of the Vijayanagar empire, the mughals established their supremacy in the south. The Nawabs acted as their representatives in Karnataka. Panchalamkuruchi palayam was acted as an ally to the Nawab of Arcot. Hence it paid tribute to the Nawabs. But in 1792, the political condition had completely changed. Based on the Carnatic treaty of 1792, the company gained the right to collect taxes from Panchalamkuruchi. The collection of tribute was the main cause for the rivalry between the English and Kattabomman.

Kattabomman met Jackson

In 1798, Colin Jackson, the collector of Ramanathapuram wrote letters to Kattabomman asking him to pay the tribute arrears. But Kattabomman replied that he was not in a position to remit the tribute due to the famine in the country. Colin Jackson got angry and decided to send an expedition to punish Kattabomman. However, the Madras government directed the collector to summon the Palayakkars at Ramanathapuram and hold a discussion.



In 1798, Kattabomman and his minister Siva Subramaniam met the Collector at Ramanathapuram. Upon a verification of accounts, Colin Jackson was convinced that Kattabomman had cleared most of the arrears leaving only 1080 pagodas as balance. During this interview Kattabomman and his Minister, Sivasubramaniam, had to stand before the arrogant collector for three hours. The Collector insulted them and tried to arrest Kattabomman and his minister. Kattabomman tried to escape with his minister. Oomathurai suddenly entered the fort with his men and helped the escape of Kattabomman. But unfortunately Sivasubramaniam was taken as prisoner.

Edward Clive and Kattabomman

After his return to Panchalamkuruchi, Kattabomman wrote a letter to the Madras Council narrating the behaviour of the Collector Colin Jackson. Edward Clive, the Governor of Madras Council ordered Kattabomman to surrender. The Madras Council directed Kattabomman to appear before a Committee. Meanwhile, Edward Clive dismissed the Collector for his misbehaviour and released SivaSubramania. Kattabomman appeared before the Committee, and found Kattabomman was not guilty. S.R. Lushington was appointed collector in the place of Colin Jackson, who was eventually dismissed from service.



The confederacy of Palayakkars

During that time, Marudu Pandyan of Sivaganga formed the South Indian Confederacy of rebels against the British, along with the neighbouring Palayakkars. This confederacy declared a proclamation which came to be known as Tiruchirappalli Proclamation. Kattabomman was interested in this confederacy. He tried to establish his influence over Sivagiri, who refused to join with alliance of the rebels. Kattabomman advanced towards Sivagiri. But the Palayakkar of Sivagiri was a tributary to the Company. So the Company considered the expedition of Kattabomman as a challenge to their authority. So the Company ordered the army to march to Panchalamkuruchi.

Fall of Panchalamkuruchi

Major Bannerman moved his army to Panchalamkuruchi on 5th September. They cut off all the communications to the Fort. In a clash at Kallarpatti, Siva Subramaniyam was taken as a prisoner. Kattabomman escaped to Pudukottai. Vijaya Ragunatha Tondaiman, Raja of Pudukottai, captured Kattabomman from the jungles of Kalapore and handed over to the Company. After the fall of Panchalamkuruchi, Bannerman brought the prisoners to an assembly of the Palayakkars and after trial sentenced them to death. Sivasubramania was executed at Nagalapuram. On the 16th October ViraPandya Kattabomman was tried before an assembly of Palayakkars, summoned at Kayathar. On 17th October 1799, Kattabomman was hanged at the fort of Kayathar. Kattabomman's heroic deeds were the subject of many folk ballads which kept his memory alive among the people.

Velu Nachiyar

Velu Nachiyar was a queen of Sivagangai. At the age of 16, she was married to Muthu Vaduganathar, the Raja of Sivagangai. In 1772, the Nawab of Arcot and the British troops invaded Sivagangai. They killed Muthu Vaduganathar in Kalaiyar Koil battle. Velu Nachiyar escaped with her daughter Vellachi Nachiyar and lived under the protection of Gopala Nayaker at Virupachi

near Dindigul. During this period she organised an army and employed her intelligent agents to find where the British stored their ammunition. She arranged a suicide attack by a faithful follower Kuyili, a commander of Velu Nachiar. She recaptured Sivagangai and was again crowned as queen with the help of Marudu brothers. She was the first queen to fight against the British colonial power in India. She is known by Tamils as Veeramangai and also known as 'Jhansi Rani of South India.'



Velu Nachiyar

Marudu Brothers

Marudu brothers were the sons of Mookiah Palaniappan and Ponnathal. The elder brother was called Periya Marudu (Vella Marudhu) and the younger brother Chinna Marudu. Chinna Marudu was more popular and was called Marudu Pandiyan. Chinna Marudu served under Muthu Vaduganatha Peria Udaya Devar (1750-1772) of Sivaganga. In 1772 the Nawab of Arcot laid seige of Sivaganga and captured it. Muthu Vaduganatha Peria Udaya Devar, died in battle. However after a few months Sivaganga was re-captured by Marudu Brothers and Periya Marudu was enthroned as the ruler. Chinna Marudu acted as his adviser. Due to the terrorist activities against British, he was called as "Lion of Sivaganga". In the later half of the eighteenth century the rebellion against the British was carried by Marudu Brothers in South India.



Marudu Brothers

Causes for the conflict

Kattabomman was hanged to death and his brother Umaithurai and others fled to Sivaganga, where Marudu Pandya gave protection to them. The merchants of



Sivaganga did not like the interference of the company in their internal politics. The company waged war against Sivaganga for these two causes.

The South Indian Rebellion (1800-1801)

In February 1801 the brothers of Kattabomman, Oomathurai and Sevathaiah escaped from Palayamkottai prison and reached Kamudhi. Chinna Marudu took them to Siruvayal, his capital. They reconstructed their ancestral fort at Panchalamkurichi. The British troops under Conlin Macaulay retook the fort in April and the Palayakkarar brothers sought shelter in Sivaganga. The English demanded Marudu Pandyas to hand over the fugitives, the latter refused. Conlonel Agnew and Colonel Innes marched against them.

The Palayakkarar War assumed a much broader character than its predecessor. It was directed by a confederacy consisting of Marudu Pandiar of Sivaganga, Gopala Nayak of Dindugal, Kerala Varma of Malabar and Krishnappa Nayak and Dhoondaji of Mysore. The English declared war against the confederacy.

The Tiruchirappalli Proclamation (1801)

The Marudu Pandyas issued a proclamation of Independence called Tiruchirappalli Proclamation in June 1801. The Proclamation of 1801 was the first call to the Indians to unite against the British. A copy of the proclamation was pasted on the walls of the Nawab's palace in the fort of Tiruchi and another copy was placed on the walls of the Vaishnava temple at Srirangam. Thus Marudu brothers spread the spirit of opposition against the English everywhere. As a result many Palayakkars of Tamil Nadu went on a rally to fight against the English. Chinna Marudu collected nearly 20,000 men to challenge the English army. British reinforcements were rushed from Bengal, Ceylon and Malaya. The rajas of Pudukkottai, Ettayapuram and Thanjavur stood by the British. Divide and rule policy followed by the English spilt the forces of the Palayakkars.

English annexed Sivagangai

In May 1801, English attacked the rebels in Thanjavur and Tiruchi areas. The rebels went to Piranmalai and Kalayarkoil. They were again defeated by the forces of the English. In the end, the superior military strength and the able commanders of the British army won the battle. The rebellion failed and English annexed Sivagangai in 1801. The Marudu brothers were executed in the Fort of Tirupathur in Ramanathapuram District on 24 October 1801. Oomathurai and Sevathaiah was captured and beheaded at Panchalamkuruchi on 16 November 1801. Seventy three rebels were sentenced to Penang in Malaya, then called the Prince of Wales Island. Though they fell before the English, they were the pioneers in sowing the seeds of nationalism in the land of Tamil.

Thus the South Indian Rebellion is a landmark in the history of Tamil Nadu. Although the 1800-1801 rebellion was to be categorized in the British records as the Second Palayakkarar War. Under the terms of the Karnataka Treaty on 31 July 1801, the British assumed direct control over Tamil Nadu. The Palayakkarar system was abolished.

Dheeran Chinnamalai

Dheeran Chinnamalai was born at Melapalayam in Chennimalai near Erode. His original name was Theerthagiri. He was a palayakkarar of Kongu country who fought the British East India Company. The Kongu country comprising Salem, Coimbatore, Karur and Dindigul formed a part of the Nayak kingdom of Madurai but had been annexed by the Wodayars of Mysore. After the fall of the Wodayars, these territories along with Mysore were controlled by the Mysore Sultans. After the third and fourth Mysore wars the entire Kongu region passed into the hands of the English.

Dheeran Chinnamalai was trained by French military in modern warfare. He was along the side Tippu Sultan to fight against the British East India Company and got victories against the British. After Tippu Sultan's death Chinnamalai settled down at Odanilai and constructed a fort



there to continue his struggle against the British. He sought the help of Marathas and Maruthu Pandiyar to attack the British at Coimbatore in 1800. British forces managed to stop the armies of the allies and hence Chinnamalai was forced to attack Coimbatore on his own. His army was defeated and he escaped from the British forces. Chinnamalai engaged in guerrilla warfare and defeated the British in battles at Cauvery, Odanilai and Arachalur. During the final battle, Chinnamalai was betrayed by his cook Nallapan and was hanged in Sankagiri Fort in 1805.

Vellore Revolt (1806)

The family members of Tippu were imprisoned at Vellore fort after the fourth Mysore war. Some three thousand ex-servants and soldiers of Hyder and Tippu had also been moved to the vicinity of Vellore and their property in Mysore confiscated. It was quite natural that they were all unhappy and they hated the English.



Vellore Fort

The Vellore fort consisted of large majority of Indian troops, a good part of it recently been raised in Tirunelveli after the Palayakarar uprising of 1800. Many of the trained soldiers of the various Palayams were admitted into the English army. Thus the Vellore fort became the meeting ground of the rebel forces of South India.

In 1803, William Cavendish Bentinck became Governor of Madras. During his period certain military regulations were introduced in 1805-06 and were enforced by the Madras Commander-in-Chief Sir John Cradock. But the sepoys felt that these were designed to insult them.

Causes for the revolt

- The strict discipline, new weapons, new methods and uniforms were all new to the sepoys.
- The sepoys were asked to shave the beard and to trim the moustache.
- The wearing of religious mark on the forehead and the use of ear-rings were also banned.
- The English treated the Indian sepoys as their inferior. There was the racial prejudice.

Immediate Cause

In June 1806, military General Agnew introduced a new turban, resembling a European hat with a badge of cross on it. It was popularly known as 'Agnew's turban'. Both the Hindu and Muslim soldiers opposed it. So the soldiers were severely punished by the English.

Course of the Revolt

The Indian soldiers were waiting for an opportunity to attack the English officers. Tippu's family also took part. Fettah Hyder, the elder son of Tippu, tried to form an alliance against the English. On July 10th in the early morning the native sepoys of the 1st and 23rd Regiments started the revolt. Colonel Fancourt, who commanded the garrison, was their first victim. The fort gates were closed. Meantime, the rebels proclaimed Futteh Hyder, as their new ruler. The British flag in the fort was brought down. The tiger-striped flag of Tippu Sultan was hoisted on the fort of Vellore.

Suppression of the Revolt

Major Cootes who was outside the fort rushed to Ranipet and informed Colonel Gillespie. Col. Gillespie reached Vellore fort. He made an attack on the rebel force. The revolt was completely suppressed and failed. Peace was restored in Vellore. On the whole, 113 Europeans and about 350 sepoys were killed in the uprising. The revolt was suppressed within a short period. It was one of the significant events in the history of Tamil Nadu.



Effects of the Vellore Revolt

- The new methods and uniform regulations were withdrawn.
- The family of Tippu as a precautionary measure was sent to Calcutta.
- William Cavendish Bentinck was removed from his service.

Causes for the failure of the Revolt

- There was no proper leadership to guide the soldiers properly.
- The rebellion was also not well organised.
- Divide and Rule policy of the English, split the unity of the Indians.

V.D. Savarkar calls the Vellore revolt of 1806 as the prelude to the first War of Indian Independence in 1857.

The Revolt of 1857

The early uprisings did not succeed in threatening the British in India. It took the Revolt of 1857 to bring home to the Company and the British thought that their rule was not accepted to a large section of the population. The Revolt of 1857 was a product of the character and the policies of colonial rule. The cumulative effect of British expansionist policies, economic exploitation and administrative innovations over the years had adversely affected the positions of all rulers of Indian states.



Causes of the Revolt

- The most important cause of revolt 1857 was a popular discontent of the British policy of economically exploiting India. This hurt all sections of society. The peasants suffered due to high revenue demands and the strict revenue collection policy.
- Policies of doctrine of lapse, subsidiary alliance and policy of Effective Control created discontentment among people. Annexation of Oudh proved that even the grovelling loyalty can't satisfy British greed for territories.

- The conversion activities of Christian missionaries were looked upon with suspicion and fear. The priests and the maulavis showed their discontent against the British rule.
- Abolition of practices like sati, female infanticide, support to widow remarriage and female education were seen by many as interference in their Indian culture by the Europeans.
- The Indian sepoys were looked upon as inferior beings and treated with contempt by their British officers. They were paid much less than the British soldiers. All avenues of the promotion were closed to them as all the higher army posts were reserved for the British.

Immediate cause

The immediate cause was the introduction of new Enfield Rifles in the army. The top of the cartridge of this rifle was to be removed by the mouth before loading it in the rifle. The cartridges were greased by the fat of pig and the cow. The Indian sepoys believed that the British were deliberately attempting to spoil the religion of both the Hindus and the Muslims because while the Hindus revered the cow, the Muslims hated the pig. The soldiers, therefore, determined to refuse their service and, ultimately revolted. Thus, the primary and the immediate cause of the revolt was the use of the greased cartridges.

The Outbreak of the Revolt

On 29 March 1857 at Barrackpur (near Kolkata) Mangal Pandey, a young Sepoy from Bengal Regiment, refused to use the greased cartridge, and shot down his sergeant. He was arrested, tried and executed. When this news spread many sepoys revolted.



Mangal Pandey



Course of the Revolt

On 10 May 1857, the Sepoys of the third cavalry at Meerut openly revolted by swarming the prisons and releasing their comrades. They were immediately joined by the men of the 11th and 20th Native Infantries, and they murdered some English officers and then marched to Delhi. The arrival of Meerut sepoys at Delhi on 11th May and declared of Bahadur Shah II as the Emperor of India. Delhi became the centre of the Great Revolt and Bahadur Shah, its symbol.

The revolt spread quickly. There were mutinies at Lucknow, Kanpur, Jhansi, Bareilly, Bihar, Faizabad, and many other places in north India. Many of them found that it was a good opportunity to burn the papers of their landlords. Many others whose titles and pensions were abolished by the British who participated in it, in order to take revenge. The Muslim leaders and Maulvis sought the opportunity of establishing the Muslim rule in India after turning out the British.



In Central India the revolt was guided by Rani Lakshmi Bai of Jhansi. She was one of the greatest patriots of India. Sir Hugh Rose occupied Jhansi. Rani Lakshmi Bai fled from Jhansi and joined hands with Tantia Tope who had assumed the leadership of the rebel army at Gwalior. But the British captured Gwalior in June 1858. Rani was killed in the battle. Tantia Tope fled away but was captured and later executed. According to the British historians, present at the time of revolt, Rani Lakshmi Bai was the best and the bravest among the leaders of the Revolt of 1857.

Suppression of the Revolt

Lord Canning, the governor-general took immediate steps to suppress the revolt. He collected the forces of Madras, Bombay, Sri Lanka and Burma. On his own initiative, he called the British army which was deputed to China by Britain to Calcutta. He ordered the loyal Sikh army to proceed to Delhi immediately. The British regained their lost positions very soon.

Delhi was recaptured by General John Nicholson on 20 September, 1857 and deportation of Bahadur Shah II to Rangoon where he died in 1862. Military operations with the recovery of Kanpur were closely associated with the recovery of Lucknow. Sir Colin Campbell occupied Kanpur. Nana Saheb was defeated at Kanpur and escaped to Nepal. His close associate Tantia Tope escaped to central India, was captured and put to death while asleep. The Rani of Jhansi had died in the battle-field. Kunwar Singh, Khan Bahadur Khan were all dead, while the Begum of Awadh was compelled to hide in Nepal. The revolt was finally suppressed. By the end of 1859, British authority over India was fully re-established.

Places of Revolt	Indian Leaders	British Officials who suppressed the revolt
Delhi	Bahadur Shah II	John Nicholson
Lucknow	Begum Hazrat Mahal	Henry Lawrence
Kanpur	Nana Saheb	Sir Colin Campbell
Jhansi & Gwalior	Lakshmi Bai, Tantia Tope	General Hugh Rose
Bareilly	Khan Bahadur Khan	Sir Colin Campbell
Bihar	Kunwar Singh	William Taylor

The Causes for the Failure of the Revolt

Various causes were responsible for the failure of the revolt.

- Lack of organisation, discipline, common plan of action, centralised leadership, modern weapons and techniques.
- The rebel leaders were no match to the British Generals. Rani Lakshmi Bai, Tantia Tope and Nana Saheb were courageous but they were not good generals.
- Non-participation of Bengal, Bombay, Madras, western Punjab and Rajputana.
- The modern educated Indians did not support the Revolts as they believed that only British rule could reform Indian society and modernize it.
- The British managed to get the loyalty of the Sikhs, Afghans and the Gurkha regiments. The Gurkhas actually helped the British in suppressing the revolt.
- The British had better weapons, better generals, and good organisation.

Consequences of the Revolt

- The Revolt of 1857 marked a turning point in the history of India. It led to changes in the system of administration and the policy of the Government.
- The administration of India was transferred from the East India Company to the British Crown through the 'Queen's Proclamation' in 1858.



- The governor general was given the title of viceroy.
- The Board of Directors and the Board of Control were replaced by the Council of 15 members headed by the Secretary of State to supervise Indian affairs.
- The Indian Army was thoroughly reorganised. More Britishers were employed in the army.
- The British military policy came to be dominated by the idea of 'divide and counterpoise'.

Infact, the Revolt of 1857 played an important role in bringing the Indian people together and imparting them the consciousness of belonging to one country. The Revolt paved the way for the rise of the modern national movement. It was at the beginning of the twentieth century that the 1857 Revolt came to be interpreted as a "planned war of national independence", by V.D. Savarkar in his book, First War of Indian Independence.

Recap

- The Vijayanager rulers appointed Nayaks in their provinces.
- The Nayak of Madurai in turn appointed Palayakkars.
- The English got the right to collect taxes and the result was the outbreak of the revolt of Palayakkars.
- The collection of tribute was the main cause for the rivalry between the English and Kattabomman.
- Marudu brothers were the sons of Mookiah Palaniappan and Ponnathal.
- Dheeran Chinnamalai was trained by French military in modern warfare.
- Tippu Sultan fought against the British East India Company.
- Rani Lakshmi Bai was the best and the bravest among the leaders of the Revolt of 1857.

GLOSSARY

Beheaded	hanged to death	தூங்கிலீடு
Betrayed	give away information about somebody	காட்டிக்கொடு
Cartridge	bullet	தோட்டா
Eventually	in the end	முடிவாக
Infantry	an army unit consisting of soldiers who fight on foot	காலாட்படை
Tribute	payment made periodically by one state	கப்பம்
Swarm	crowd	கூட்டம்



Evaluation

I. Choose the correct answer

1. The Palayakkars system was instituted in
a) 1519 b) 1520
c) 1529 d) 1530



2. Which of the following Palayakkars of Tamil Nadu was the pioneer against the English rule
a) Pulitevan
b) Yusuf Khan
c) Kattabomman
d) Marudhu brothers
3. Colin Jackson was the collector of
a) Madurai b) Tirunelveli
c) Ramanathapuram d) Tuticorin



4. Veera Pandiya Kattabomman was hanged at the fort of
a) Panchalamkurichi b) Sivagangai
c) Tiruppathur d) Kayathar
5. Velu Nachiyar was a queen of
a) Nagalapuram b) Sivagiri
c) Sivagangai d) Virupachi
6. Tiruchirapalli proclamation was issued by
a) Marudhu Pandiyars
b) Krishnappa Nayak
c) Velu Nachiyar
d) Dheeran Chinnamalai
7. Which of the following place was associated with Dheeran chinnamalai
a) Dindigul b) Nagalapuram
c) Pudukottai d) Odanilai
8. Rani Lakshmi Bai led the revolt at
a) Central India b) Kanpur
c) Delhi d) Bareilly

II Fill in the Blanks

1. The Eastern Palayms were ruled under the control of _____.
2. Vishwanatha Nayakar instituted the Palayakarar system with the consultation of his minister _____.
3. The ancestors of Kattabomman belonged to _____.
4. _____ was known by Tamils as Veera mangai and Jhansi Rani of south india.
5. _____ was called as 'lion' of sivagangai.
6. _____ was described the revolt of 1857 as First War of India Independence.

III Match the following

1.	Delhi	Kunwar singh
2.	Kanpur	Khan Bahudar Khan
3.	Jhans	Nana Saheb
4.	Bareilly	Lakshmi Bai
5.	Bihar	Bahadur Shah II

IV State true or false

1. The Vijayanagar rulers appointed Nayaks in their provinces.
2. Sivasubramania was the minister of Marudhu pandiyas.
3. Kattabomman was hanged on 17th October 1799.
4. Fettah Hyder was the elder son of Tippu Sultan.

V. Consider the following statements and tick (✓) the appropriate answer

- i) The Vellore revolt was held in 1801.
ii) The family members of Tippu were imprisoned at Vellore fort after the fourth Mysore war.
iii) At the time of Vellore revolt, the Governor of Madras was Lord William Bentinck.
iv) The victory of revolt of Vellore against British was one of the significant event in the history of India.
a) i & ii are Correct
b) ii & iv are Correct
c) ii & iii are correct
d) i, ii & iv are correct

a) Find out the wrong pair

1. Marudu Pandiyar - Ettayapuram
2. Gopala Nayak - Dindigul
3. Kerala Varma - Malabar
4. Dhoondaji - Mysore



b) Find out the odd one

Kattabomman, Oomaithurai,
Sevathaiah, Tippu Sultan.

VI Answer the following in one or two sentences

- 1.What you know about the Palayakarars?
Name some of them.
- 2.What was the part of Velu Nachiyar in the Palayakkarar revolt?
- 3.Who were the leaders of Palayakkarar confederacy in the south Indian rebellion?
- 4.What was the importance of Tiruchirappalli proclamation?
- 5.Bring out the effects of the Vellore revolt.
- 6.What was the immediate cause of the Revolt of 1857?

VII Answer the following in detail.

- 1.What do you know about the Pulithevar?
- 2.Explain the events that led to conflict between Dheeran Chinnamalai and the british.
- 3.What were the causes for the Great revolt of 1857?
- 4.What were the causes for the failure of the Revolt of 1857?

VIII HOTs

Prove that there was no common purpose among the leaders of the Great revolt of 1857.

IX Map skill

On the River map of India mark the following centres of the revolt of 1857.

- | | |
|-----------|----------------|
| 1) Delhi | 2) Lucknow |
| 3) Meerut | 4) Barrackpore |
| 5) Jhansi | 6) Gwalior |
| 7) Kanpur | |

X Project and Activity

collect pictures of Palayakkars and prepare an album.



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INTERNET RESOURCES

- <https://www.britannica.com>
- <https://www.ducksters.com/>
- https://en.wikipedia.org/wiki/Vellore_mutiny
- https://en.wikipedia.org/wiki/Indian_Rebellion_of_1857



Unit - 1

Rocks and Soils



Learning Objectives

- ▶ To understand the nature of rocks, their types and uses.
- ▶ To learn to identify the different types of rocks.
- ▶ To study about the nature of soil and its composition
- ▶ To understand the importance of soil conservation



Introduction

Have you ever noticed any mountains or rocks nearby your location or during your travel? Have you ever been to any hill station during your vacation? Do you know how they originated on the earth surface? Do you know what kinds of material are used in the construction of temples, buildings, roads, flyovers etc. In this lesson, we will learn about rocks and soils.

In lower classes, we have studied about four realms of the earth, namely lithosphere, hydrosphere, atmosphere and biosphere. Lithosphere is the upper most and significant layer of the earth. It is composed of solid rocks and unconsolidated materials. The literal meaning of lithosphere is “**The sphere of rock**”.



Petrology is a branch of geology which deals with the study of rocks. ‘Petrology’ is derived from the Greek word “Petrus” refers to rock and “Logos” refers to study

Find out

What is the base of the house made up of?

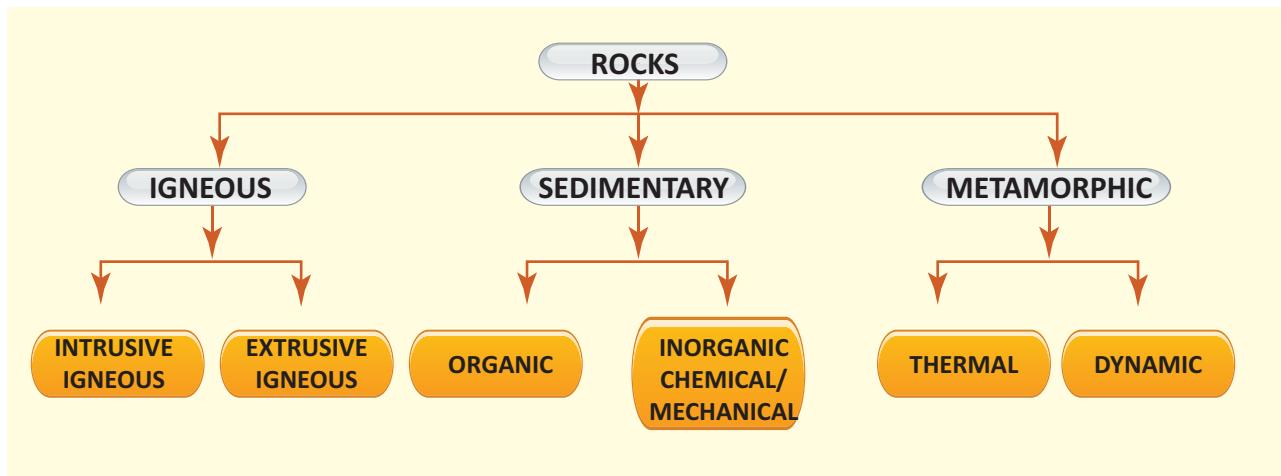
Rocks

The rocks are the solid mineral materials forming a part of the surface of the earth and other similar planets. The earth’s crust (Lithosphere) is composed of rocks. A rock is an aggregate of one or more minerals. Rock is an important natural resource and is found in solid state. It may be hard or soft in nature. An estimation reveals that there are 2,000 different types of minerals found on the earth surface out of which only 12 are the basic minerals commonly found all over the earth. Minerals are chemical substances which exist in nature. They may occur either in the form of elements or compounds.

Classification of Rocks

According to the mode of formation the rocks are classified into three types as follows.

1. Igneous Rocks
2. Sedimentary Rocks and
3. Metamorphic Rocks



Igneous Rocks

The igneous rocks are formed by the solidification of molten magma. These rocks are also called as the 'Primary Rocks' or 'Parent Rocks' as all other rocks are formed from these rocks.



Igneous rock



The word **Igneous** is derived from the Latin word 'Ignis' means 'fire'

Characteristics of Igneous Rocks

1. These rocks are hard in nature
2. These are impermeable
3. They do not contain fossils
4. They are associated with the volcanic activities
5. These rocks are useful for construction works

Types of Igneous Rocks

Igneous Rocks are of two types. They are:

1. Extrusive Igneous Rocks
2. Intrusive Igneous Rocks

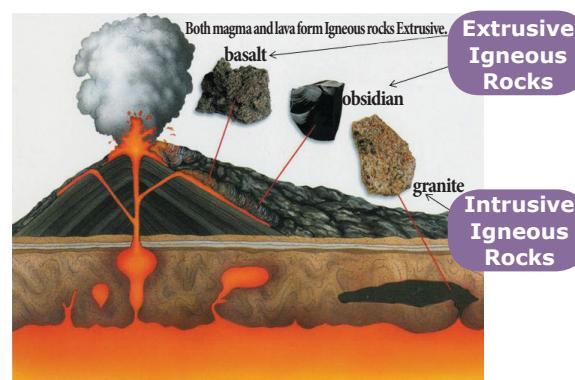
1. Extrusive Igneous Rocks

Can you visualize the lava comes out from a volcano? Lava is actually a fiery red molten magma comes out from the interior of the

earth on its surface. After reaching the earth surface the molten materials get solidified and form rocks. Rocks formed in such a way on the crust are called Extrusive igneous rocks. These rocks are fine grained and glassy in nature due to rapid solidification. Basalt found in the north western part of peninsular India is the example for this type of rock.

2. Intrusive Igneous rocks

The molten magma sometimes cools down deep inside the earth's crust and becomes solid. The rocks formed this way is called '**Intrusive Igneous Rocks**'. Since they cool down slowly, they form large grains. Intrusive Igneous rocks are of two types. The deep seated rocks are called '**Plutonic rocks**' and the ones formed at shallow depths are called '**Hypabysal rocks**'. Granite, Diorite and Gabbro are the examples of plutonic rocks and Dolerite is an example of hypabysal rocks. Since the intrusive Igneous rocks consist of large crystals, they are also called as '**Crystalline rocks**'.



Extrusive & Intrusive Igneous rocks



Some major **Active Volcanoes**: Mount Vesuvius, Mt. Stromboli and Mt. Etna in Italy and Mauna Loa and Mauna Kea in Hawaii Islands.

Sedimentary Rocks

The word '**Sedimentary**' has been derived from Latin word '**Sedimentum**' means settling down. The sedimentary



Sedimentary Rocks

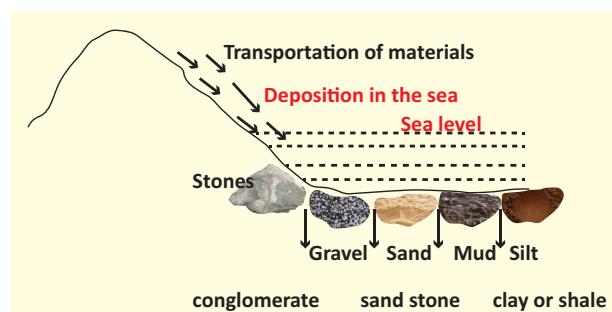
rocks are formed by the sediments derived and deposited by various agents. Due to high temperature and pressure, the undisturbed sediments of long period cemented to form sedimentary rocks. Sedimentary rocks consist of many layers which were formed by the sediments deposited at different periods. As it consists of many strata, it is also known as '**Stratified rocks**'.



Sedimentary rocks are the important source of natural resources like coal, oil and natural gas.

Characteristics of Sedimentary rocks

1. They have many layers.
2. They are non-crystalline rocks.
3. They contain fossils.
4. They are soft and get eroded easily



Formation of Sedimentary Rocks



Oldest sedimentary rocks of the world has been identified in Greenland and estimated as 3.9 billion years old.

Types of Sedimentary Rocks

1. Organic Sedimentary Rocks

These rocks are formed as a result of the decomposition of dead plants and animals. It contains fossils. Chalk, Talc, Dolomite and Limestone rocks are of this category.

2. Mechanical Sedimentary Rocks

These rocks are formed from the disintegration of igneous and metamorphic rocks. The natural agents erode and transport these rocks and deposit them at some places. After a long period of time, they cemented to form rocks. Sandstone, Shale and Clay are the examples of rocks of this type.

3. Chemical Sedimentary rocks

These are formed by precipitating of minerals from water. It is formed usually through evaporation of chemical rich solutions. These rocks are also called as evaporates. Rock Salt is an example of this kind.

Metamorphic Rocks

The word Metamorphic is derived from two Greek words "Meta" and "Morpha", Meta means change and Morpha means shape. When Igneous and sedimentary rocks subject to high temperature and pressure, the original rocks get altered to form a new kind of rock called metamorphic rocks. Metamorphism is of two types. They are 1. Thermal Metamorphism: If the change in the rocks is mainly caused by high temperature, the process is called as thermal metamorphism. 2. Dynamic Metamorphism: If the change in the rock is mainly caused by high pressure, the process is called as Dynamic Metamorphism.



One of the world wonders Taj Mahal in India was built by White Marble in a metamorphic rock.



Metamorphic Rock

Formation of Metamorphic Rocks from Igneous rocks

1. Granite into gneiss caused by dynamic metamorphism.
2. Basalt into slate caused by thermal metamorphism.

Formation of Metamorphic Rocks from Sedimentary rocks

1. Sandstone into quartz caused by thermal metamorphism.
2. Shale into slate caused by thermal metamorphism.

Characteristics of Metamorphic Rocks

1. Metamorphic rocks are mostly crystalline in nature.
2. They consist of alternate bands of light and dark minerals.

Rock cycle

Igneous rocks are the primary rocks formed first on the earth. These rocks are weathered, eroded, transported and deposited at some places to form sedimentary rocks. The Igneous and Sedimentary rocks are changed into metamorphic rocks under the

influence of temperature and pressure. The metamorphic rocks are also get disintegrated and deposited to form sedimentary rocks. Formation of igneous rocks take place when there is an outflow of molten materials. Like this, the rocks of the earth crust keeps on changing from one form to another form under various natural forces and agents. The endless process is referred as **Rock Cycle**.



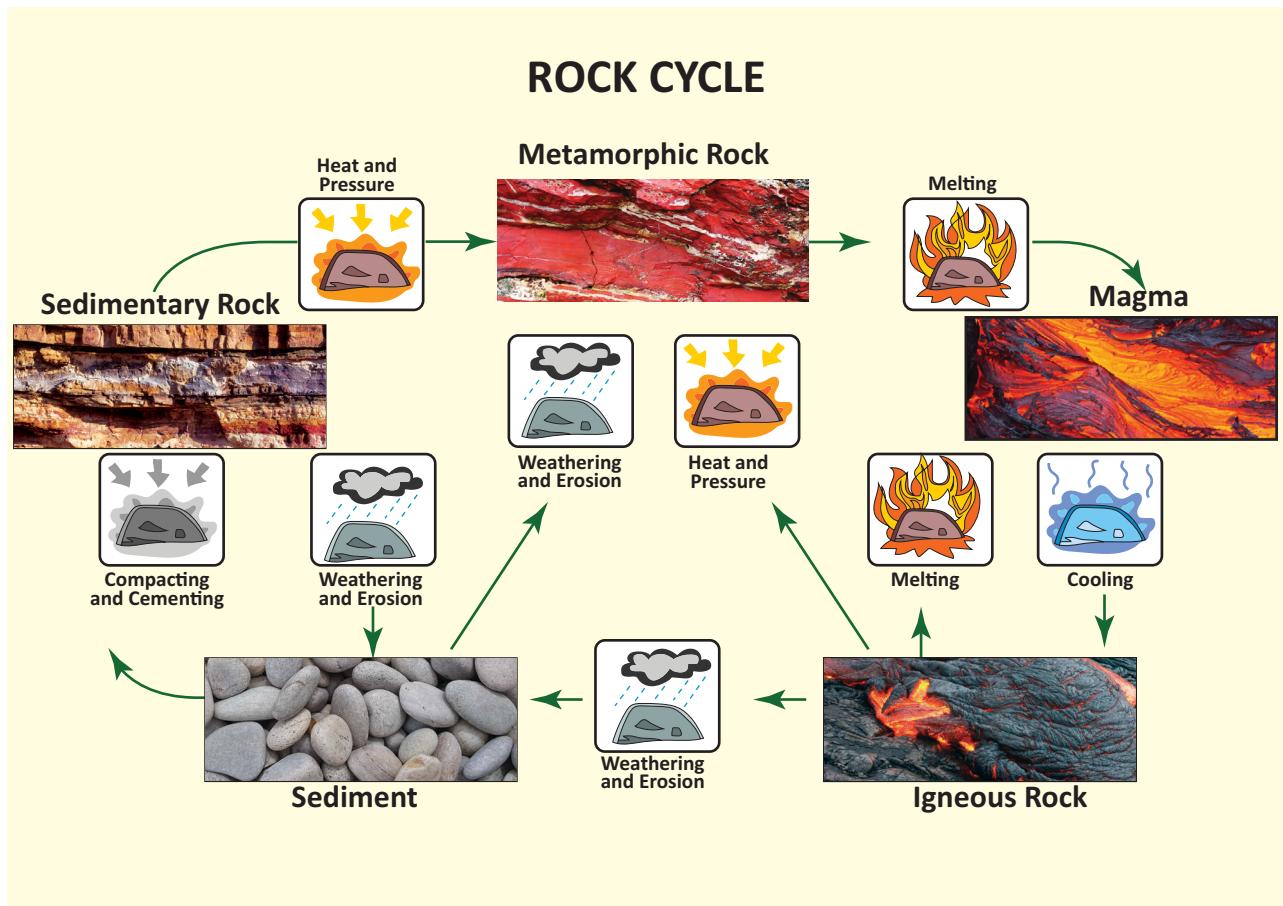
Quartzite and Marble are the rocks commonly used for construction and sculpture works. Marbles are widely used for making beautiful statues and decorative items such as vase, tiny gift articles and grinded marble is used to produce plastics, paper etc.,

Uses of rocks

Rocks have been used by mankind throughout the history. Rocks are highly valuable and important to almost all aspects of our economy. The minerals and metals in rocks have been found essential to human civilization. Rocks are used for many purposes in our life and some of them are given below

Rocks are useful for making

1. cement
2. Writing chalk
3. Fire
4. Building materials
5. Bath scrub
6. Kerb stone
7. Ornament
8. Roofing materials
9. Decorative materials
10. These are valuable source of minerals such as gold, diamond, sapphire etc.

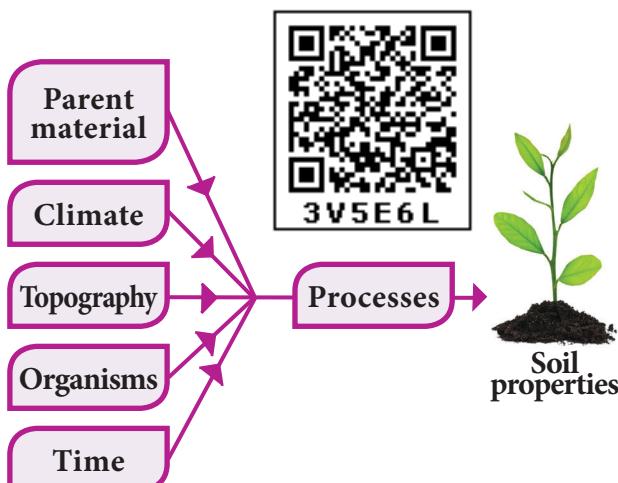


Rock Cycle

ACTIVITY

Collect different types of rocks and display them in the class room

Soil and its Formation



Soil is a mixture of organic matter, minerals, gases, liquids and organisms that together support life. **Soil** minerals form the basis of soil. It forms on the surface of the earth. It is known as the '**skin of the earth**'. Soils are produced from rocks (parent material) through the **processes** of weathering and natural erosion. Water, wind, temperature change, gravity, chemical interaction, living organisms and pressure differences all help break down parent material. It leads to the formation of loose material. In course of time, they further break down into fine particles. This process release the minerals locked in the rock fragments. Later on, the vegetative cover which develop in that region forms humus content in the soil. This way the soil gets matured gradually.

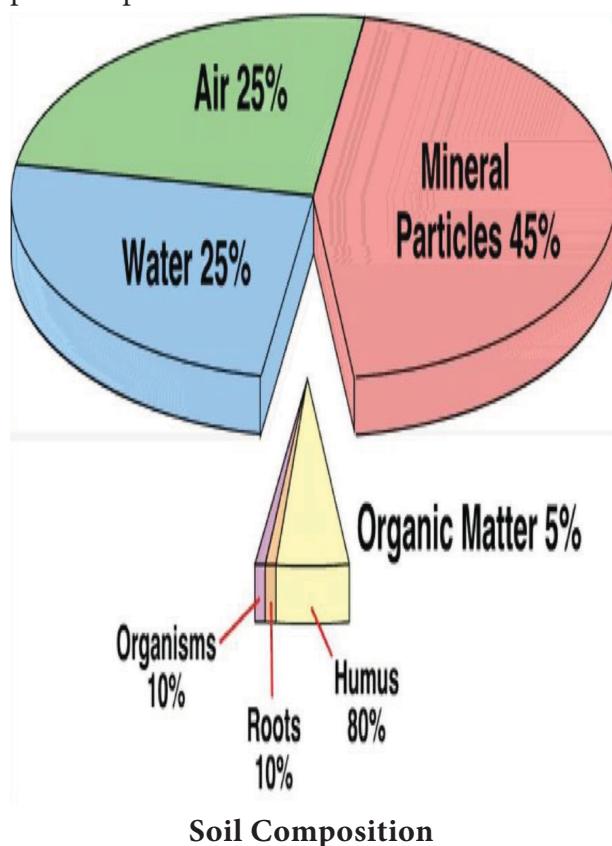


World Soil Day is observed on 5th December, every year



Soil Composition

The basic components of soil are mineral, organic matter, water and air. It consists of about 45% mineral, 5% organic matter, 25% of water and 25% air. It is only a generalized fact. The composition of soil varies from place to place and time to time.



Soil profile

The soil profile is defined as the vertical section of the soil from the ground surface and extends downwards.

ACTIVITY

Collect samples of soil from your place and exhibit in the class room.

Classification of soils

Soils are classified on the basis of their formation, colour, physical and chemical properties. Based on these, soil is classified into six major types. They are: Alluvial soil, Black soil, Red soil, Laterite soil, Mountain soil, Desert soil

Alluvial soil

These soils are found in the regions of river valleys, flood plains and coastal regions. These are formed by the deposition of silt by the running water. It is the most productive of all soils. It is suitable for the cultivation of sugarcane, jute, rice, wheat and other food crops.

Black soils

These soils are formed by weathering of igneous rocks. Black soil is clayey in nature. It is retentive of moisture. It is ideal for growing cotton.

Red Soils

These soils are formed by weathering of metamorphic rocks and crystalline rocks. The presence of iron oxide makes this soil brown to red in colour. It is usually found in semi-arid regions. It is not a fertile soil. It is suitable for millet cultivation.

Laterites soils

These are the typical soils of tropical regions. These soils are found in the regions which experienced alternate wet and dry condition. As these soils are formed by the process of leaching, it is infertile. It is suitable for plantation crops of tea and coffee.

Mountain soils

These soils are found over the slopes of mountain. Soils in these regions are thin and acidic. However characteristic of soil differs from region to region based on the altitude.

Desert soils

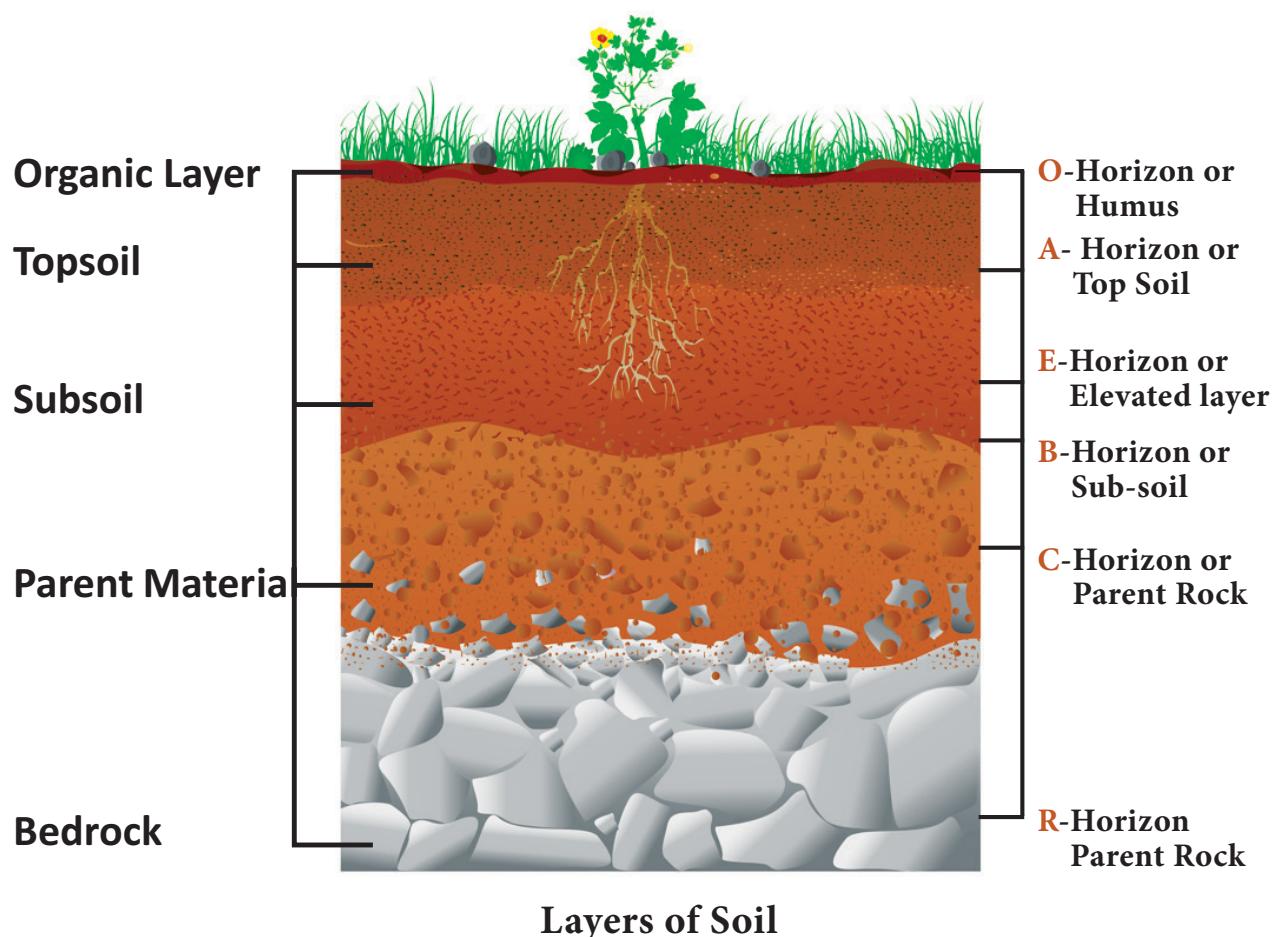
These are sandy soil found in the hot desert regions. These soils are porous and saline. Since it is infertile agriculture in these soils are not so successful.

Soil Erosion

Soil erosion is the removal or destruction of the top layer of soil by natural forces and human activities. Soil erosion reduces the



LAYERS OF SOIL



Layers of soil	
O-Horizon or Humus	This layer is dominated by organic material (leaves, needles, twigs, moss and lichens).
A- Horizon or Top Soil	It is a part of top soil, composed of organic matter mixed with mineral matter.
E- Horizon or Elevated layer	E-Stands for elevated layer. This layer is significantly leached of clay, iron, and aluminum oxides, which leaves a concentration of ore
B- Horizon or Sub-soil	This layer reflects the chemical or physical alteration of parent material. Thus iron, clay, aluminum and organic compounds are found accumulated in this horizon.
C- Horizon or Parent Rock	Partially weathered parent material accumulates in this layer.
R- Horizon Parent Rock	This layer consists of unweathered part of bed rock.

fertility of soil which in turn reduces the agricultural productivity. Running water and wind are the major agents of soil erosion. Sheet erosion, Rill erosion and Gully erosion are the major types of soil erosion.

Soil conservation

Soil conservation is the process of protecting the soil from erosion to maintain its fertility. The methods that are widely practiced for conserving soil are afforestation, controlled grazing, construction of dams,



How long does it take to form soil?

The time needed to form a soil depends on the Climate. The environments which is characterized by mild climate, takes 200-400 years to form one cm of soil and in wet tropical area, soil formation is faster and takes upto 200 years. To become a well matured soil, it takes about 3000 years.

Crop rotation, Strip farming, contour ploughing, terrace farming, checking shifting cultivation, wind break etc.,

Uses of soils

Soil is one of the important natural resource. It is a basic requirement for plant growth and supports various life forms on the earth.

- The minerals present in the soil enhance and nourishes the crops and plants.

- It is used in making of ceramics or pottery.
- It is a source of material for construction and handicraft works.
- It acts as natural filter of water and purifies it.
- Soil supports ecosystem and play an important role in land management.

Rocks and soils are the important renewable natural resources. Both of them play an important role in everyday life of human beings as well as economic development. Nowadays rock-based companies are in increase which provide employment to a sizeable population. Soils attract human settlement and other economic activities. As India is an agricultural country, the proper management of soil resource will lead to sustainable food production besides its use for various other purposes. So, the soil resources must be conserved.

Recap

- A rock is an aggregate of one or more minerals.
- The word ‘**Sedimentary**’ has been derived from Latin word ‘**Sedimentum**’ means settling down.
- Igneous rocks are the primary rocks formed first on the earth.
- Soil is a mixture of organic matter, minerals, gases, liquids and organisms that together support life.

GLOSSARY

Crust	Outermost layer of the earth	പുണിയിൽക്കേലോ
Lava	Hot molten rock erupted from a volcano.	സൈലോ
Magma	Hot fluid or semi-fluid material found beneath the earth crust.	ഓറിമലൈക്കുമ്പ്
Metamorphic rock	A rock formed by the alteration of igneous and sedimentary rocks caused by the metamorphic rocks.	ഉന്നമാർഡിയപ്പ പാരൈ
Rock cycle	The continuous process of transformations of rocks from one form to another.	പാരൈ ചൂഫ്റ്റശി
Sedimentary rock	Rock is formed by the deposition of sediment.	പാടവുപ്പ് പാരൈ



Evaluation

I. Choose the correct answer.

1. Which of the following is known as sphere of rocks
 - a) Atmosphere
 - b) Biosphere
 - c) Lithosphere
 - d) Hydrosphere
2. World soil day is observed on
 - a) 15th August
 - b) 12th January
 - c) 15th October
 - d) 5th December
3. Fossils are found in
 - a) Sedimentary rocks
 - b) Igneous rocks
 - c) Metamorphic rocks
 - d) Plutonic rocks
4. The first layer of soil is called as
 - a) Regur
 - b) Regolith
 - c) Unweathered rock
 - d) partially weathered rock
5. Ideal soil for growing cotton is
 - a) Red soil
 - b) Black soil
 - c) Alluvial soil
 - d) Mountain soil
6. The major component of soil is
 - a) Rocks
 - b) Gas
 - c) Water
 - d) Minerals
7. Which one of the following is the most widespread most and productive category of soil
 - a) Alluvial soil
 - b) Black soil



- c) Red soil
- d) Mountain soil

II. Fill in the blanks.

1. Scientific study of rocks is called _____.
2. _____ soil is highly suitable for cotton cultivation.
3. The “skin of earth” is _____.
4. _____ is the kind of metamorphic rock using which Taj Mahal was built.
5. _____ is known as the primary rocks.

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

1. Igneous rocks are called primary rocks.
2. Slate is formed from shale.
3. Red soil is formed by the process of leaching.
4. M-sand is used as alternative for natural sand in construction.
5. Volcanic mountains are covered with sedimentary rocks.

IV. Match the following.

1)

a.	Granite	1.	Bed rock
b.	Soil layer	2.	Plutonic rock
c.	Barren island	3.	Strip farming
d.	Soil conservation	4.	Active Volcano

	a	b	c	d
A	2	1	4	3
B	2	1	3	4
C	4	3	2	1
D	3	4	2	1

2)

a.	Basalt	1.	Anthracite
b.	Limestone	2.	Extrusive igneous
c.	Coal	3.	Metamorphic rock
d.	Gneiss	4.	Sedimentary rock



	a	b	c	d
A	2	4	1	3
B	2	4	1	3
C	3	1	2	4
D	3	1	4	2

V. Choose the incorrect statement from the following.

1. a) Igneous rocks are called the primary rocks.
b) Soil is the product of weathering of rocks.
c) Sedimentary rocks are the hardest ones.
d) Deccan plateau is the region of Igneous rocks.
2. a) Soil erosion decreases its fertility.
b) Dynamic metamorphism is caused by high temperature.
c) Soil is a renewable source.
d) Humus is a part of the top layer of soil.

VI. Consider the following statements and choose the right option from the given ones.

- I) **Statement (1):** Sedimentary rocks consist of many layers.
Statement (2): Sedimentary rocks are formed by the sediments deposited at different points of time.
- a) 1 and 2 are correct and 2 explains 1
 - b) 1 and 2 are correct but, 2 does not explain 1
 - c) 1 is correct but, 2 is incorrect
 - d) 2 is correct but, 1 is incorrect.

VII. Give reasons for the following.

1. Chemical sedimentary rocks are found in the beds of reservoirs.
2. Igneous rocks are found in the regions of volcanoes.

VIII. Distinguish the following.

1. Metamorphic rock and sedimentary rock.
2. Soil conservation and Soil erosion.

IX. Give short answers.

1. How are igneous rocks formed?
2. Describe about the composition of soil.
3. Define 'rock'.
4. State the types of soils.
5. What is soil conservation?

X. Give detailed answer for the following.

1. Explain the process of soil formation.
2. Classify and explain the rocks.
3. Give an account on different layers of soil.
4. Classify and explain the soil?

XI. Activity Corner.

1. Complete the following table with the help of internet source

Rocks	Mode of formation	Characteristics	Examples	Uses

2. **Map Work:** Mark the areas of black soil on the outline map of India.
3. **Exhibition:** Collect the soil samples of different types and display them with their names in the classroom .
4. **Group Discussion:** Natural sand is replaced by M-sand in construction.
 1. Status -
 2. Advantages -
 3. Disadvantages -



REFERENCE BOOKS

1. *Physical geography*-Dr.Shami swaroop.
2. *Outlines of General Geography* - By E.O. Robinson, M.A.
3. Text book in Geography for class VIII-Social science Resource and development - NCERT-New Delhi.
4. Geography for UPSC Civil Service Preliminary Examination - By Surender Singh.
5. School Atlas Book - Tamilnadu Text Book Corporation.



INTERNET RESOURCES

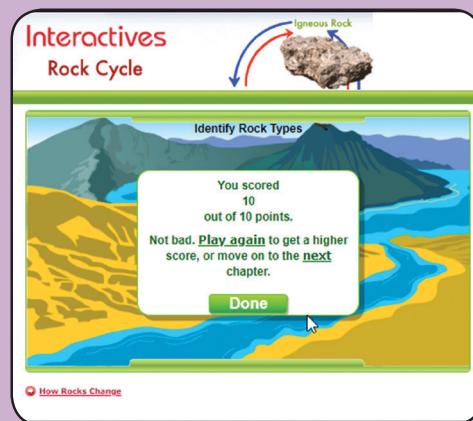
- www.Fert.nic.in
- www.greathimalayannationalpark.org
- www.csmrs.gov.in



ICT CORNER

ROCK AND SOIL

Through this activity you will know about types of rocks, how rocks change and the rock cycle.



Steps

- Open the Browser and type the URL given below (or) Scan the QR Code.
- Click the 'Begin' button, start your rock collection
- Click 'Add to rock collection' one by one
- Go to 'identify rock types' and play the game



B360_8_SOCIAL_EM

Website URL:

<http://www.learner.org/interactives/rockcycle/index.html>



Unit - 2

Weather And Climate



Learning Objectives

- ▶ To understand the importance of weather and climate
- ▶ To learn about the nature of the elements of weather and climate.
- ▶ To know the instruments used for measuring weather elements
- ▶ To be able to recognize the kind of weather and climate of a place



Introduction

Climate is one of the basic elements in the natural environment. It affects landforms, soil types, fauna and flora. It influences man to a large extent.

In a small village in Dharmapuri district, Tamil nadu, in the month of May, Yuktha enjoys her vacation with her brother and family. She always wears cotton cloths. Her mother makes food like porridge, buttermilk, lemonade, watermelon etc which suits to summer. At the same time (In May month) Tiya who lives in Auckland, New Zealand with her father and mother wear fleece jacket, jeans, gloves and socks. Her mother makes hot food like sandwich, salmon, oatmeal, soups etc. Yuktha celebrates Christmas with friends in winter, where as Tiya celebrates Christmas during summer. Can you think of why?

Yuktha and Tiya stay in two different hemispheres and have different way of life. This is because of the difference in weather condition of those places.

Weather and climate influence man's activities like what we eat, wear, the house

in which we live and work, farming, sailing, fishing, modern transport and even our play time etc. Hence one should have knowledge about the weather and climate. So, in this chapter we are going to learn about weather and climate, its elements and how they influence our lifestyle.

Weather

Weather is the day today conditions(state) of the atmosphere at any place as regards sunshine, temperature, cloud cover, Wind fog condition, air pressure, humidity, precipitation and such other elements. It refers to short periods like a day, a week, a month or a little longer and as such the weather changes from time to time in a day and one period to the other in an year. In the



Earth's atmosphere is a layer of gases surrounding the planet earth and retained by the earth's gravity. It contains about 78% nitrogen, 21% oxygen, 0.97% argon, 0.03% carbon dioxide and 0.04% trace amounts of other gases and water vapour.



Find out

Do all the planets in the solar system have atmosphere?

morning the weather might be sunny with a clear sky in a place and evening there might be clouds and rain. Similarly the weather is cool in winter and hot in summer.

We often hear people saying "Today the climate is good or bad". It is incorrect to say like that. Instead it has to be said that the weather is good or bad. We could observe the television news readers saying weather report and not the climate report for e.g. cricket match have been postponed due to bad weather etc.

Climate

Climate is generally defined as the average conditions (state) of the weather of a place or a region. The average atmospheric conditions are determined by measuring the weather elements for a long period of time which is usually for 35 years. The elements of weather and climate are the same. The climate does not change often like weather.

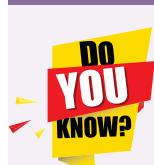


The word Climate is derived from the ancient Greek word "Klimo" which means "Inclination".

Controlling factors of weather and climate

Angle of the sun's rays, the length of daytime, altitude, distribution of land and water bodies, location and direction of mountain ranges, air pressure, winds and ocean currents are the major factors which affect the weather and climate of a region.

The earth is spherical in shape. So, the sun's rays fall unevenly on the earth's surface. The Polar regions receive slanting sun's rays. Hence there is little or no sunlight, thus there is an extreme cold winters. Vertical sun's ray's fall directly on regions around the equator,



Scientific study of weather is called **Meteorology** and the scientific study of climate is called **climatology**.

hence the climate is very hot and almost no winters. The difference in temperature makes the air and water move in currents. Warm air rises and creates more space for air beneath, while cool air settles down.

ACTIVITY

Discuss in the class room how altitude, distribution of land and water bodies, direction of mountain ranges, air pressure, winds and ocean currents affect weather/climate.

Elements of weather and climate

Temperature, rainfall, pressure, humidity and wind are the major elements of weather and climate.



a) Temperature



Thermo Meter

Temperature is one of the key elements of weather and climate. The earth and its atmosphere get heated from the sun through insolation. The degree of heat present in the air is termed as temperature. Apart from sun's rays, the heat in air also depends the atmospheric mass to a small extent.



Distribution of weather elements are shown by means of Isolines on maps. Isolines are those which join the places of equal values. Isolines are given different names based on the weather element they represent.

Isotherm	Equal temperature
Isocryme	Equal lowest mean temperature for a specified period
Isohel	Equal sunshine
Isollobar	Equal pressure tendency showing similar changes over a given time
Isobar	Equal atmospheric pressure
Isohyet	Equal amount of rainfall

Temperature varies with time due to changes in the level of radiation which reach the earth surface. This is due to motions of the earth (The rotation and revolution) and inclination of the earth's axis.

The temperature influences the level of humidity, the process of evaporation, condensation and precipitation.

Heat energy from solar radiation is received by the earth through three mechanisms. They are radiation, conduction and convection. The Earth's atmosphere is heated more by terrestrial radiation than insolation.

Temperature varies both horizontally and vertically. Temperature decreases with increasing height is known as Lapse rate which is 6.5 degree celsius per 1000 meters in troposphere .

b) Factors affecting the distribution of temperature

Latitude, altitude, nature of land, ocean currents, prevailing winds, slope, shelter and distance from the sea, natural vegetation and soil are the major factors which affect the distribution of temperature.

c) Measuring Temperature

The temperature of a unit volume of air at a given time is measured in scales like Celsius, Fahrenheit, and Kelvin. Meteorologist measures the temperature by the Thermometer, Stevenson screen and minimum and maximum Thermometer. The energy received by the earth through insolation is lost by outgoing radiation. Atmosphere is mainly heated by outgoing radiation from 2 to 4pm .So the maximum temperature is recorded between 2 and 4 pm regularly and minimum temperature is recorded around 4 am before sunrise.

Mean Temperature

The average of maximum and minimum temperatures within 24 hours is called **mean daily temperature** $((87^{\circ}\text{F}+73^{\circ}\text{F})/2=80^{\circ}\text{F})$. **Diurnal range of temperature** is the difference between the maximum and minimum temperatures of a day. **Annual range of temperature** is the difference between the highest and lowest mean monthly temperatures of a year. The distribution of temperature is shown by means of Isotherms. **Isotherms** are imaginary lines which connect the same temperatures of different places.

d) Heat zones of the earth

The fact that the earth is spherical in shape results in different parts of the earth



getting heated differently. Based on the heat received from the sun, Earth is divided into three heat zones. They are

Torrid Zone

It is a region between the tropic of cancer and the tropic of Capricorn. This region receives the direct rays of the sun and gets the maximum heat from the sun. This zone known as the torrid or the tropical zone

Temperate zone

This zone lies between the Tropic of cancer and the Arctic circle in the Northern Hemisphere and between the Tropic of Capricorn and the Antarctic circle in the southern Hemisphere. This zone gets the slanting rays of the sun and the angle of the sun's rays goes on decreasing towards the poles. Thus this zone experiences moderate temperature.

Frigid Zone

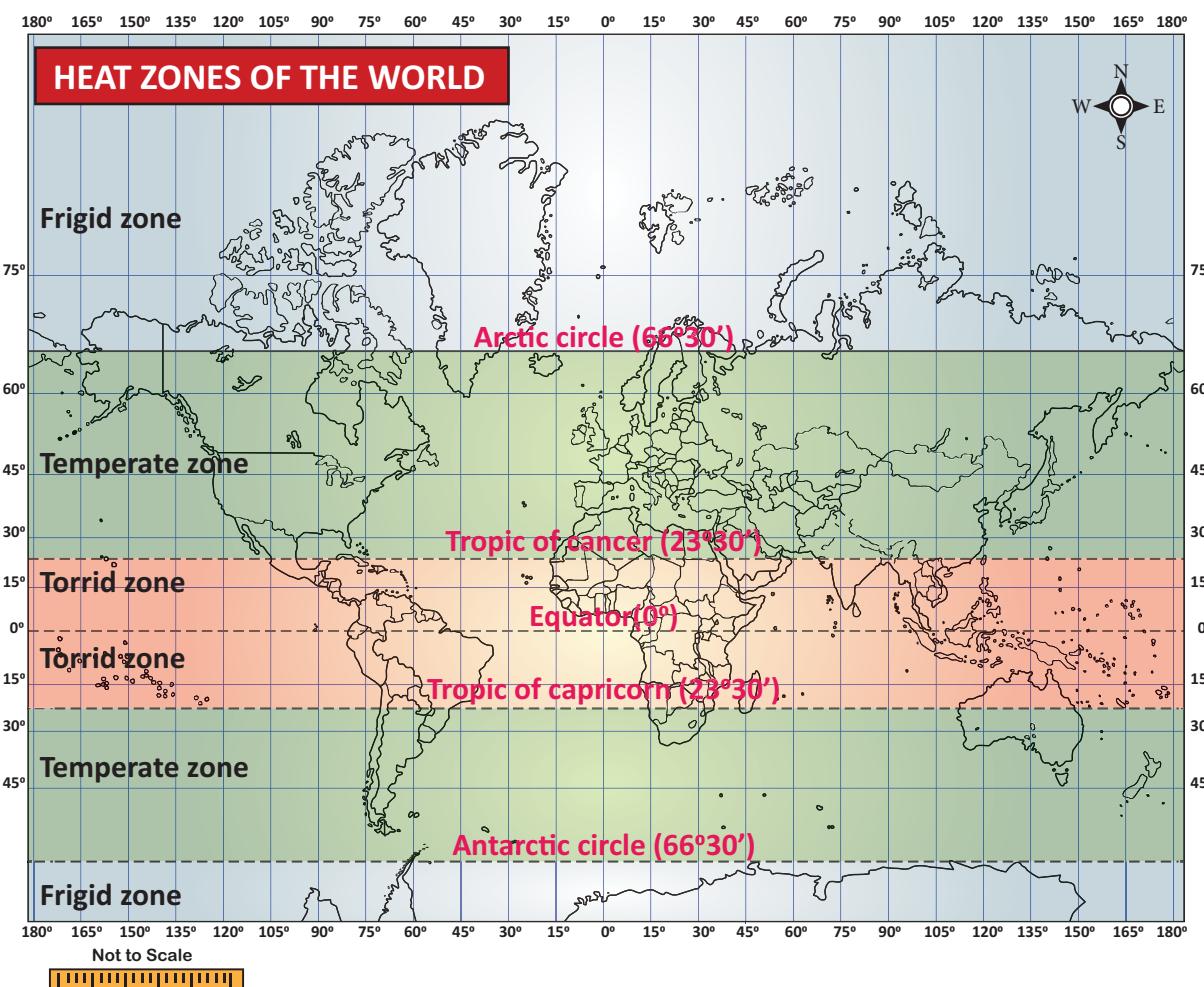
The frigid zone lies between the Arctic circle and the North Pole and between the Antarctic circle and the South Pole. This region also known as Polar region. Since it receives the extremely low temperature throughout the year, these regions are covered with snow.

Highest Temperature ever recorded

The highest temperature ever recorded on the earth is 56.7°C (134°F). It was recorded on 10th July 1913 at **Greenland Ranch of Death Valley**, California, USA.

Lowest Temperature ever recorded

The lowest temperature ever recorded on the earth is -89.2 °C (-128.6 °F; 184.0 K). It was recorded on 21st July, 1983 at **Soviet Vostok Station** in Antarctica.





Rainfall

Rain is a liquid water in the form of droplets that have condensed from atmospheric water vapour and then become heavy enough to fall under gravity. Rain is a major component of the water cycle and is responsible for depositing most of the fresh water on the Earth. It is the source of water for all purposes. There is a close relationship between the temperature and rainfall distribution. Generally rainfall is high in the equatorial region and decreases gradually towards poles. Rainfall is measured by **Raingauge**.



Raingauge

Air Pressure



Aneroid Barometer

The weight of air above a given area on the earth's surface is called atmospheric pressure or air pressure. The air pressure is measured by Barometer. **The standard air pressure at sea level is 1013.25mb.** At the earth's surface the pressure is 1.03kg.per sq cm. The variation in standard atmospheric pressure is found both horizontally and vertically. Based on the level of pressure, it is categorised into low pressure and high pressure. Low pressure area is an area in the atmosphere where the pressure is lower than its surrounding areas. In this situation, the wind from the surroundings blow towards the centre of low pressure. High pressure is an area of atmosphere where the barometric pressure is higher than its surrounding areas. In this case, the wind from the centre of high pressure blows towards the surrounding low pressure areas. Low pressure system is marked as "L" on weather map, where as the high pressure system is marked as "H". Low pressure systems are also called as a **depression and cyclones**. High pressure system is called **anti cyclones**. **Low pressure leads** to cloudiness, wind, and precipitation. High pressure leads to fair and calm weather. **Isobar** is used to show the distribution of air pressure.

Highest pressure ever recorded.

DO YOU KNOW? The highest ever air pressure at sea level was recorded at Agata, Russia on 31st December, 1968. The pressure was 1083.8mb

Lowest pressure ever recorded

The lowest pressure of 870mb was recorded at Typhoon Tip, near Guam, Mariana Island in Pacific Ocean on 12th October, 1979.

Humans are not sensitive to small variation in air pressure. But the small variations in pressure that do exist largely determine the wind and storm patterns of the earth. The distribution of atmospheric pressure is controlled by altitude, atmospheric temperature, air circulation, earth rotation, water vapour, atmospheric storms etc.



Measuring air pressure

Meteorologist uses barometer/aneroid barometer to measure the air pressure. Barograms are used for recording continuous variation in atmospheric pressure.

Why Do Your Ears Pop in Airplanes?

As you go up in an airplane, the atmospheric pressure becomes lower than the pressure of the air inside your ears. Your ears pop because they are trying to equalize or match the pressure. The same thing happens when the plane is on the way down and your ears have to adjust to a higher atmospheric pressure.

Humidity

Humidity refers to the degree of water vapour present in the atmosphere in gaseous form in particular time and place. It ranges from 0-5 percent by volume in atmosphere. Climatically it is an important constituent of the atmosphere and its quantity depends on the level of temperature. So, the level of humidity decreases towards poles from equator. Humidity is expressed in different ways.



Specific humidity is a ratio of the water vapor content of the mixture to the total air content on a mass basis. It is expressed in grams of vapour per kilogram of air

Absolute Humidity is the mass or weight of water vapour present per unit volume of air. It is expressed usually in grams per cubic meter of air.

Relative humidity is a ratio between the actual amount of water vapour present in the air and the maximum amount of water vapour it can hold at a given temperature. It is expressed as a percentage.

Generally, warm air holds more water vapour than the cold air. When relative humidity reaches 100%, the air gets saturated. In this condition the temperature is said to be at dew-point. Further cooling will condense the water vapour into the clouds and rain. Relative humidity affects human health and comfortness. Very high and very low humidity are injurious to health. It also affects the stability of different objects, buildings and electrical applications.

Measurement of Humidity

Hygrometer is used to measure the humidity. (which comprises wet and dry bulb-plate side by side in the Stevenson screen)

Find out

The effect of low and high humidity over Human beings in particular.



With decreasing air pressure, the availability of oxygen to breath also decreases. At very high altitudes, atmospheric pressure and available oxygen get so low that people can become sick and even die. Mountain climbers use bottled oxygen when they ascend very high peaks. They also take time to get used to the altitude as the quick move from high pressure to low pressure can cause decompression sickness. Aircraft create artificial pressure in the cabin which makes the passengers remain comfortable while flying.



Wind

The horizontal movement of air is called wind. Vertical movement of air is said as air current. The winds move from high pressure to low pressure. Unlike other elements a wind is made up of a series of gusts and eddies which can only be felt and not seen. Winds get their name from the direction from which they blow i.e., wind blows from south west is called southwest wind.

The wind systems are broadly categorized into three as follows.

- Planetary winds
- Seasonal winds
- Local winds

Planetary Winds are the ones which blow almost in the same direction throughout the year. So, they are called as Permanent or planetary winds. Trade winds, Westerlies and polar easterlies are the types of prevailing winds. **Seasonal winds are those** which change their direction according to season in a year. They are called as monsoon winds. These winds blow from sea to land during summer and land to sea during winter. **Local winds** are the winds blow over a small area only during a particular time of a day or a short period of a year. Land and sea breezes are example of these winds.

The Beaufort scale is a scale for measuring wind speed. It is based on observation rather than accurate measurement. It is the most widely used system to measure wind speed today. The scale was developed in 1805 by Francis Beaufort, an officer of the Royal Navy and first officially used by HMS Beagle.



Al-Balakhi, an Arab Geographer collected climatic data from the Arab travellers and prepared the First climatic Atlas of the world

Measuring wind direction and speed

Meteorologist measures wind direction using **wind vane** or **weather cock**. Wind speed is measured by **anemometer**. Wind rose is a diagram used to depict the direction and periods (No. of days) of prevailing winds on map. **Meteorograph or triple register is an instrument** which records wind speed and direction, sunshine and precipitation. It also provides graphic representation.



Anemometer



DO
YOU
KNOW?

Brazil has a large area where the average wind speed is low. Gabon, Congo and DR Congo in Africa, Sumatra, Indonesia and Malaysia are the least windy places on earth.

Recap

- **Weather** is the day today condition of the atmosphere at any place. **Climate** is the average weather condition (state) of a place for a long period and is usually for 35 years.
- Temperature, precipitation, pressure, humidity and wind are the major elements of weather and climate.
- Temperature is the degree of heat present in the air.
- The weight of air above a given area on the earth's surface is called atmospheric pressure or air pressure.
- Horizontal movement of air is called wind.



GLOSSARY

Conduction	Transfer of heat energy from one place to another through the substances that are in direct contact with each other	வெப்பக்கடத்தல்
Condensation	The process in which the water vapour changes into liquid form.	ஆவிசருங்குதல்
Eddies	They are the wind circulation that develops when the wind blows over or adjacent to rough terrain, buildings, mountains or other obstructions.	சுழற்காற்று
Humidity	The amount of water vapour in the air	நரப்பதம்
Insolation	Incoming solar radiation	சூரியக்கதிர்வீசல்
Radiation	The transmission of heat energy from one body to the other body without any medium is called radiation	கதிர்வீச்சு



Evaluation



I. Choose the correct answer.

1. Earth's atmosphere contains about ---- percentage of nitrogen and oxygen.
a) 78% and 21% b) 22% and 1%
c) 21% and 0.97% d) 10% and 20%
2. ----- is generally defined as the average conditions of the weather of a place or a region.
a) earth b) atmosphere
c) climate d)s un
3. The earth receives energy from -----.
a) current b) electro magnetic radiation
c) waves d) heat
4. Which one the following represents places with equal amount of rainfall
a) isotherm b) isohel
c)isobar d) isohytes
5. ----- is used to measure the humidity.
a) anemometer b) barometer
c) hygrometer d) thermometer

II. Fill in the blanks.

1. _____ refers to the condition of atmosphere for a short period of time.
2. The scientific study of weather is called _____.
3. The highest temperature ever recorded on the earth is _____.
4. _____ is a ratio between the actual amount of water vapour and the maximum amount of water vapour the air can hold.
5. _____ and _____ are measured by anemometer and wind vane respectively.
6. _____ are imaginary lines which connect the same temperatures of different places.

III. Match the following.

1.	Climate	Locating and Tracking Storms
2.	Isonif	Cyclone
3.	Hygrometer	Equal Snowfall
4.	Radar	Long Term Changes
5.	Low Pressure	Humidity



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

1. The atmosphere is a layer of gases surrounding the planet.
2. The Scientific study of weather is called Climatology.
3. Isohel refers equal sunshine.
4. Humidity is calculated by Aneroid Barometer.

V. Answer in brief.

1. Define 'weather'.
2. What is insolation?
3. What is meant by atmospheric pressure?
4. Write a short note on "Planetary winds"
5. What are "Isolines"?

VI. Distinguish the following.

1. Weather and climate.
2. Absolute and relative humidity.
3. Permanent and seasonal winds.

VII. Give reasons.

1. The Weather and climate in different regions vary.
2. Temperature decreases with increase in altitude.
3. Mountain climbers carry oxygen cylinders while ascending peaks.

VIII. Answer in a paragraph.

1. How is temperature measured?
2. Write about the wind and its types.
3. List out the weather elements and associated measuring instruments.

IX. Give any three suggestions to reduce global warming.

1. _____.
2. _____.
3. _____.

X. Activities.

1. Make weather instruments like wind vane and rain gauge using web resources.
2. Make mini-meteorological station model in your school.
3. Observe and record the weather condition of your place in the following table.

Date			
Place and Time			
Temperature			
Barometric pressure			
Precipitation type and amount			
Wind direction			
Wind speed			
Source of information-			

REFERENCE BOOKS

1. *Climatology an atmospheric science* John E. Oliver, John J. Hidore, 2003, person education (singapore)pte,Ltd. India branch, Delhi.
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INTERNET LINKS

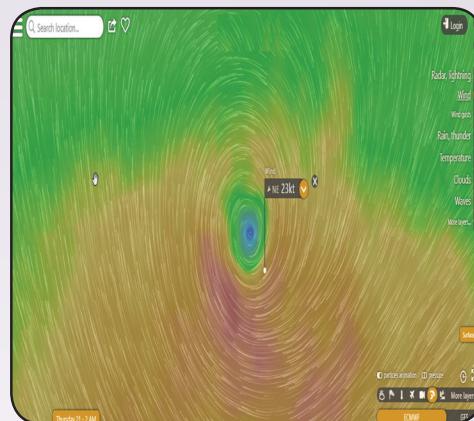
1. <https://www.nationalgeographic.com/>
2. <https://climatekids.nasa.gov/menu/atmosphere/>



ICT CORNER

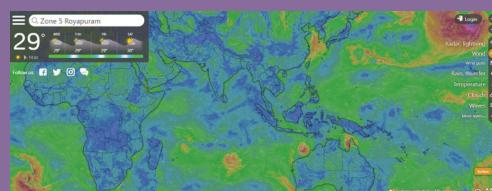
WEATHER AND CLIMATE

Through this activity you will know about wind direction, temperature, humidity and weather forecast visualization of the world



Procedure

- Step - 1** Open the Browser and type the URL given below (or) Scan the QR Code.
- Step - 2** Enter your location in search box (Ex.Tiruchirappalli)
- Step - 3** Use the Drag flag and zoom in your area.
- Step - 4** Go to menu in right side and select from the list to know the weather of your area (Ex.Temperature)



Step1



Step3



Step2



Step4

URL:

<https://www.windy.com>

Mobile: <https://play.google.com/store/apps/details?id=com.windyty.android>

*Pictures are indicatives only.

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



B360_8_SOCIAL_EM



Unit - 3

Hydrologic Cycle



Learning Objectives

- To understand the status of water on the earth.
- To learn the basic concepts of Hydrologic cycle.
- To study the different components of hydrologic cycle.



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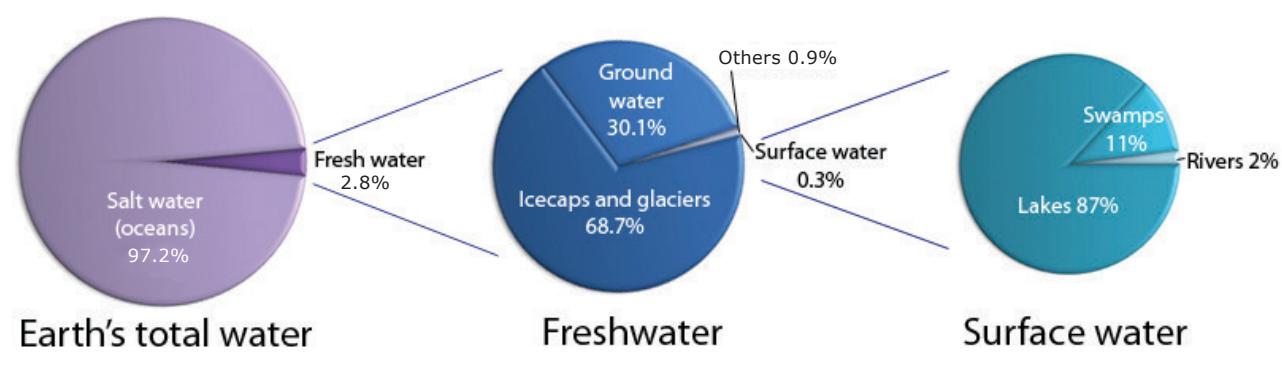
Introduction

Water is one of the most important elements on earth. All plants and animals need water for survival. Apart from drinking, water is required for domestic, agriculture, industrial purposes etc. Water is very essential for carrying out almost all economic activities. So, water is an indispensable element without which life form on the earth is not possible.

Water on the Earth

About 71% of the earth's surface is covered by water. The quantity of water

present on the earth is about 326 million cubic miles. It is hard to visualise this massive quantity of water. Most of the water on the earth is saline and is found in seas and oceans. The salt water constitutes about 97.2% and the fresh water is only about 2.8%. Out of this 2.8%, about 2.2% is available as surface water and the remaining 0.6% as groundwater. From this 2.2% of surface water, 2.15% is available in the form of glaciers and icecaps, 0.01% in lakes and streams and the remaining 0.04% is in other forms. Only about 0.25% of the total ground water of 0.6% can be





economically extracted with the present drilling technology.

Water resources are useful or potentially useful to humans. Water in India is available in three sources. They are **precipitation**, **surface water** and **groundwater**.

Table 1: Estimated Volume of Water on the Earth's Surface

Water Source	Volume of water (Cubic Miles)	Percentage to Total Water
Oceans, Seas, & Bays	321,000,000	96.54
Ice caps, Glaciers, & Permanent Snow	5,773,000	1.74
Groundwater	5,614,000	1.69
Soil Moisture	3,959	0.001
Ground Ice & Permafrost	71,970	0.022
Lakes	42,320	0.013
Atmosphere	3,095	0.001
Swamp Water	2,752	0.0008
Rivers	509	0.0002
Biological Water	269	0.0001

(Source: Shiklomanov, 1993)

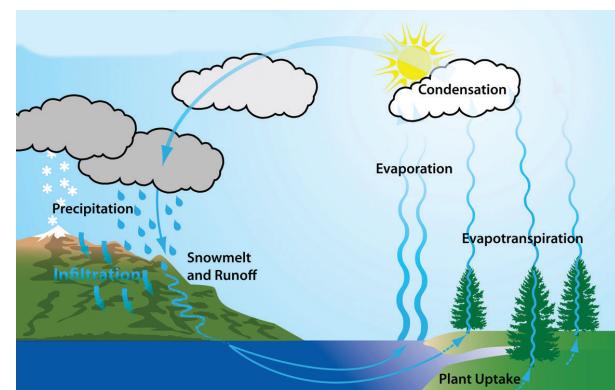
Hydrologic Cycle or Water Cycle

Hydrology is the science which deals with the various aspects of water such as its occurrence, distribution, movement and properties on the planet earth. Availability of water on the earth is not uniform. Some places are very rich in water resources while some other places are poor in water resources.

Hydrologic cycle is a global sun-driven process where water is transported from oceans to atmosphere, from atmosphere to land and from land back to oceans. The water cycle can be considered as a closed system for the earth, as the quantity of water involved in the cycle is invariable, though its distribution varies over space and time.

Evaporation takes place from the surface water and transpiration from the plants. Water vapour gets condensed at higher altitudes by condensation nuclei and form clouds (resulting in droplet growth). The clouds melt and sometimes burst resulting in precipitation of different forms. A part of water from precipitation flows over the land is called runoff and the other part infiltrates into the soil which builds up the groundwater.

Hydrologic cycle is a circulation of water. It is a continuous process and takes place naturally. The three important phases of the hydrologic cycle are: 1) **Evapotranspiration**, 2) **Precipitation** and 3) **Runoff**.



Hydrologic Cycle

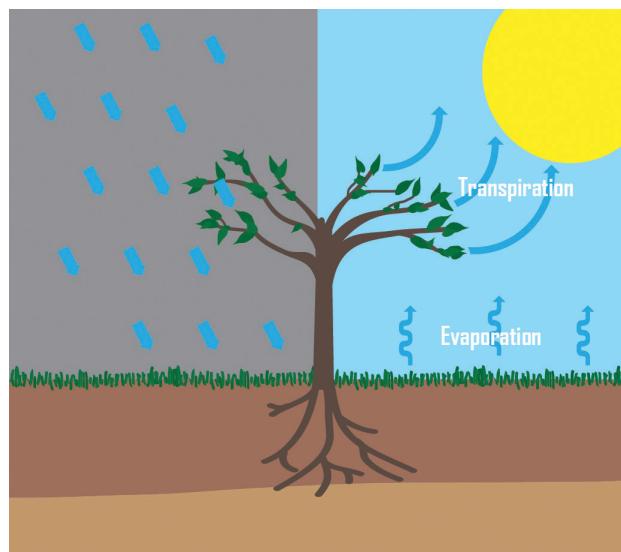
Components of Hydrologic Cycle

There are six main components in hydrologic cycle. They are: 1) Evapotranspiration, 2) Condensation, 3) Precipitation, 4) Infiltration, 5) Percolation, and 6) Runoff.

Evapotranspiration

It is defined as the total loss of water from the earth through evaporation from the surface water bodies and the transpiration from vegetation. In cropped area, it is difficult to determine the evaporation and transpiration separately. Therefore it is collectively called as evapotranspiration.





Evapotranspiration

Evaporation

Evaporation refers to the process in which the liquid form of water changes into gaseous form. Water boils at 100°C (212°F) temperature but, it actually begins to evaporate at 0°C (32°F); and the process takes place very slowly. Temperature is the prime element which affects the rate of evaporation. There is a positive relationship between these two variables. Areal extent of surface water, wind and the atmospheric humidity are the other variables which affect the rate of evaporation.

Many studies reveal that the oceans, seas, lakes and rivers provide nearly 90 % of the moisture in the atmosphere through evaporation and the remaining 10 % is contributed by plants through transpiration.

On a global scale, the amount of water gets evaporated is about the same as the amount of water delivered to earth as precipitation. This process varies geographically, as the evaporation is more prevalent over the oceans than precipitation, while over the land, precipitation routinely exceeds evaporation. The rate of evaporation is low during the periods of calm winds than during windy times. When the air is calm, evaporated water tends to stay close to the water body. During windy, the water vapour is driven away and is replaced by dry air which facilitates additional evaporation.

The rate of evaporation increases with

- Increase in wind speed
- Increase in temperature
- Decrease in humidity and
- Increase in areal extent of surface water bodies.

Transpiration

Transpiration refers to the process by which the water content in the plants are released into the atmosphere in the form of water vapour. Much of the water taken up by plants is released through transpiration. The rate of transpiration is also affected by the temperature, wind and humidity. The soil water content and the ability of the soil to conduct water to the roots, the nature of the plant parts including barks and leaves also determine the transpiration rate. In case of agriculture, the crop characteristics, its environment and cultivation practices also affect the transpiration process.

Condensation

It refers to the process in which the gaseous form of water changes into liquid form. Condensation generally occurs in the atmosphere when warm air rises, cools and loses its capacity to hold water vapour. As a result, excess water vapour condenses to form cloud droplets. Condensation is responsible for the formation of clouds. These clouds produce precipitation which is the primary route for water to return to the earth's surface in the water cycle. Condensation is the opposite of evaporation.

Forms of Condensation

Dew, Fog and Clouds are the three major forms of condensation

- a) **Dew:** It is a water droplet formed by the condensation of water vapour on a relatively cold surface of an object. It forms when the temperature of an object drops below the dew point temperature.



Frost: The ice crystals formed by deposition of water vapour on a relatively cold surface of an object is known as frost. It forms when the temperature of an object drops below the freezing point of temperature.

b) **Fog:** Fog is the suspended tiny water droplets or ice crystals in an air layer next to the earth's surface that reduces the visibility to 1,000 m or lower. For aviation purposes, the criterion for fog is 10 km or less.

Mist: Mist is the tiny droplets of water hanging in the air. These droplets form when the water vapour in the air is rapidly cooled, causing it to change from invisible gas to tiny visible water droplets. Mist is less dense than fog.

c) **Clouds:** Clouds consist of tiny water droplets/ice particles which are so small and light in weight. Clouds are formed by microscopic drops of water or by small ice crystals. The size of the droplets generally range from a couple of microns to 100 microns. This is the limit beyond which cloud drops become rain drops.



- Condensation occurs when the air get saturated.
- Warm air can hold more water vapour than the cool air.
- Saturation occurs when the temperature drops down.

Precipitation

Precipitation refers to all forms of water that fall from clouds and reaches the earth's surface. For the occurrence of precipitation, cloud droplets or ice crystals must grow heavy enough to fall through the air. When the droplets grow large in size, they tend to fall. While moving down, by collecting some small droplets, they become heavy enough to fall out of the cloud as raindrops.

Forms of Precipitation

The form of precipitation in a region depends on the kind of weather or the climate of the region. The precipitation in the warmer parts of the world is always in the form of rain or drizzle. In colder regions, precipitation may fall as snow or ice. Common types of precipitation include rain, sleet, freezing rain, hail and snow.

Rain: The most common kind of precipitation is rain. The precipitation in the form of water droplets is called rain. The precipitation in which the size of rain drops are <0.5 mm in diameter is known as drizzle and the rain drops with >0.5 mm in diameter is known as rain. Generally drizzle takes place from stratus clouds.

Sleet: The precipitation which takes place in the form of mixture of water droplets and tiny particles of ice(5mm in diameter) is known as sleet. Sometimes raindrops fall through a layer of air below 0°C , the freezing point of water. As they fall, the raindrops freeze into solid particles of ice. So, the mixture of water droplets and ice particles would fall on the earth surface.

Freezing Rain: At other times raindrops falling through cold air near the ground do not freeze in the air. Instead, the raindrops freeze when they touch a cold surface. This is called freezing rain and the drops of water are usually greater than 0.5 mm in diameter.

Hail: The precipitation which consists of round pellets of ice which are larger than 5 mm in diameter is called hail or hailstones. Hail forms only in cumulonimbus clouds during thunderstorms. A hailstone starts as an ice pellet inside a cold region of a cloud. Strong updrafts in the cloud carry the hailstone up and down through the cold region many times.

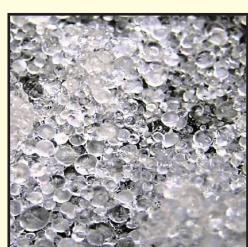
Snow: Often water vapour in a cloud is converted directly into snow pieces due to lowering of temperature. It appears like a



powdery mass of ice. The precipitation in the form of powdery mass of ice is known as snowfall. It is common in the polar and high mountainous regions.



RAIN



SEET



FREEZING RAIN



HAIL

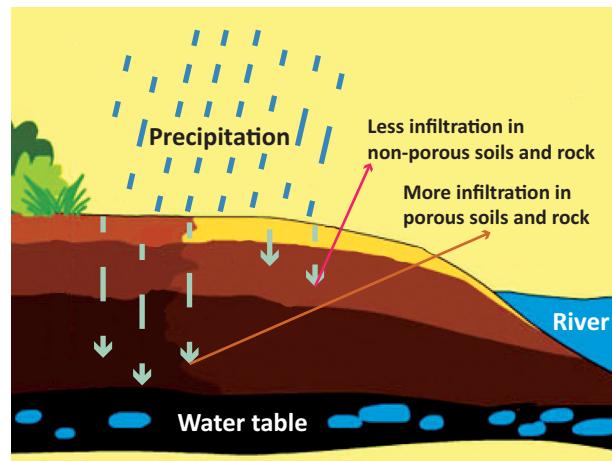


SNOW

Different forms of Precipitation

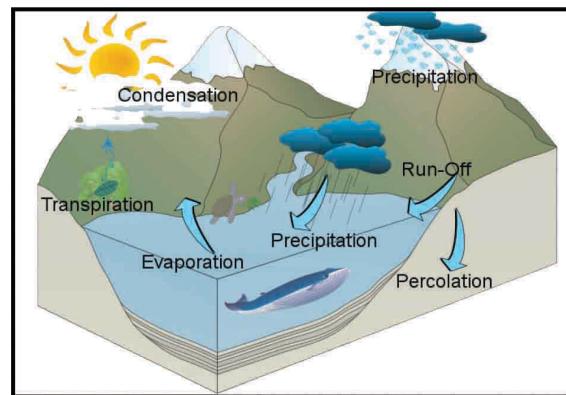
Infiltration

Water entering the soil at the surface of the ground is termed as infiltration. Infiltration allows the soil temporarily to store water, making it available for plants use and organisms in the soil. Infiltration is an important process where rain water soaks into the ground, through the soil and underlying rock layers. Some of this water ultimately returns to the surface through springs or low spots down hills. Some of the water remains underground and is called groundwater. The rate of infiltration is influenced by the physical characteristics of the soil, vegetative cover, moisture content of the soil, soil temperature and rainfall intensity. The terms infiltration and percolation are often used interchangeably.



Infiltration Process

Percolation



Percolation Process

Percolation is the downward movement of infiltrated water through soil and rock layers. Infiltration occurs near the surface of the soil and delivers water from the surface into the soil and plant root zones. Percolation moves the infiltrated water through the soil profile and rock layers which leads to the formation of ground water or become a part of sub-surface run-off process. Thus, the percolation process represents the flow of water from unsaturated zone to the saturated zone.

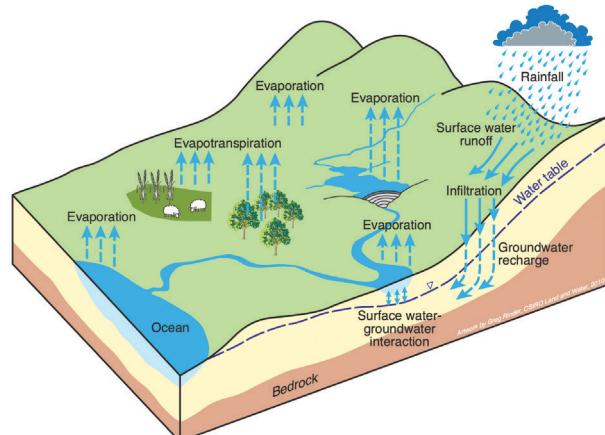
Runoff

Runoff is the water that is pulled by gravity across land's surface. It replenishes groundwater and surface water as it percolates into an aquifer (it is an underground layer of water-bearing rock) or moves into a river, stream or watershed. It comes from unabsorbed water from rain, snowmelt,



irrigation or other sources, comprising a significant element in the water cycle as well as the water supply when it drains into a watershed.

Runoff is also a major contributor to the erosion which carves out canyons, gorges and related landforms. The amount of runoff that can happen depends on the amount of rainfall, porosity of soil, vegetation and slope. Only about 35% of precipitation ends up in the sea or ocean and the other 65% is absorbed into the soil.



Runoff Process

Types of Runoff

Based on the time interval between the instance of rainfall and generation of runoff, the runoff may be classified into following three types

- Surface Runoff:** It is the portion of rainfall, which enters the stream immediately after the rainfall. It occurs, when the rainfall is longer, heavier and exceeds the rate of infiltration. In this condition the excess water makes a head over the ground surface, which tends to move from one place to another following land gradient and is known as overland flow. When the overland flow joins the streams, channels or oceans, it is termed as surface runoff or surface flow.
- Sub-Surface Runoff:** The water that has entered the subsoil and moves laterally without joining the water-table to the streams, rivers or oceans is known as sub-

surface runoff. The sub-surface runoff is usually referred as interflow.

- Base Flow:** It is a flow of underground water from a saturated ground water zone to a water channel. It usually appears at a downstream location where the channel elevation is lower than the groundwater table. Groundwater provides the stream flow during dry periods of small or no precipitation.

Units of the Measurement pertaining to Hydrology

- Evaporation /interception - inches (or) cm
- Infiltration - inches (or) cm / hour
- Precipitation - inches (or) mm (or) cm
- Run off - inches (or) mm (or) cm
- Run off rate - cubic feet per second
- Run off volume - acre feet (or) cubic feet
- Storage - cubic feet (or) acre feet

Recap

- Water is one of the most important elements on earth. All plants and animals need water for survival.
- About 71% of the earth's surface is covered by water. Out of this, only about 2.8% is fresh water and the remaining 97.2% is saltwater found in seas and oceans.
- Hydrological cycle is a global sun-driven process where water is transported from oceans to atmosphere, from atmosphere to land and from land back to oceans.
- There are six main components in hydrologic cycle. They are evapotranspiration, condensation, precipitation, infiltration, percolation, and runoff.
- The precipitation in the warmer parts of the world is in the form of rain or drizzle. The common types of precipitation include rain, sleet, freezing rain, hail, and snow.
- Infiltration occurs near the surface of the soil and delivers water from the surface into the soil and plant rooting zone. Percolation moves it through the soil profile and rock layers to form groundwater.



GLOSSARY

Aquifer	It is an underground layer of water - bearing permeable rocks, rock fractures or unconsolidated materials (gravel, sand or silt)	நீர்க்கொள்பாறை
Evapotranspiration	It refers to the water lost through evaporation from the water bodies and transpiration from vegetation	நீராவியாதல்
Infiltration	the seepage of water into soil or rock	நீர் ஊட்டுவல்
Percolation	the slow movement of water through the pores in soil	நீர்க்கசிவு
Precipitation	falling products of condensation in the atmosphere, as rain, snow, or hail	மழை
Runoff	overflow	ஓடும்நீர்



Evaluation



I. Choose the Correct Answer.

1. The process in which the water moves between the oceans, atmosphere and land is called
 - a) River Cycle
 - b) Hydrologic Cycle
 - c) Rock Cycle
 - d) Life Cycle
2. The percentage of fresh water on the earth is
 - a) 71
 - b) 97
 - c) 2.8
 - d) 0.6
3. The process of changing of water from gaseous to liquid form is known as
 - a) Condensation
 - b) Evaporation
 - c) Sublimation
 - d) Rainfall
4. Water that flows in the sub-soil or through the ground into the streams, rivers, lakes and oceans is termed as
 - a) Condensation
 - b) Evaporation
 - c) Transpiration
 - d) Runoff
5. The evaporation of water from the leaves of plants is called
 - a) Transpiration
 - b) Condensation
 - c) Water vapour
 - d) Precipitation

6. Water that is good enough to drink is called
 - a) Groundwater
 - b) Surface water
 - c) Potable water
 - d) Artesian water

II. Fill in the blanks.

1. The degree of water vapour present in the atmosphere is known as _____.
2. There are _____ phases in the water cycle.
3. The falling of water towards the earth surface from atmosphere in any form is known as _____.
4. The precipitation with the rain drop size of <0.5mm in diameter is known as _____.
5. Mist is denser than _____.

III. Match the following.

1.	Vegetation	Clouds
2.	Condensation	Sleet
3.	Snow and rain drops	At the surface
4.	Infiltration	Transpiration

IV. Choose the correct statement

1. Evaporation refers to
 - I. The process in which the gaseous form of water changes in to liquid form.



- II. It refers to the process in which the liquid form of water changes into gaseous form.
- III. Water boils at 100°C temperature but, it actually begins to evaporate at 0°C.
- IV. It is responsible for the formation of clouds.
- a) I, IV and V are correct
- b) II only correct
- c) II and III are correct
- d) All are correct

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

- 1. Water boils at 212°F temperature but, it begins to evaporate at 32°F.
- 2. Mist is not the tiny droplets of water hanging in the air.
- 3. The sub-surface runoff is usually referred as interflow.

VI. Answer in brief.

- 1. Write a short note on aquifer.
- 2. Define “hydrological cycle”.
- 3. How is the dew formation takes place?
- 4. Write a short note on surface run-off.

VII. Give reasons.

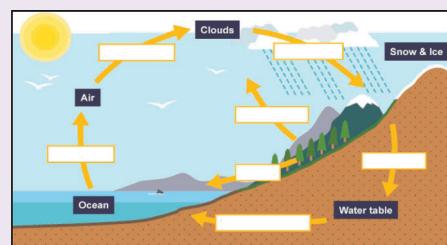
- 1. Infiltration of water is low in the region of non-porous soil.
- 2. Fresh water is less on the earth.
- 3. Snowfall is common in the polar region and mountainous regions.

VIII. Answer in a paragraph.

- 1. Explain the different stages involved in the hydrological cycle.
- 2. Distinguish between evaporation and transpiration.
- 3. Give a detailed explanation on different forms of precipitation.
- 4. Explain the run-off and its types.

ACTIVITY

Find out the missing components of hydrologic cycle in the given diagram and fill it up appropriately.



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INTERNET RESOURCES

1. <http://www.fao.org/docrep/X0490E/x0490e04.htm>.
2. <https://www.sciencelearn.org.nz> (University of Waikato).
3. <https://cals.arizona.edu/azmet/etowhat1.pdf>.
4. https://pmm.nasa.gov/education/sites/default/files/lesson_plan_files/evaporation_investigation_lesson_plan.pdf.
5. <https://www.watereducation.org/aquapedia-background/runoff>.



STANDARD EIGHT

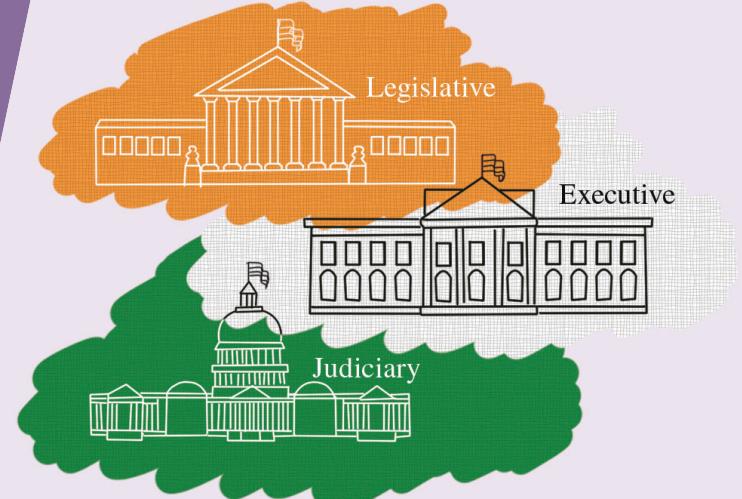
CIVICS

ECONOMICS



Unit - 1

How The State Government Works



Learning Objectives

Students acquire knowledge in

- ▶ The State executive.
- ▶ Powers and functions of the Governor.
- ▶ Powers and functions of the Chief Minister.
- ▶ Legislative Assembly and Council.
- ▶ State Judiciary.



Introduction

There are two sets of government in our country – the central government and the state government. There are 29 state governments in our country; every State has a government to run its own administration. The States have their own executive and legislature and Judiciary. The state executive consists of the Governor and the Council of Ministers headed by the Chief Minister. The Governor is an integral part of the State legislature.

The State Executive

The Governor

The Constitution provides for the post of the Governor as the Head of a State in India. He is appointed by the President of India. He is the constitutional Head of a State. The Governor is appointed for a term of five years. But before the



expiry of his full term, the President can dismiss him from office. The Governor may also resign on his own interest. His term of office may be extended and he may be transferred to another State. However, the State Government cannot remove the Governor from his post. To be the Governor, a person must be a citizen of India and should have completed 35 years of age. And he cannot be a member of the Parliament or the State legislature. He should not hold any office of profit.



While appointing the Governor, the President acts as per the advice of the Union Cabinet. The State Government is also consulted when the appointment is to be made. Generally, a person is not appointed Governor in his own State.

Powers and functions

- ▶ The Governor is the Chief Executive in a State. All the executive powers of the State are



vested upon him and decisions are taken in his name. He appoints the Chief Minister and Council of Ministers.

- He makes some important appointments of the State Government, such as, the Advocate general, Chairman and members of the State Public Service Commission and others.
- The President imposes emergency in a State under Article 356 on the basis of the report of the Governor. The Governor also acts as the Chancellor of State Universities.
- He summons and prorogues the sessions of the State legislature and he can dissolve the Legislative Assembly.
- Money bills can be introduced in the State Legislative Assembly only with the approval of the Governor. The Governor may promulgate ordinances when the Legislative Assembly or both the Houses of the legislature (when there are two Houses) are not in session.
- The Governor may nominate one member from the Anglo- India Community to the Legislative Assembly if there are Anglo-Indian people in a State and when they are not duly represented in the State legislature. He may also nominate 1/6 members of the Legislature Council from among persons who are experts in the fields of science, literature, arts, social service and co- operative movement.
- The annual budget of the State Government is laid before the legislature with the approval of the Governor. The Governor must give his assent to all the bills passed in the legislature including money bills. The Contingency fund of the State is also placed at the disposal of the Governor.

Position of the Governor

The position of the Governor of a State is compared to the President of India as a nominal executive. But the Governor is not always a nominal executive. He can exercise his powers in the real sense on some occasions. He acts as an agent of the Central Government

in a State. Therefore, he is responsible for maintaining relation between the Central Government and the State Government. The Governor may advise the Council of Ministers when faces difficult situations. The President declares emergency in a State on the basis of the report of the Governor regarding the law and order situation in the State. The Governor takes independent decisions while exercising discretionary powers. He may seek information from the Council of Ministers regarding various activities of the Government.

The Chief Minister

The Governor appoints the leader of the majority party in the State Legislative Assembly as the Chief Minister. He is the head of the State Council of Ministers. The Chief Minister has no fixed term of office. He remains in office so long as he gets support of the majority members of the Legislative Assembly. When he loses support in the legislature, he has to resign. The resignation of the Chief Minister means the resignation of the whole Council of Ministers in the State.

The Chief Minister must be a member of the State Legislature. If he is not a member of the State legislature at the time of his taking over charge, he must be so within a period of six months.

Powers and Functions

- The Chief Minister is the chief administrator of the State. All major decisions of the State Government are taken under his leadership.
- The Chief Minister plays an important role in the formation of the Council of Ministers. On the advice of the Chief Minister, the Governor appoints the other Ministers.
- The Chief Minister supervises the activities of different ministries and advises them accordingly. He also coordinates the activities of different ministries.





- The Chief Minister plays an important role in making policies of the State Government. He has to ensure that the policies of the government do not go against public interest. His voice is final in policy decisions of the State Government.
- He plays an important role in making higher appointments of the State Government. The Governor appoints different higher officials of the State Government on the advice of the Chief Minister and his Council of Ministers.

The Legislature

In India, the State Legislature consists of the Governor and one or two houses. The upper house is called the Legislative Council while the lower house is called the Legislative Assembly.

states with bicameral legislature



Legislative Council

The Constitution provides that the total strength of the Legislative Council must not be less than 40 and not more than 1/3 of the total strength of the Legislative Assembly of the State. The members of the Legislative Council are elected indirectly. One third of its members are elected by the local government bodies like the District Panchayat and Municipalities. Another one third is elected by the members of the Legislative Assembly. One twelfth is elected by the graduates of the constituency and another one twelfth by the teachers of secondary schools, colleges and universities. One sixth

At present, only seven states in India have Legislative Council in their legislature. They are Bihar, Uttar Pradesh, Maharashtra, Karnataka, Jammu & Kashmir, Andhra Pradesh and Telengana

of the members of the Legislative Council are nominated by the Governor of the State.

The Legislative Council is a permanent house. One-third of its members retire every two years and elections are held to fill the vacant seats. The members are elected for a term of six years. To be a member of the Legislative Council, one must be a citizen of India and should have completed 30 years of age. He cannot be a member of the Legislative Assembly or either of the houses of the Parliament. The Chairman is the presiding officer of the Legislative Council. In his absence, the Deputy Chairman presides over its meetings. They are elected from among the members of that house.

Legislative Assembly

The people who make the laws of a state government are called 'Members of the Legislative Assembly' (MLA). MLAs are chosen from different constituencies. For the election of MLAs the entire state is divided into different constituencies. These constituencies are called the legislative constituencies. One legislative constituency may have one lakh or even more people. One MLA is chosen from each legislative constituency to represent that legislative assembly.

Election to the Assembly

Different political parties compete in the elections to the legislative assembly. These parties nominate their candidates from each constituency. The candidate is that person who contests for the election and asks people to vote for him. A person has to be at least 25 years old to contest for election to the legislative assembly. One person can stand for election in more than one constituency at the same time. Even if a person does not belong to any political



party, he can contest election; such candidate is called an independent candidate. Every party has its own symbol. Independent candidates are also given election symbol. The members of legislative assembly (MLA) are elected directly by the people. All people residing in the area of a legislative constituency who are 18 years of age can cast a vote in the legislative assembly elections.

According to the Constitution, a Legislative Assembly cannot have more than 500 members and not less than 60 members. Some seats in the Legislative Assembly are reserved for Scheduled Castes and Scheduled Tribes. The Governor can nominate one member from the Anglo-Indian community. The members of the Legislative Assembly are elected for a term of five years. But the Governor can dissolve the house before the expiry of its term and can call for fresh elections. The meetings of the Assembly are presided over by the Speaker who is elected from among the members of the Assembly. In his absence, the Deputy Speaker conducts its meetings.

The States Council of Ministers

The leader of the majority party in the election is chosen as Chief Minister. In Tamil Nadu there are 234 legislative constituencies. The party with more than 118 elected candidates (MLA) are invited by the governor to form the Government. The Chief Minister (who also should be an MLA) chooses his ministers from the MLAs of his party. Ministers for various departments headed by the Chief Minister is called the State Government. So it is said that the party which got majority seats in the election forms the government.

The working of the State Government

After being elected to the legislative assembly the MLAs are expected to regularly participate in its sittings. The legislative assembly meets 2 or 3 times in a year. The main duty of the Legislative Assembly is to make laws for the state. It can make law on the subjects mentioned in the state list and the concurrent

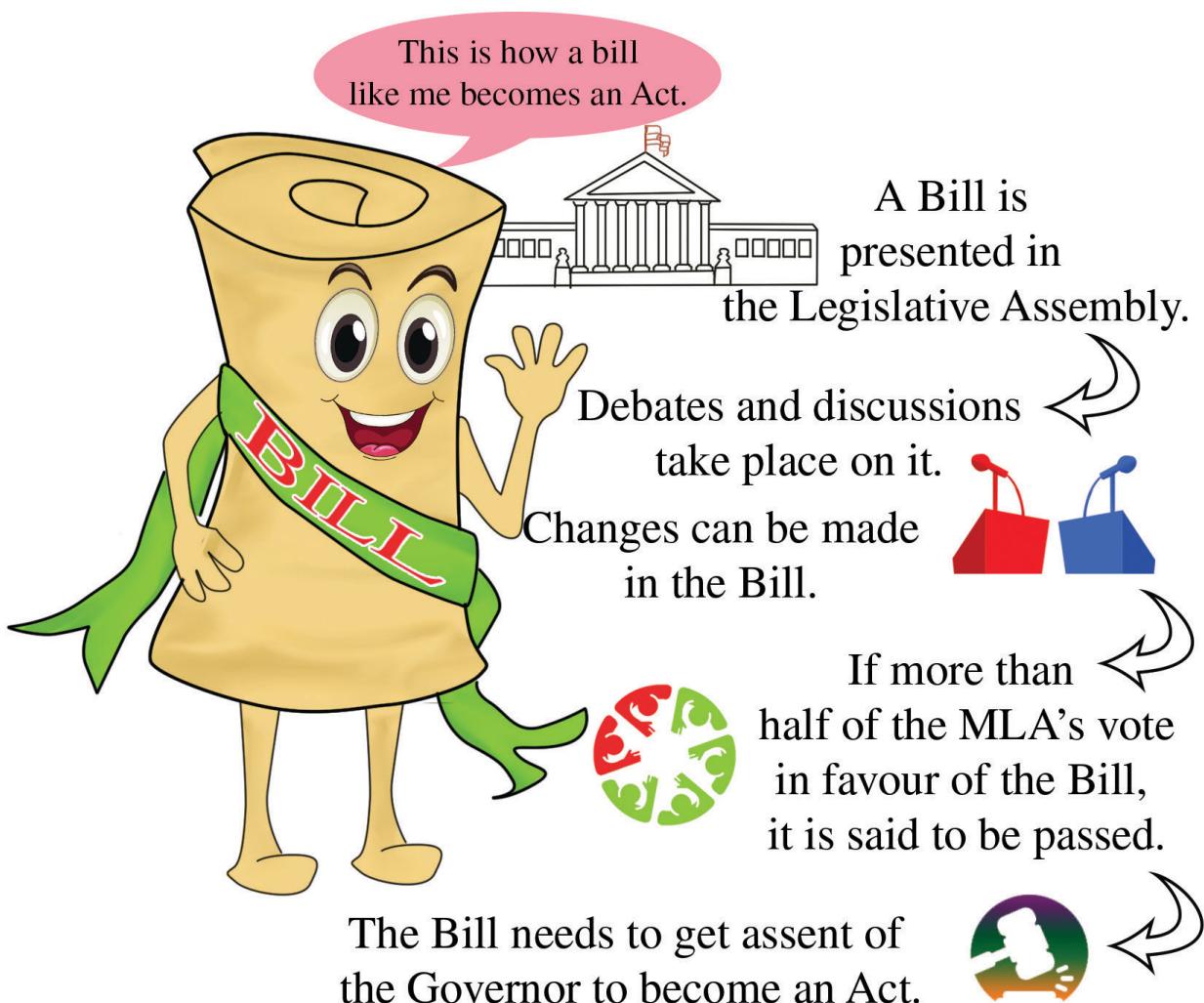
list. However, during state emergency, it cannot exercise its legislative power.

The assembly has control over the State council of Ministers. The State council of ministers are responsible or answerable to the Assembly for its activities. The Assembly may pass a no confidence motion against the council of Ministers and bring its downfall if it is not satisfied with the performance of the council of Ministers. The legislative Assembly has control over the finances of the state. A money bill can be introduced only in the Assembly. The government cannot impose, increase, lower or withdraw any tax without the approval of the Assembly. The elected members of the Legislative Assembly can take part in the election of the president of India and all members can take part in the election of the members of the Rajya Sabha from the state. The Assembly also takes part in the amendment of the Constitution on certain matters. So the government has three basic functions: making laws, executing laws and ensuring justice.

How laws are made in State Government?

Several kinds of rules and laws have been made for all people of our country. For instance, there is a law that you cannot keep a gun without having a licence for it. Or that woman cannot marry before the age of 18 years old and men cannot marry before the age of 21 years. These rules and laws have not been made just like that. People elected their government who thought carefully before making such laws. A lot of such laws are made by the state and central government.

In the legislative assembly meetings, MLAs discuss a number of topics like public works, education, law and order and various problems faced by the state. The MLAs can ask questions to know the activities of ministries, which the concern ministers have to answer. The legislative assembly makes laws on certain issues. The process of law making as follows:



DO YOU KNOW?

The State legislature follows the same procedure for passing an ordinary or a money bill like that of the Parliament. In State legislatures also, the Legislative Assembly which is the lower house is more powerful than the Legislative Council which is the upper house.

Executing Laws

It is the job of the state's council of ministers to execute the law. The legislative assembly of Tamilnadu is located at Chennai. The place where a state's legislative assembly is located and where its council of ministers function is called the capital of that state.

The state government has several lakhs of government employees to execute the laws

made by the legislative assembly- Collectors, Tahsildars, Block Development Officers, Revenue officers, Village Administrative Officers, Policemen, Teachers and Doctors, etc. All of them are paid salaries by the state government. They have to follow the orders of the state government.

Judiciary of State

High Courts

The High court stands at the apex of the State Judiciary. As per the constitution there shall be a High Court in each state. But there may be a common High Court for two or more states and Union Territories. The State High Court consists of a Chief Justice and such other Judges as the President may appoint from time to time if necessary. The number of judges in



the High Courts is not uniform and fixed. The President appoints the Chief Justice of High Court in consultation with the Chief Justice of India and the Governor of the state.

A Judge of High Court must have the following qualification:

- He must be a citizen of India
- He must have at least ten years' experience as head of the judicial office in the territory of India.
- He must have at least ten years' experience as an advocate in one or more High Courts.

A Judge of High Court holds the office until he completes the age of 62 years. A Judge of the High Court can be removed from office only for proven misbehaviour or incapacity and only in the same manner in which a Judge of the Supreme Court is removed.

Power and Functions of the High Court

- The High Court has been empowered to issue writs of Habeas corpus, Mandamus, Prohibition, Certiorari and Quo Warranto for the enforcement of the fundamental rights and for other purposes.
- Every High Court has a general power of superintendence over all the lower courts and tribunals within its jurisdiction except military courts and tribunals.
- If a case is pending before a sub – ordinary court and the High Court is satisfied that it involves a substantial question of the

constitutional law, it can take up the case and decide it itself.

- The High Court controls all the subordinate courts in the State.
- Like the Supreme Court, the High Court also acts as a Court of Record.

For the purpose of judicial administration, each state is divided into a number of districts, each under the jurisdiction of a district judge. The district court Judges were appointed by the Governor. In the exercise of the above mentioned powers, the High Court enjoys full powers and freedom to act within its jurisdiction. The constitutional safeguards have ensured its independent working.

Recap

- There are 29 state governments in our country. Every State has a government to run its own administration.
- The Constitution provides for the post of the Governor as the Head of a State in India.
- The Chief Minister plays an important role in making higher appointments of the State Government.
- The people who make the laws of a state government are called 'members of the Legislative Assembly' (MLA).
- The High court stands at the apex of the State Judiciary. As per the constitution there shall be a High Court in each state.

GLOSSARY

Constituency	the body of voters who elect a representative for their area	தொகுதி
Jurisdiction	power or authority to interpret and apply the law	அதிகார வரம்பு
Legislature	an organized body having the authority to make laws for a political unit	சட்டமன்றம்
Promulgate	announce widely known	பிரகடனம்
Prorogues	to suspend or end a legislative session	தள்ளிவை



Evaluation



I. Choose the correct answer.

1. The Governor of a state is appointed by
 - a) President
 - b) Vice President
 - c) Prime Minister
 - d) Chief Minister
2. The State Council Ministers is headed by
 - a) The Governor
 - b) Chief Minister
 - c) Speaker
 - d) Home Minister
3. Who can summon and prorogue the sessions of the State legislature?
 - a) Home Minister
 - b) President
 - c) Speaker
 - d) The Governor
4. Who does not participate in the appointment of the High Court Judge?
 - a) Governor
 - b) Chief Minister
 - c) Chief Justice of the High Court
 - d) President of India
5. The age of retirement of the Judges of the High Court is
 - a) 62
 - b) 64
 - c) 65
 - d) 58

II. Fill in the blanks.

1. _____ States are there in India at present.
2. The tenure of the Governor is normally _____ years.
3. The District Judges are appointed by _____.
4. The Governor is the _____ Head of the State.
5. Minimum age for elections as MLA _____ years.

III. Match the following.

1.	Governor	Lower House
2.	Chief Minister	Nominal Head
3.	Legislative Assembly	Upper House
4.	Legislative Council	Real Head

IV. State true or false.

1. Chief Minister is the chief administrator of the State.
2. The Governor nominates two members of the Anglo- Indian Community to Legislative Assembly.
3. The number of judges in the High Courts is not uniform and fixed.

V. Choose the correct statement.

1. The State Legislative Assembly participates in the election of
 - i) President
 - ii) Vice – President
 - iii) Rajya Sabha members
 - iv) Members of the Legislative Council of the State
- a) i, ii & iii are Correct
- b) i & iii are Correct
- c) i, iii & iv are correct
- d) i, ii , iii & iv are correct

VI. Answer the following in one or two sentences.

1. Name the two houses of the State legislature?
2. Write the qualifications of the members of the Legislative Assembly?
3. How is the Chief Minister appointed?
4. How is the Council of Ministers formed?

VII. Answer the following in detail.

1. Discuss the powers and functions of the Chief Minister.
2. Discuss the powers and functions of the Legislative Assembly.?



3. Write about the powers and functions of the High Court?

VIII. Project and Activity.

List out the name of the Tamil Nadu Governor and Chief Minister, Ministers and Governors and Chief Ministers of the neighbouring states.



REFERENCE BOOKS

- The Constitution of India, Government of India, Ministry of Law and Justice, 2011

- Om Prakash Aggarawala, S.K. Aiyar The Constitution of India, Metropolitan Book Company Ltd., Delhi 1950



INTERNET RESOURCES

- www.tnrajbhavan.gov.in/
- www.tn.gov.in/
- indiancourts.nic.in/



ICT CORNER

HOW THE STATE GOVERNMENT WORKS

Through this activity students will explore the Indian Parliament Virtually



VIRTUAL TOUR



Steps

- Enter the following URL or scan the QR code to land in Lok Sabha official website. Select “Members” tab to explore the sitting members of the parliament.
- Scroll the middle section of the page to know the cabinet members of different departments that governs India.
- Hover the mouse over the “pie chart” to know the strength of the different parties that constitutes the central government.
- Click “Virtual tour” from the lower section of the page and view the structure of the parliament.



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Website URL:

<https://indiancitizenshiponline.nic.in/Home.aspx>



Unit - 2

Citizens and Citizenship



Learning Objectives

Students acquire knowledge in

- ▶ Meaning, definition of citizens and citizenship
- ▶ The Constitutional Provisions of India
- ▶ Acquisition and termination of Indian citizenship
- ▶ Nature of overseas citizenship of India
- ▶ Rights and responsibility of a citizen



Introduction

Civics is the study of government. The word 'Citizen' is derived from the Latin word 'Civis' which means resident of a City State of Ancient Rome. After the disappearance of City-State system, it has been used to mean a member of the State. The citizens of a state enjoy full civil and political rights.

Citizen and Citizenship

Citizen is a person of a country who is entitled to enjoy all the legal rights and privileges granted by a state and is obligated to obey its laws and to fulfill his duties.

Citizenship is the status given to the citizens which provide them the right to legally live in a country as long as they want.

Types of Citizen

There are two types of citizens, Natural and Naturalised citizens.

1. Natural citizens: are the citizens by birth.
2. Naturalised citizens: are the one who acquires citizenship.

Indian Citizenship Act, 1955



This act is to provide for the acquisition and termination of Indian citizenship.

Acquisition of citizenship

The citizenship Act of 1955 prescribes five ways of acquiring citizenship. They are by birth, descent, registration, naturalisation and incorporation of territory.

1) By Birth

- a. A person born in India on or after 26th January 1950 but before 1st July 1987 is a citizen of India by birth irrespective of the nationality of his Parents.
- b. A person born in India on or after 1st July 1987 is considered as a citizen of India only if either of his Parents is a citizen of India at the time of his birth.





- c. Those born in India on or after 3rd December 2004 are considered citizens of India or one of whose parents is a citizen of India and the other is not an illegal migrant at the time of their birth.

- d. he is a good character and has an adequate knowledge of a language specified in the Eighth Schedule to the Constitution. (presently 22 languages)

2) By Descent

- a. A Person born outside India on or after 26th January 1950 but before 10th December 1992 is a citizen of India by descent, if his father was a citizen of India at the time of his birth.
- b. A person born outside India on or after 10th December 1992 is considered as a citizen of India if either of his parents is a citizen of India at the time of his birth.
- c. From 3rd December 2004 onwards, a person born outside India shall not be a citizen of India by descent, unless his birth is registered at an Indian consulate within one year of the date of birth.

3) By Registration

- a. A Person of Indian origin who is ordinarily resident in any country or place outside undivided India.
- b. A Person of Indian origin who is ordinarily resident in India for seven years before making an application for registration.
- c. A Person who is married to a citizen of India and is ordinarily resident in India for seven years before making an application for registration

4) By Naturalisation

The Central Government may, on an application, grant a certificate of naturalization to any person

- a. if he is not a citizen of any country where citizens of India are Prevented from becoming subjects or citizens of that country
- b. a citizen of any country, renounce the citizenship of that country
- c. he has either resided in India or been in the service of a Government in India or throughout the period of twelve months

5) By incorporation of Territory

- a. If any foreign territory becomes a part of India, the Government of India specifies the persons who among the people of the territory shall be the citizens of India. Such persons become the citizens of India from the notified date. For example, when Pondicherry became a part of India, the Government of India issued the citizenship (Pondicherry) order, 1962.

Loss of Indian Citizenship

Part II of the Constitution of India (Article 5-11) prescribes three ways of losing citizenship.

Renunciation: (is a voluntary act) when a person after acquiring the citizenship of another country gives up his/her Indian citizenship.

Termination: (takes place by operation of law) When an Indian citizen voluntarily acquires the citizenship of another country; he/she automatically ceases to be an Indian citizen.

Deprivation: (is a compulsory termination) The citizenship is deprived on the basis of an order of the Government of India in cases involving acquisition of Indian citizenship by fraud, false representation or being disloyal to the Constitution.



Nationality and citizenship

Nationality is the status of belonging to a particular nation by origin, birth basically, it's an ethnic and racial concept.

Nationality of a person cannot be changed.

Citizenship is granted to an individual by the government of the country when he/she complies with the legal formalities. Citizenship can be changed.



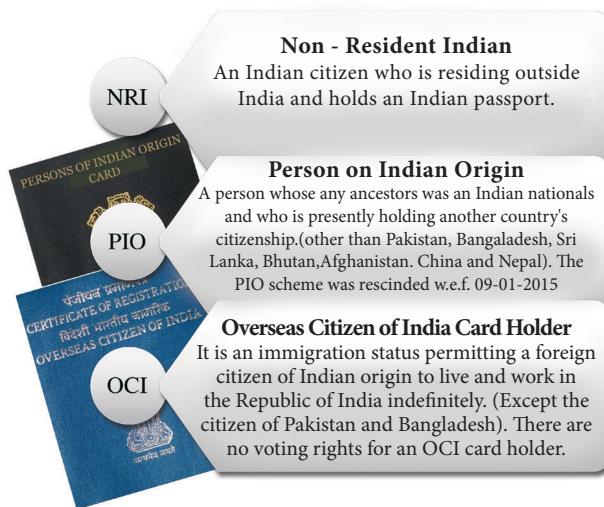
Single citizenship

Our Indian Constitution provides for only Single citizenship, that is, the Indian citizenship. But federal states like USA and Switzerland has dual citizenship. (National citizenship and the State citizenship). In India, all citizens irrespective of the state in which they are born or reside enjoy the same political and civil rights of citizenship all over the country.



As per the order precedence President is the first citizen of our country.

Overseas Citizenship of India



Rights and Duties of Citizen

Our Constitution confers the following rights for the citizen of India.

- Fundamental Rights
- Right to vote in the election to the Lok Sabha and the State Legislature
- Right to hold certain public offices
- Right to become the Member of Parliament and State Legislature.

According to 42 Amendment of our Constitution, a set of Fundamental Duties are prescribed for all citizens of India. (For e.g. paying taxes honestly, respecting the rights,

beliefs and opinions of others, defending the country, respect and obey state and local laws and so on)

Alien and immigrant are two terms that are used to refer to non-nationals of a country.

Alien refers to all non-citizens or non-nationals residing in a country. e.g. tourists, foreign students

Immigrant refers to alien who has been granted the right to reside and work permanently without restriction in a particular country.

Qualities of a good citizen

- Loyalty to the Constitution.
- Obeys laws.
- Contributes to society and community and performs civic duty.
- Quality of goodness and justice.
- Respecting diversity.

Global Citizenship

Global citizenship is an idea that everyone, no matter where they live is part of a worldwide community rather than as the citizen of particular nation or place. All people have rights and civic responsibilities. It is fundamental in enabling young people to access and participate in shaping modern society.





Overseas Indians' Day

Pravasi Bharatiya Divas (PBD) Sponsored by Ministry of External Affairs of Government of India is celebrated once in every two years, to "mark the contributions of Overseas Indian Community in the development of India". The day commemorates the arrival of Mahatma Gandhi in India from South Africa.

Conclusion

Our Constitution of India has introduced Single citizenship and provides uniform rights

for the people of India to promote the feeling of fraternity and unity among them to build an integrated Indian nation.

Recap

- Citizen is a person of a country who is entitled to enjoy all the legal rights and privileges granted by a State.
- Part II of the constitution of India, Articles 5 – 11 deals with the Citizenship of India.
- Indian Citizenship Act of 1955 provides for the acquisition and termination of Indian citizenship.
- Our Indian Constitution provides for Single Citizenship.

Glossary

acquisition	act of acquiring	முயன்று அடைதல்
amendment	a minor change	திருத்தம்
Constitution	Law determining the fundamental political principles of a government	அரசியலமைப்பு
fraternity	brotherhood	சகோதரத்துவம்
Resident	inhabitant	குடியிருப்பவர்



Evaluation



I. Choose the correct answer.

1. Which of the following is not a condition for becoming the citizen of India?
 - a. Birth
 - b. acquiring property
 - c. descent
 - d. naturalization

2. _____ of the Constitution of India deals with the Citizenship.
 - a. Part II
 - b. Part II Article 5-11
 - c. Part II Article 5-6
 - d. Part I Article 5-11

3. Who is called the first citizen of India?

- a. The Prime Minister
- b. The President
- c. The Chief Minister
- d. The Chief Justice of India

II. Fill in the blanks.

1. _____ of a state enjoy full civil and political rights.
2. Our Indian Constitution provides for only _____ citizenship.
3. An Indian citizen who is residing outside India and holds an Indian passport are called _____.
4. All have right and _____ responsibility citizens.
5. _____ is an idea enabling young people to access and participate in shaping modern society.

III. State true or false.



1. USA has single citizenship.
2. OCI card holder has voting rights in India.
3. Citizen of India can enjoy Fundamental Rights guaranteed by our constitution.
4. Nationality can be change and citizenship can not be changed.

IV. Consider the following statements.

Tic (✓) the appropriate answer.

1. Indian Citizen of a person can be terminated if
 - a. a person voluntarily acquires the citizenship of some other country.
 - b. a person who has become a citizen through registration.
 - c. the Government of India is satisfied that citizenship was obtained by fraud.
 - d. a citizen who is by birth indulges in trade with an enemy country during war.
 - a. I and II are correct.
 - b. I and III are correct
 - c. I, III, IV are correct.
 - d. I, II, III are correct.
2. **Assertion:** When Pondicherry becomes the part of India in 1962, the people lived there became Indian citizens.
Reason. It was done by one of the provisions of the Act of 1955 - by incorporation of Territory.
 - a. R is the correct explanation of A
 - b. R is not the correct explanation of A
 - c. A is wrong but R is correct.

- d. Both A and R are wrong.

V. Answer the following in one or two sentences.

1. Name the types of citizens?
2. What are the Rights that a citizen can enjoy in our country?
3. Mention any three qualities of a good citizen.
4. Name the five ways of acquiring citizenship?
5. What do you know about the citizenship Act of 1955?

VI. Answer the following:

1. On what grounds that the citizenship of a person is cancelled?

VII. Student Activity.

- a. Tabulate: How will you be a good citizen inside the classroom and outside the classroom.
- b. My responsibility as a Good Citizen (write any three points)

At Home	At School
To myself	To the Environment



ICT CORNER

Steps

CITIZENS AND CITIZENSHIP

- Enter the following URL or scan the QR code to land in Ministry of Home Affairs official website.
- Select “Act/Rules/Regulations” tab to explore constitutional procedures to become an Indian citizen.
- Select “Required Documents” tab from bottom section to know about important documents.
- Click “Sample Forms” and explore the format to apply for citizenship.

Website URL:

<https://indiancitizenshiponline.nic.in/Home.aspx>



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Unit - 1

Money, Savings And Investments



"Learning gives creativity, creativity leads to thinking, thinking provides knowledge, knowledge makes you great".

-A.P.J. Abdul Kalam

Learning Objectives

- To know about the Evolution of Money.
- To know about the value, nature, function, and importance of money.
- To understand about Savings and Investments.
- To know about the black money.



Introduction

Money is a fascinating subject and full of curiosities. It is important to capture this element for the students. The history of money and how various forms were used at different times is an interesting story. Modern forms of money are linked to the banking system.

Money is a fundamental discovery, which has eased the day to day transactions, valuing goods and services and has allowed us to store the wealth and trade in future. "Money is anything which is widely accepted in payment for goods or in discharge of other business obligations" Robertson. Money in some form, has been part of human history for atleast the last 3000 years Before that time, it is assumed that a system of bartering was likely used.

Evolution of Money

The word Money is derived from Roman word "Moneta Juno". It is the roman goddesses and the republic money of roman empire. The Indian rupee is derived from Sanskrit word 'Rupya' which means silver coin. Today we use paper notes, coins as money. But the evolution of this stage has not happened overnight. It took thousands of years to reach such a stage. There are many stages of evolution of money. The earliest and primitive stage is Barter system.

Barter system

Barter system is exchanging goods for goods without the use of money in the primitive stage. A barter system is an old method of exchange. This system has been used for centuries and long before money was invented. People exchanged services and



goods for other services and goods in return. The value of bartering items can be negotiated with the other party. Bartering doesn't involve money which is one of the advantages.

Hence Barter system had many deficiencies like,

1. Lack of double coincidence of wants,
2. Common measure of value
3. Indivisibility of commodities
4. Difficulties of storing wealth

Some of the major stages through which money has evolved are as follows

Commodity Money, Metallic Money, Paper Money, Credit Money, Near Money and recent forms of Money. Money has evolved through different stages according to the time, place and circumstances.

Commodity Money

In the earliest period of human civilization, any commodity that was generally demanded and chosen by common consent was used as money. Goods like furs, skins, salt, rice, wheat, utensils, weapons etc. were commonly used as money. Such exchange of goods for goods was known as 'Barter Exchange'.

Metallic Money

With progress of human civilization, commodity money changed into metallic money. Metals like gold, silver, copper, etc. were used as they could be easily handled and their quantity can be easily ascertained. It was the main form of money throughout the major portion of recorded history.

During the ancient time.....

BARTER SYSTEM:

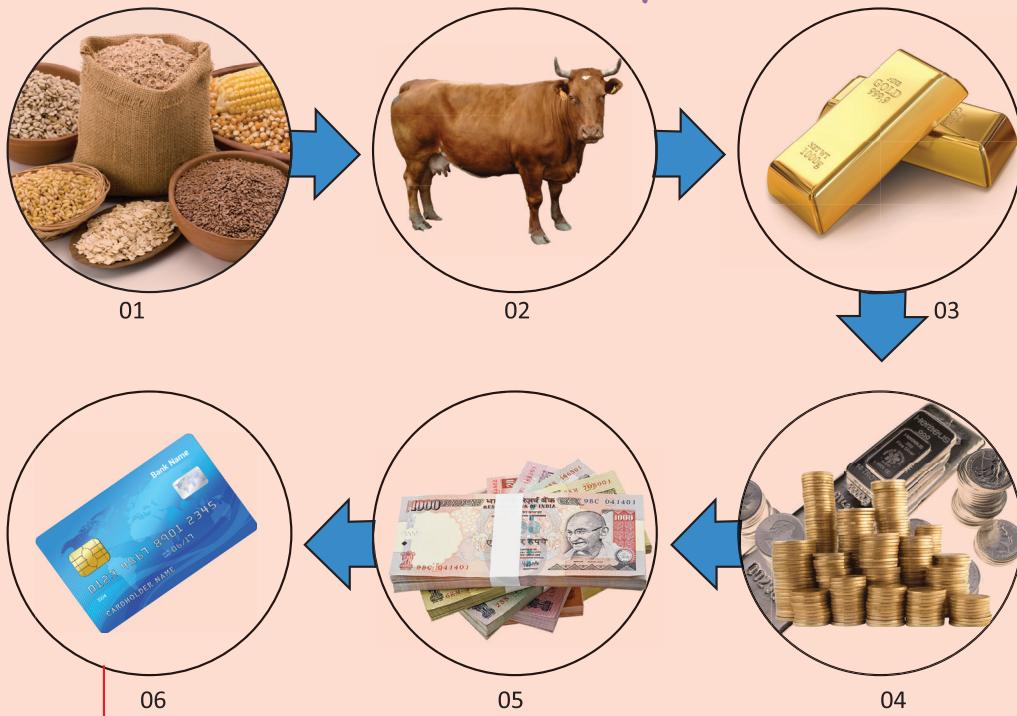
Goods and Services are traded in exchange for other good.



Barter system



Evolution of Money



RECENT FORMS OF MONEY TRANSACTION



Evolution of Money



History of Metallic Money

The precious metals especially gold, silver, bronze were used for metallic money. The standard weight and fineness of metal particularly gold and silver with a seal on it became medium of exchange. They were of different denomination easily divisible, portable and were convenient in making payment.

King Midas of Lydia innovated metal coin in the 8th century BC (BCE) by the ancient historian Herodotus. But gold coins were in use in India many centuries than in Lydia.

The earliest issuers of coins in the world are the ancient Indians along with Chinese and Lydians from the middle east. The first time Indian coins were minted in the 6th century BC (BCE) by the Mahajanapadas known as Puranas, Karshapanas or Panas.

The Mauryas came up with the Punch Marked Coins minting of silver, gold copper or lead and Indo-Greek Kushan kings introduced the Greek custom of engraving portraits on the coins. Turkish sultans of Delhi has replaced the royal designs of Indian kings with Islamic Calligraphy by the 12th century AD (CE). The currency was made up of gold, silver and copper known as Tanka and lower valued coin known as Jittals.

The Mughal Empire from 1526 AD consolidate the monetary system for the entire empire. In this era evolution of rupee occurred with Sher Shah Suri defeated Humayun and issued a silver coin of 178 gms known as rupiya and was divided into 40 copper pieces or paisa and during the whole Mughal period silver coin remained in use. During the British East India company i.e. 1600, the mughal currency remained popular but in 1717 AD, Farrukhsiyar the Mughal Emperor gave permission to the British to coin Mughal Money at the Bombay mint. The British gold coins were termed as Carolina, the silver coins as Angelina, the copper coins as cupperoon and the tin coins as tinny.

METALIC MONEY



Maurya



Maurya



Karshapanas



Delhi Sultan



Delhi Sultan



Tanka - Shershah Suri



Shersha Suri Coin



Maurya

Metallic Money



Paper Money



It was found inconvenient as well as dangerous to carry gold and silver coins from place to place. So, invention of paper money marked a very important stage in the development of money. The development of paper money started on the basis of storage of gold and the receipts were issued by the goldsmiths for these storages. This receipts of goldsmiths were a substitute for money and became paper money. Paper money is regulated and controlled by Central bank of the country (Reserve Bank of India). At present, a very large part of money consists mainly of currency notes or paper money issued by the central bank.



Reserve Bank of India

Credit Money or Bank Money

Emergence of credit money took place almost side by side with that of paper money. People keep a part of their cash as deposits with banks, which they can withdraw at their convenience through cheques. The cheque (known as credit money or bank money), itself, is not money, but it performs the same as functions of money.



ACTIVITY: 1

Fill up the following Table:

Sl.No.	Name in the Country	Name in Currency
1	India	
2	Germany	
3	Japan	
4	Singapore	
5	Malaysia	
6	Saudi Arabia	
7	USA	
8	UK	
9	Sri Lanka	
10	Pakistan	

Near Money

The final stage in the evolution of money has been the use of bills of exchange, treasury bills, bonds, debentures, savings certificate etc.

Recent forms of Money

Plastic Money

The latest type of money is plastic money in the form of Credit cards and Debit cards. They aim for cashless transactions.





E-Money

Electronic Money is money which exists in banking computer systems and is available for transactions through electronic system.

Online Banking (Net Banking)

Online Banking, also known as internet banking is an electronic payment system that enables customers of a bank or other financial institutions to conduct a range of financial transactions through website.



E-Banking

Electronic banking, also known as National Electronic Funds Transfer (NEFT), is simply the use of electronic means to transfer funds directly from one account to another rather than by cheque or cash.



ACTIVITY: 2

- Prepare the duplicate model of different stages of Money, like Commodity money, Metal money, Plastic Money, etc.(including Barter System)
- Give the models to the each group students.
- Teacher and students discuss about the different stages of money

Value of Money

Value of money is meant the purchasing power of money over goods and services in a country. Thus it is related to the price level of goods and services. But the relation between the value of money and price level is an inverse one.

Symbol of Rupee

The Indian Rupee symbol designed by Mr. Udayakumar, Villupuram Dist Tamil Nadu. It was approved by the Government of India on 15-July-2010



The value of money is of two types

1. Internal value of money
2. External value of money

The Internal value of money refers to the purchasing power of money over domestic goods and services. The External value of money refers to the purchasing power of money over foreign goods and services.

ACTIVITY: 3

- Students to know about the value of money,
- Set up your classroom like a shop or market
- Students are asked to purchase some commodities from the shop
- Do the market activities
- Teacher and students together discuss the value of money

Nature of Money

There has been lot of controversy and confusion over the meaning and nature of money (Scitovsky). "Money is a difficult concept to define, partly because it fulfills not one but three functions, each of them providing a criterion of moneyness those of a unit of account, a medium of exchange, and a store of value". Sir John Hicks, say that "Money is defined by its functions, anything is money which is used as money, "Money is what money does".



These are the functional definitions of money because they define money in terms of the functions it performs. Some economists define money in legal terms saying that "anything which state declares as money is money". Such money possesses general acceptability and has the legal power to discharge debts. But people may not accept legal money by refusing to sell goods and services against the payments of legal tender money. On the otherhand, they may accept some other things as money which are not legally defined as money in discharge of debts. This may circulate freely.

Functions of Money

Functions of money are classified into Primary or Main function, Secondary function and Contingent function.

Primary or main functions

The important functions of money performed in every economy are classified under main functions:-

i) Medium of exchange or means of payment

Money is used to buy the goods and services.

ii) Measure of value

All the values are expressed in terms of money it is easier to determine the rate of exchange between various type of goods and services.

Secondary functions

The three important of secondary functions are

i) Standard of deferred payment

Money helps the future payments too. A borrower borrowing today places himself under an obligation to pay a specified sum of money on some specified future date.

ii) Store of value or store of purchasing power

Savings were discouraged under barter system as some commodities are perishable. The introduction of money has helped to save it for future as it is not perishable.

iii) Transfer of value or transfer of purchasing power

Money makes the exchange of goods to distant places as well as abroad possible. It was therefore felt necessary to transfer purchasing power from one place to another.

Contingent functions

1. Basis of credit
2. Increase productivity of capital
3. Measurement and Distribution of National Income

Hots
If there is no invention of money - imagine.

Inflation and Deflation
 Inflation refers to the prices are rising, the value of money will fall. Deflation refers to the prices are falling, the value of money will rise.

Savings in Banks and Investments

Savings

Savings are defined as the part of consumer's disposable income which is not used for current consumption, rather kept aside for future use. There are several ways through which a person can save money. The banking facilitates saving money through various forms of accounts.





1. Student Savings Account

There are savings accounts some banks offer specifically for young people enrolled in high school or college, and they main feature more flexible terms such as lower minimum balance requirements.

2. Savings Deposits

Savings deposits are opened by customers to save the part of their current income. The customers can withdraw their money from their accounts when they require it. The bank also gives a small amount of interest to the money in the saving deposits.

3. Current Account Deposit

Current accounts are generally opened by business firms, traders and public authorities. The current accounts help in frequent banking transactions as they are repayable on demand.

4. Fixed Deposits

Fixed deposits accounts are meant for investors who want their principle to be safe and yield them fixed yields. The fixed deposits are also called as Term deposit as, normally, they are fixed for specified period.

Benefits of Savings

- You will be financially independent sooner.
- You would not have to worry any unforeseen expenses.
- In future, you will have financial backup in place if you lose your job.
- You will be prepared if your circumstances change.

- You will be more comfortable in retirement.
- Save today for better tomorrow

Intensity to save among the students

- Teach them about taxes and accounting.
- Involve them in grown-up money decisions.
- Encourage them to apply for scholarship.
- Help them budget and apply for student loans.
- Teach them personal savings.

Encourage them to open a student Sanchayeka Scheme.

Investments

The process of investing something is known as an investment. It could be anything, i.e. money, time efforts or other resources that you exchange to earn returns in future.



Investment can be made in different investment vehicles like,

1. Stock
2. Bonds
3. Mutual funds
4. Commodity futures
5. Insurance
6. Annuities
7. Deposit account or any other securities or assets

An investment always comes with risks of losing money, but it is also true that you can reap more money with the same investment vehicle. It has a productive nature that helps in the economic growth of the country.



Comparison of Savings and Investments

Basis for comparison	Savings	Investments
Meaning	Savings represents that part of the person's income which is not used for consumption	Investment refers to the process of investing funds in capital asset, with a view to generate returns
Purpose	Savings are made to fulfil short term or urgent requirements	Investment is made to provide returns and help in capital formation
Risk	Low or negligible	Very high
Returns	No or Less	Comparatively high
Liquidity	Highly liquid	Less liquid

Black Money

Black Money is any money on which it is not paid to the government. Black Money is money earned through any illegal activity controlled by country regulations. Black money proceeds are usually received in cash from underground economic activity and, as such, are not taxed.



Black Money

The black money is accumulated by the criminals, smugglers, hoarders, tax-evaders and other anti-social elements of the society. In India, black money is funds earned in the black market, on which income and other taxes have not been paid. The total amount of black money deposited in foreign banks by Indians is unknown. The root cause for the increasing rate of black money in the country is the lack of strict punishments for the offenders.

Effects of Black Money on economy

1. Dual economy
2. Tax evasion, thereby loss of revenue to government.
3. Undermining equity
4. Widening gap between the rich and poor
5. Lavish consumption spending
6. Distortion of production pattern

7. Distribution of scarce resource
8. Effects on production.



Demonetization

In India, On 8-November-2016, the Government of India announced demonetization of all ₹500 and ₹1000 bank notes against Black Money.

Recent steps against Black Money

- 1 Under pressure from India and other countries, Switzerland has made key changes in its local laws governing assistance to foreign allegedly stashed in Swiss Banks.
- 2 Special Investigation Team appointed by government on the directions of Supreme Court on black money.
- 3 Demonetization

Some Legislative Framework in India against to Black Money

- 1 Prevention of money laundering act 2002
- 2 Lokpal and Lokayukta act
- 3 Prevention of corruption act- 1988
- 4 The undisclosed foreign Income and Asset Bill(Imposition of Tax) 2015
- 5 Benami transactions prohibition act 1988 amended in 2016
- 6 The Real Estate (Regulation and Development) Act, 2016



Recap

- The word Money is derived from Roman word “Moneta Juno”.
- Barter System - Men exchanged goods for goods without the use of Money.
- Some of the major stages through which money has evolved are Commodity Money, Metallic Money, Paper Money, Credit Money, Near Money and recent forms of Money.
- Value of money is meant the purchasing power of money over goods and services in a country.
- Money is defined by its functions: anything is money which is used as money:“Money is what money does”.
- Savings are defined as the part of consumer’s disposable income which is not used for current consumption, rather kept aside for future use.
- Black Money is money earned through any illegal activity controlled by country regulations.

GLOSSARY

Coincidence	accident	தற்செயல்
Demonitization	to officially stop using particular	பண மதிப்பு குறைப்பு
Dual Economy	an economic system that consists of two very different parts	இணை பொருளாதாரம்
Purchasing Power	the value of money considered as the amount of goods it will buy	வாங்கும் சக்தி
Unanimity	the state of being unanimous	ஒரு மனதாக முடிவெடுத்தல்
Tax Evasion	ways of illegally paying less tax	வரி ஏற்பாடு
Deterioration	the process of becoming progressively worse	மேம்பாசம் அடைதல்



Evaluation

I Choose the correct answer.

- Which metals were used for metallic money?
 - gold
 - silver
 - bronze
 - all the above
- Who introduced the paper money?
 - British
 - Turkish
 - The Mugual Empire
 - Mauryas



- The value of money is
 - Internal value of money
 - External value of money
 - Both a & b
 - None of these
- Which is the Bank Money?
 - Cheque
 - Draft
 - Credit and Debit cards
 - All the above
- Pick out the incorrect one:
Investment can be made in different vehicle.
 - Stock
 - bonds
 - Mutual fund
 - Pay tax



6. Who is responsible for the collection and publication of monetary and financial information?
- Finance commission
 - Finance Ministry
 - Reserve Bank of India
 - Auditor and Comptroller General of India

II Fill in the blanks.

- Online Banking is also known as _____.
- _____ is what money does.
- The term of bank is derived from _____ word.
- Value of money is meant _____ of money.
- The Indian banking regulation act of _____.

III Match the following.

1. Barter system	tax evaders
2. Reserve Bank act	Electronic Money
3. E- Money	Consumer's disposable income
4. Savings	exchanged goods for goods
5. Black money	1935

IV Write the one word answer.

- The word Money is derived from?
- Which bank gives both short term and long term loans?

V Choose the correct statement.

- Barter system had many deficiency like
 - Lack of double coincidence of wants
 - No difficulties of storing wealth
 - Common measure of value
 - Indivisibility of commodities
 - I and II is correct
 - I and IV is correct**

- I, III and IV is correct
- All are correct

VI Find out the odd one.

- Recent forms of money transactions are
 - Credit card
 - Barter system
 - Debit card
 - Online banking
- Effects of black money on economy is
 - Dual economy
 - Undermining equity
 - No effects on production
 - lavish consumption spending

VII Write short answer.

- What is the Barter System?
- What are the recent forms of money?
- Short note on E-Banking and E-Money.
- What are the essential of Money in your life?
- What is the Value of Money?
- What is the Commercial Bank and its types of Deposits?
- What is Savings and Investment?
- What is meant by Black Money?
- What are the effects of black money on economy?

VIII Write Brief answer.

- What are the disadvantages of barter system?
- Write about the evolution of Money?
- What are the functions of Money? and explain it.
- Explain the types of bank Deposits.
- What are the difference between savings and investment?
- What are the effects of black money on economy?

IX Project and Activity.

- Students are asked to prepare a chart containing dummy images of new and old currencies in India and also from other countries.



2. Go to your nearest Post Office and know about the savings scheme in India and teachers and students are discuss about the savings schemes.

X Life skills.

1. Students to know about the value of money, Set up your classroom like a shop or market.
2. Students are asked to purchase some commodities from the shop, Do the market activities.
3. Teacher and students together discuss the value of money.



REFERENCE BOOKS

- *Jhingan - Monetary Economics*
- *Jagdish Handa - Monetary economics*
- *Wynne A. H. Godley - Monetary economics*
- *Mervyn K. Lewis - Monetary Economics*



INTERNET RESOURCES

- www.investopedia.com
- www.vikaspedia.com
- www.coinsindia.com



ICT CORNER

UNIT-1. MONEY, SAVINGS AND INVESTMENTS

Steps

- Open the Browser and type the URL given below (or) Scan the QR Code.
- Go to Currency converter
- Go to drop down menu, select any country name (Ex. India-America)

Website URL:

<https://fx-rate.net/>



B360_8_SOCIAL_EM



SOCIAL SCIENCE- VIII

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