SCIENCE

Classes: IX (2023-24) (Code No. 086)

COURSE STRUCTURE

(Annual Examination) **Marks: 80**

Unit No.	Unit	Marks
I	Matter - Its Nature and Behaviour	25
II	Organization in the Living World	22
III	Motion, Force and Work	27
IV	Food; Food Production	06
	Total	**80**
	Internal assessment	**20**
	Grand Total	**100**

Theme: Materials

Unit I: Matter-Nature and Behaviour

Definition of matter; solid, liquid and gas; characteristics - shape, volume, density; change of state-melting (absorption of heat), freezing, evaporation (cooling by evaporation), condensation, sublimation.

Nature of matter: Elements, compounds and mixtures. Heterogeneous and homogenous mixtures, colloids and suspensions. Physical and chemical changes (excluding separating the components of a mixture).

Particle nature and their basic units: Atoms and molecules, Law of Chemical Combination, Chemical formula of common compounds, Atomic and molecular masses.

Structure of atoms: Electrons, protons and neutrons, Valency, Atomic Number and Mass Number, Isotopes and Isobars.

Theme: The World of the Living

Unit II: Organization in the Living World

Cell - Basic Unit of life : Cell as a basic unit of life; prokaryotic and eukaryotic cells, multicellular organisms; cell membrane and cell wall, cell organelles and cell inclusions; chloroplast, mitochondria, vacuoles, endoplasmic reticulum, Golgi apparatus; nucleus, chromosomes - basic structure, number.

Tissues, Organs, Organ System, Organism:

Structure and functions of animal and plant tissues (only four types of tissues in animals; Meristematic and Permanent tissues in plants).

Theme: Moving Things, People and Ideas

Unit III: Motion, Force and Work

Motion: Distance and displacement, velocity; uniform and non-uniform motion along a straight line; acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, elementary idea of uniform circular motion.

Force and Newton's laws : Force and Motion, Newton's Laws of Motion, Action and Reaction forces, Inertia of a body, Inertia and mass, Momentum, Force and Acceleration.

Gravitation: Gravitation; Universal Law of Gravitation, Force of Gravitation of the earth (gravity), Acceleration due to Gravity; Mass and Weight; Free fall.

Floatation: Thrust and Pressure. Archimedes' Principle; Buoyancy.

Work, Energy and Power: Work done by a Force, Energy, power; Kinetic and Potential energy; Law of conservation of energy (excluding commercial unit of Energy).

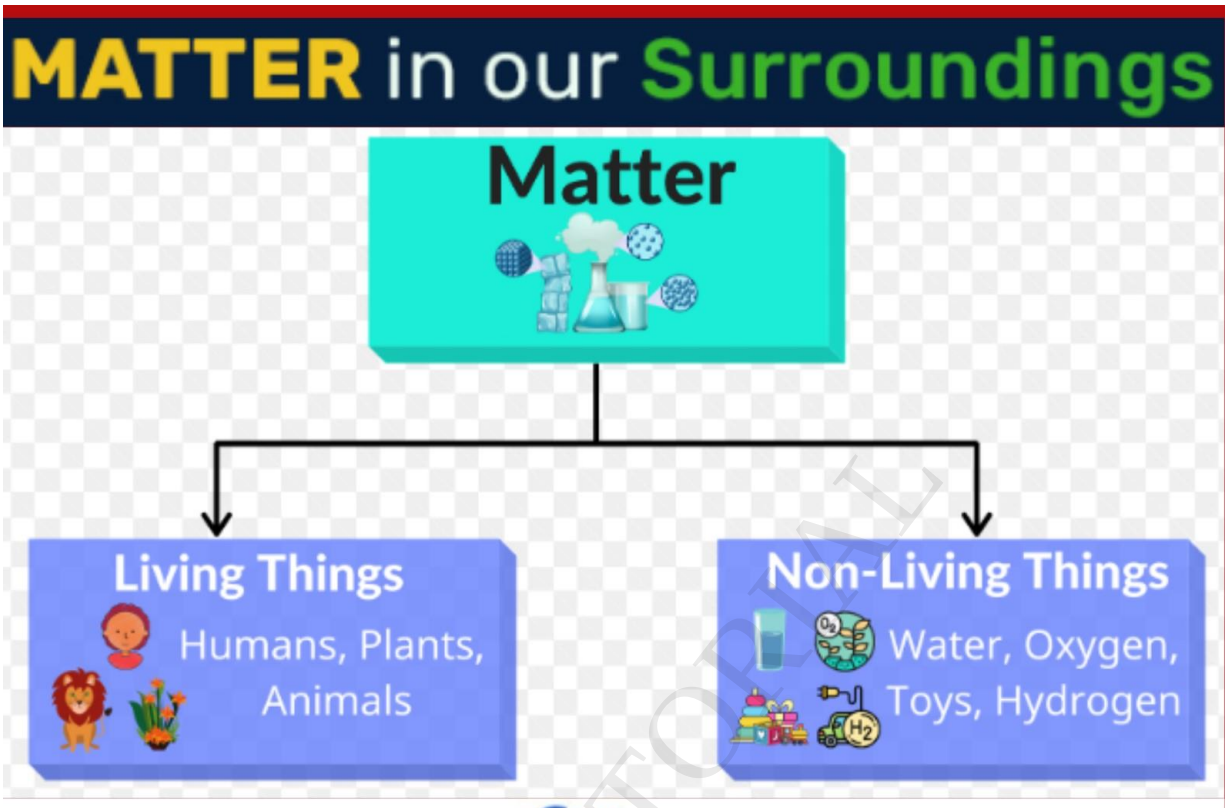
Sound: Nature of sound and its propagation in various media, speed of sound, range of hearing in humans; ultrasound; reflection of sound; echo.

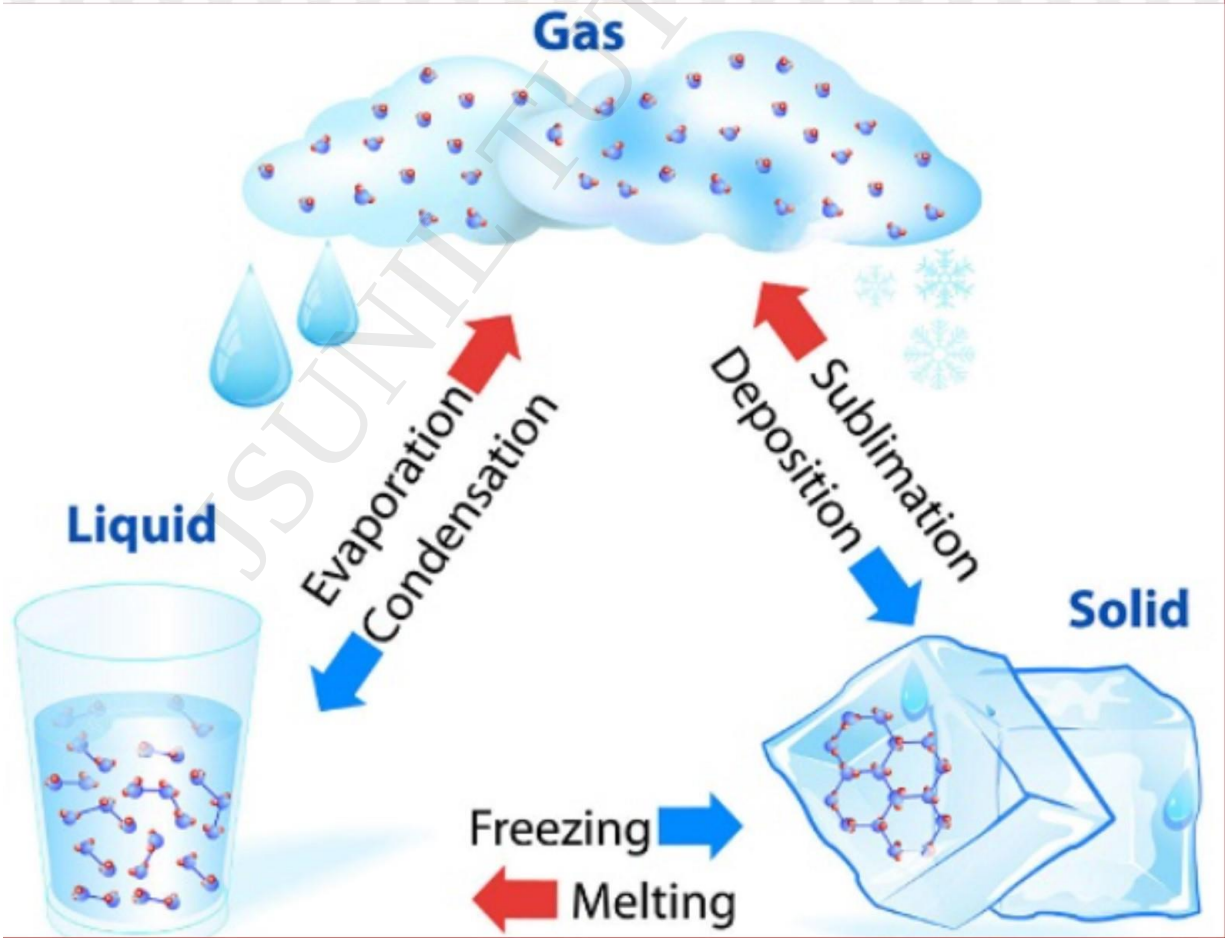
Theme: Food

Unit IV: Food Production

Plant and animal breeding and selection for quality improvement and management; Use of fertilizers and manures; Protection from pests and diseases; Organic farming.

INDEX



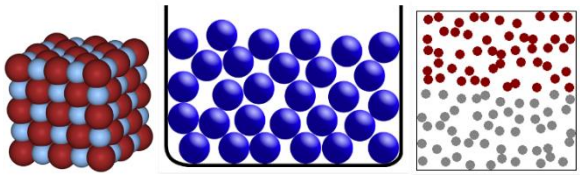


CHAPTER 1

MATTER IN OUR SURROUNDINGS

Definition of matter: Matter is anything that has mass and occupies space.

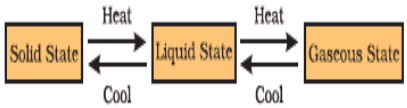
- Matter can be classified as solid, liquid and gas on the basis of interparticle forces and the arrangement of particles.
- These three forms of matter are interconvertible by increasing or decreasing pressure and temperature. For example, ice can be converted from solid to a liquid by increasing the temperature.

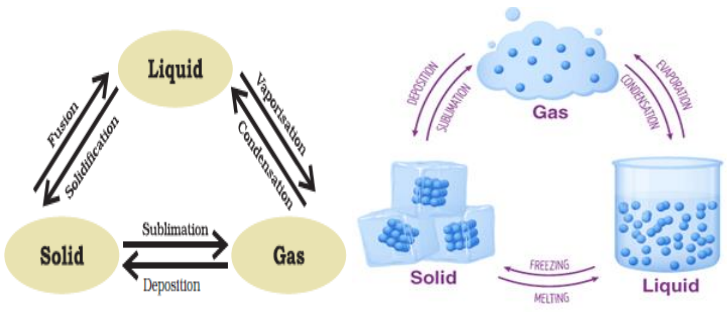


SOLID LIQUID GAS

Property	Solid	Liquid	Gas
Shape and volume	Fixed shape and volume	No fixed shape but has volume	Neither definite shape nor volume
Arrangement of molecules	Regular and closely arranged	Random and little sparsely arranged	Random and more sparsely arranged
Interparticle space	Very less	More	Large
Movement	Negligible	Depends on interparticle attraction	Free, constant and random
Fluidity	Cannot flow	Flows from higher to lower level	Flows in all directions

Change of state Matter: Flowchart for inter-conversion of the three states of matter:





EFFECT OF CHANGE OF TEMPERATURE:
(a) Conversion of ice to water,
(b) Conversion of water-to-water vapour

Change of state melting (absorption of heat):

Melting point: The melting point of a solid is defined as the temperature at which solid melts to become liquid at the atmospheric pressure.
At melting point, these two phases, i.e., solid and liquid are in equilibrium, i.e., at this point both solid state and liquid state exist simultaneously.
The melting point at which ice a solid turn to water a liquid is 32°F (0°C).

Fusion: When two atoms collide to create a heavier atom, such as when two hydrogen atoms combine to create one helium atom, this process is known as fusion.

Boiling point: The boiling point of a liquid is defined as the temperature at which the vapour pressure of the liquid is equal to the atmospheric pressure.

The boiling point for any material is the temperature point at which the material transforms into the gas phase in the liquid phase. This happens at 100 degrees centigrade for water. The Celsius scale was in fact created on the basis of the ice/water melting point and the liquid water/vapor boiling point.

For water this temperature is 373 K (100^0C = 273 + 100 = 373 K).

Latent heat of fusion: It is the amount of heat energy that is required to change 1 kg of a solid into liquid at atmospheric pressure at its melting point.

Latent heat of vaporization: It is the amount of heat energy that is required to change 1 kg of a liquid into gas at atmospheric pressure at its boiling point.

Effect of change in pressure on state of matter

By applying pressure, the interparticle spaces between particles of matter decreases. Thus, by applying pressure and reducing temperature we can convert a solid to liquid and a liquid to gas.

Evaporation: The phenomenon by which molecules in liquid state undergo a spontaneous transition to the gaseous phase at any temperature below its boiling point is called evaporation.

- For example, the gradual drying of damp clothes is caused by the evaporation of water-to-water vapour.

Factors affecting evaporation

- **Temperature:** The rate of evaporation increases with an increase in temperature.

- **Surface area:** The rate of evaporation increases with an increase in surface area.
- **Humidity:** The rate of evaporation decreases with an increase in humidity.
- **Wind speed:** The rate of evaporation increases with an increase in wind speed.

Cooling due to evaporation: During evaporation, the particles of a liquid absorb energy from the surroundings to overcome the inter-particle forces of attraction and undergo the phase change. The absorption of heat from the surrounding makes the surrounding cool.

For example, sweating cools down our body.

Applications of Evaporative Cooling

- To keep water cool, it is kept in earthenware containers. Similar to the pores in cotton fabric, the pores in the earthen pot's surface area allow for more evaporation.
- To keep our body cool, we sweat a lot. Evaporation is what transpiration ultimately is. Our body's water evaporates, using energy in the process and lowering our body temperature as a result.
- We dress in cotton during the summer. Since cotton is a powerful water absorbent, it allows more perspiration to come into touch with the air, promoting more evaporation. We have a cooling effect when wearing cotton clothing because of this.

Condensation

Condensation is the process where water vapour is changed into liquid form. This change is brought about by a change in the pressure and temperature of the substance.

When the water is present in the gaseous form in the air, it is called water vapour.

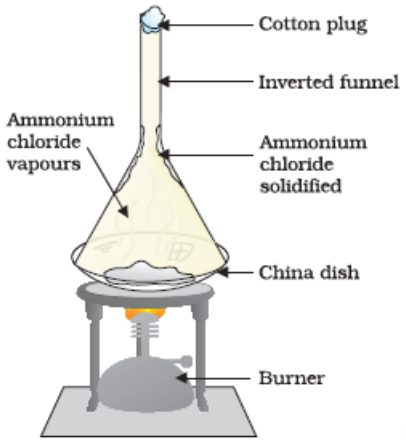
It is the process through which water vapour in the air is converted into liquid water. This is called condensation.

Explanation:

The boiling point and the condensation point of water are the same. It occurs at 212 degrees Fahrenheit or 100 degrees Celsius. Water tends to evaporate once the temperature increases from the boiling point which is beyond 100 degrees Celsius. The water boils and evaporates into the air forming water vapour. If the process is reversed, that is the water-cooled down to below 10 degrees Celsius; the water vapour will condense and turn back into its original liquid form.

This temperature of condensation occurs between 32 Fahrenheit or 0 Celsius and 212 F or 100 Celsius. It is most noticeable when there is a greater temperature difference between the object and the atmosphere. When droplets of water form on an ice candy when the temperature is hot.

Sublimation: The transition of a substance directly from its solid phase to gaseous phase without changing into the liquid phase (or vice versa) is called **sublimation.**



Sublimation of Ammonium chloride

ASSIGNMENT:

MULTIPLE CHOICE QUESTIONS

1. In all the three states of water, (i. e. ice, liquid and vapour) chemical composition of water remains same

(a) only the physical state is different.

(b) the physical state remains same

(c) sometimes same and sometimes different

(d) none of the above

Ans: (a)

2. Which of the following statements is incorrect about the state of matter?

(a) The force of attraction between the gas particles is very less.

(b) Plasma consists of super energetic and super excited particles.

(c) The plasma glows with a special colour depending on the nature of the gas.

(d) Bose-Einstein condensate is formed by heating gas of extremely low density.

Ans: (d)

Solution: Bose-Einstein condensate is formed by cooling a gas of extremely low density.

3. Which of the following is not a property of gas?

(a) Gases have a definite shape

(b) Gases have no definite volume

(c) The rate of diffusion of a gas is higher

(d) Gaseous particles are in a state of random motion

Ans: (a)

Solution: Gas is a state of matter in which the KE of particles is very high. Gases neither have definite shape nor volume.

4. When heat is constantly supplied by a burner to boiling water, then the temperature of the water during vaporization:

(a) Rises very slowly

(b) Rises rapidly until steam is produced

(c) First rises and then becomes constant

(d) Does not rise at all

Ans: (d)

Solution: During the process of vaporization the temperature remains constant.

5. Which of the following phenomena would increase on rising temperature?

(a) Diffusion, evaporation, compression of gases

(b) Evaporation, compression of gases, solubility

(c) Evaporation, diffusion, expansion of gases

(d) Evaporation, solubility, diffusion, compression of gases

Ans: (c)

Solution: With the rising temperature, the phenomena of evaporation, diffusion, and expansion of gases increase.

6. Which of the following conditions is most favorable for converting gas into liquid?

(a) High pressure, low temperature

(b) Low pressure, low temperature

(c) Low pressure, high temperature

(d) High pressure, high temperature

Ans: (a) At high pressure and low-temperature gas is converted into liquid.

7. Which of the following statements is correct?
Statement I: An iron rod undergoes expansion on heating.
Statement Il: Solids show maximum thermal expansion.

(a) Only statement I is correct
(b) Only statement Il is correct
(c) Both the statements are correct
(d) Neither statement I nor statement Il is correct

Ans: (a) the thermal expansion is highest in gases, then liquids, then solids.

SHORT ANSWER QUESTIONS:

8. (a) Which of the following are matter? Chair, air, love, smell, hate, almonds, thought, cold, lemon water, smell of perfume.

Ans. Chair, Air, Almonds, Lemon water and Smell of perfume.

(b) Convert the following temperature to Celsius scale:

a. 300 K b. 573 K.

Ans. a. 27 ^{0}C b. 300 ^{0}C

(c)What is the physical state of water at: (a) 250ºC (b) 100ºC?

Ans. (a) At 250°C – Gaseous state since it is beyond its boiling point.

(b) At 100°C – It is at the transition state as the water is at its boiling point.

9. Define the following terms: (a) Sublimation (b) Latent heat of fusion

Ans. (a) Conversion of solid to vapour is called sublimation.

(b) Latent heat of fusion is the amount of heat required to convert a unit mass of the substance from a solid form to a liquid form without changing the temperature.

10. Give reasons

(a) A gas fills completely the vessel in which it is kept.

(b) A gas exerts pressure on the walls of the container.

(c) A wooden table should be called a solid.

(d) We can easily move our hand in air but to do the same through a solid block of wood we need a karate expert.

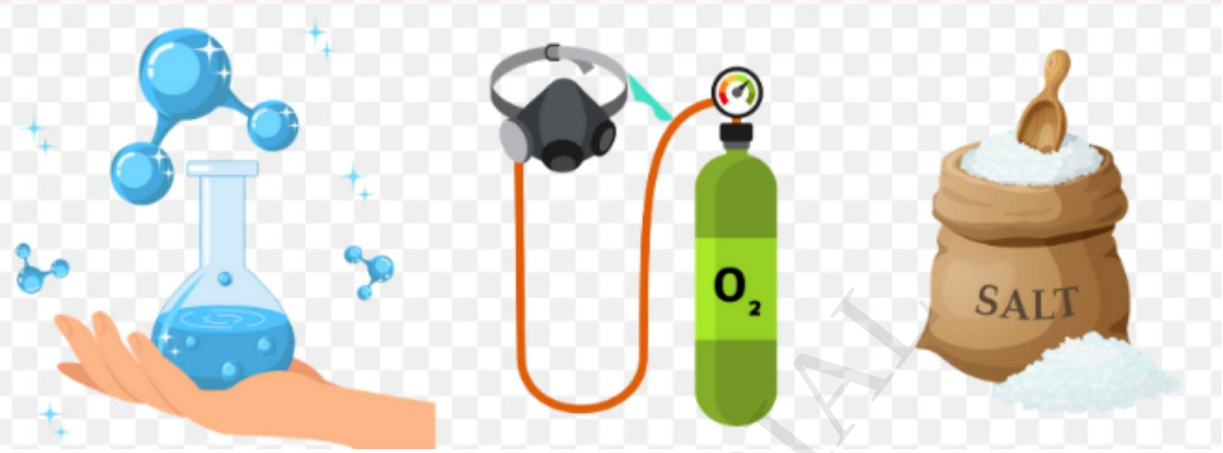
Ans. (a) There is a low force of attraction between gas particles. The particles in the filled vessel are free to move about.

(b) Gaseous particles have the weakest attraction force. They are always moving in a haphazard manner. When a gas particle collides with the container's walls, it exerts force and thus pressure on the wall.

(c) There is a distinct contour and volume to the hardwood table. The wood particles are tightly packed. They do not conform to the container's shape. As a result, the solid features of a hardwood table are satisfied.

(d) The boundaries between air particles are quite loose. They are a long way apart and have a lot of space between them. As a result, we may move our hands freely in the air. The particles in a solid block, on the other hand, are bound together by a strong force of attraction. As a result, there is either some or no space between them. As a result, we'll require a karate expert.

Is Matter Around Us Pure?



Elements

Tin

Diamond

Compounds

Sugar

Water

Chemical and Physical Changes

Chemical change: A chemical reaction forms new products.

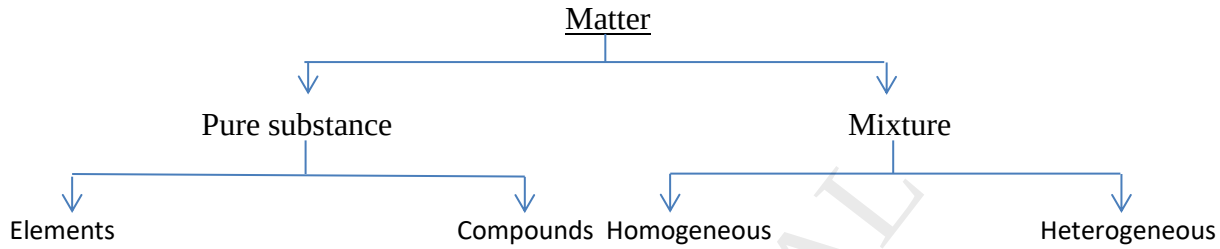
Physical change: Matter changes form but not chemical identity.

Combustion Boiling

CHAPTER 2

IS MATTER AROUND US PURE

Nature of matter:



Element: It is a basic form of matter that cannot be broken down into simpler substances by chemical reactions. Elements can be normally divided into metals, non-metals and metalloids.

Metals:
• They have lustre (shine).
• They have silvery-grey or golden-yellow colour.
• They conduct heat and electricity.
• They are ductile (can be drawn into wires).
• They are malleable (can be hammered into thin sheets).
• They are sonorous (make a ringing sound when hit).
Examples of metals are gold, silver, copper, iron, sodium, potassium etc.
Mercury is the only metal that is liquid at room temperature.

Non-metals:
• They display a variety of colours.
• They are poor conductors of heat and electricity.
• They are not lustrous, sonorous or malleable.
Examples of non-metals are hydrogen, oxygen, iodine, carbon (coal, coke), bromine, chlorine etc.

Metalloids: Some elements have intermediate properties between those of metals and non-metals, they are called metalloids; examples are boron, silicon, germanium etc.

Compound: A compound is a substance composed of two or more elements, chemically combined with one another in a fixed proportion.
Compounds can be of three types:

a. Covalent compounds
b. Metallic compounds
c. Ionic compounds.

Compounds can also be classified as organic compounds or inorganic compounds depending on the presence of carbon in the molecular structure.
For examples, Water, salt, baking soda, etc.

Mixtures are substances that are formed by physically mixing two or more substances. A mixture can have a variable composition of the substances forming it.
For examples, Oil and water, sand and water, smog (smoke + fog), etc.

Mixtures are mainly of two types:

1. **Homogenous mixtures:** These are the types of mixtures in which the components mixed are uniformly distributed throughout the mixture.
   Example: rainwater, vinegar, etc.
2. **Heterogeneous mixtures:** This is a type of mixture in which all the components are completely mixed and all the particles can be seen under a microscope.
   Example: seawater, pizza, etc.

Difference Between Compound and Mixture:

S.NO.	Compounds	Mixtures
1.	Elements react to form new compounds.	Elements or compounds just mix together to form a mixture and no new compound is formed.
2.	The composition of each new substance is always fixed.	A mixture has a variable composition.
3.	The new substance has totally different properties.	A mixture shows the properties of the constituent substances.
4.	The constituents can be separated only by chemical or electrochemical reactions.	The constituents can be separated fairly easily by physical methods.

Physical and Chemical Changes

The interconversion of states is a physical change because these changes occur without a change in composition and no change in the chemical nature of the substance.
Although ice, water and water vapour all look different and display different physical properties, they are chemically the same.
Both water and cooking oil are liquid but their chemical characteristics are different.
They differ in Odour and inflammability. We know that oil burns in air whereas water extinguishes fire. It is this chemical property of oil that makes it different from water.
Burning is a chemical change. During this process one substance reacts with another to undergo a change in chemical composition.
Chemical change brings change in the chemical properties of matter and we get new substances.
A chemical change is also called a chemical reaction.

Suspension: A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium.

Properties of a Suspension
Suspension is a heterogeneous mixture.
The particles of a suspension can be seen by the naked eye.
The particles of a suspension scatter a beam of light passing through it and make its path visible.
The solute particles settle down when a suspension is left undisturbed, that is, a suspension is unstable. They can be separated from the mixture by the process of filtration. When the particles settle down, the suspension breaks and it does not scatter light any more.

Colloids:
A colloid is a kind of solution in which the size of the solute particles is intermediate between those in true solution and those in suspension.
Examples of colloids are mayonnaise, milk, butter, gelatin, and jelly.

Properties of colloids:
A colloid is a heterogeneous mixture.
The size of particles of a colloid is too small to be individually seen by naked eyes.
Colloids are big enough to scatter a beam of light passing through it and make its path visible.
They do not settle down when left undisturbed, that is, a colloid is quite stable.
They cannot be separated from the mixture by the process of filtration. But, a special technique of separation known as centrifugation can be used to separate the colloidal particles.

The components of a colloidal solution are the dispersed phase and the dispersion medium. The solute-like component or the dispersed particles in a colloid form the dispersed phase, and the component in which the dispersed phase is suspended is known as the dispersing medium.
Colloids are classified according to the state (solid, liquid or gas) of the dispersing medium and the dispersed phase.
A few common examples of colloids are given below:

Dispersed phase	Dispersion medium	Type	Example
Solid	Solid	Solid sol	Coloured gemstone, milky glass
Liquid	Solid	Gel	Jelly, cheese, butter
Gas	Solid	Foam	Foam rubber, sponge, pumice
Solid	Liquid	Sol	Milk of magnesia, mud
Liquid	Liquid	Emulsion	Milk, face cream
Gas	Liquid	Foam	Shaving cream
Solid	Gas	Aerosol	Smoke
Liquid	Gas	Aerosol	Fog, cloud, mist

Colloidal solution: A colloidal solution is a heterogeneous mixture, for example, milk.
Because of the small size of colloidal particles, we cannot see them with naked eyes.
But these particles can easily scatter a beam of visible light. This scattering of a beam of light is called the Tyndall effect.

Tyndall effect can also be observed when a fine beam of light enters a room through a small hole. This happens due to the scattering of light by the particles of dust and smoke in the air. Tyndall effect can be observed when sunlight passes through the canopy of a dense forest. In the forest, mist contains tiny droplets of water, which act as particles of colloid dispersed in air.

ASSIGNMENT:

MULTIPLE CHOICE QUESTIONS:

Q1. Which of the following statements are true for pure substances?

i. Pure substances contain only one kind of particles
ii. Pure substances may be compounds or mixtures
iii. Pure substances have the same composition throughout
iv. Pure substances can be exemplified by all elements other than nickel

a. (i) and (ii)
b. (i) and (iii)
c. (iii) and (iv)
d. (ii) and (iii)

Ans: (b) (i) and (iii)

Q2. Which of the following properties does not describe a compound?

(a) It is composed of two or more elements

(b) It is a pure substance.

(c) It cannot be separated into constituents by physical means

(d) It is mixed in any proportion by mass

Ans: (d)

Q3. Which of the following is not a homogeneous mixture?

(a) Air (b) Tincture of iodine

(c) Sugar solution (d) milk

Ans: (d) Milk is a heterogeneous mixture. It is a colloidal solution of water and fat.

Q4. Which of the following statement “10 percent glucose in water by mass” signifies.

(a) 10 grams of glucose dissolved in 100 grams of water.

(b) 10 grams of glucose dissolved in 90 grams of water.

(c) 20 grams of glucose dissolved in 200 grams of water.

(d) 20 grams of glucose dissolved in 90 grams of water.

Ans: (b) “10 percent glucose in water by mass” signifies that 10 gram of glucose dissolved in 90 grams of water.

Q5. Sol and gel are examples of ————————

(a) Solid-solid colloids

(b) Sol is a solid-liquid colloid and gel is liquid-solid colloid

(c) Sol is solid- solid colloid and gel is solid-liquid colloid

(d) Sol is a liquid-solid colloid and gel is a solid-liquid colloid

Ans: (b) Sol is a solid-liquid colloid and gel is liquid-solid colloid.

Q6. An example of liquid metal and liquid non-metal is

(a) Gallium, mercury

(b) Mercury, chlorine

(c) Mercury, bromine

(d) Bromine, Sulphur

Ans: (c)

Q7. A mixture of sulphur and carbon disulphide is

a. heterogeneous and shows Tyndall effect
b. homogeneous and shows Tyndall effect
c. heterogeneous and does not show Tyndall effect
d. homogeneous and does not show Tyndall effect

Ans. (a) Heterogeneous and shows Tyndall effect

Q8. Tincture of iodine has antiseptic properties. This solution is made by dissolving

a. iodine in potassium iodide
b. iodine in Vaseline
c. iodine in water
d. iodine in alcohol

Ans. (c) Iodine in water

Q9. Which of the following are physical changes?

i. Melting of iron metal
ii. Rusting of iron
iii. Bending of an iron rod
iv. Drawing a wire of iron metal

a. (i), (ii) and (iii)
b. (i), (ii) and (iv)

c. (i), (iii) and (iv)
d. (ii), (iii) and (iv)

Ans. (c) (i), (iii) and (iv)

Q10. Which of the following are chemical changes?

i. Decaying of wood
ii. Burning of wood
iii. Sawing of wood
iv. Hammering of a nail into a piece of wood

a. (i) and (ii)
b. (ii) and (iii)
c. (iii) and (iv)
d. (i) and (iv)

Ans. (a) (i) and (ii)

Q11. Which of the following will show “Tyndall effect”?

(a) Salt solution

(b) Milk

(c) Copper sulphate solution

(d) Starch solution.

Ans. (b) Tyndall effect is exhibited by only milk and starch solution from the above-mentioned list of solutions.

SHORT ANSWER QUESTIONS:

Q12. List the points of differences between homogeneous and heterogeneous mixtures. Classify each of the following as a homogeneous or heterogeneous mixture.

soda water, wood, air, soil, vinegar, filtered tea.

Ans. Difference between homogeneous and heterogeneous mixtures

Homogeneous mixtures- soda water, air, vinegar, filtered tea.

Heterogeneous mixtures- wood, soil.

Q13. A solution contains 40 g of common salt in 320 g of water. Calculate the concentration in terms of mass-by-mass percentage of the solution.

Ans. Mass of solute (salt) = 40 g

Mass of solvent (water) = 320 g

Mass of solution = Mass of solute + Mass of solvent = 40 g + 320 g = 360 g

Mass percentage of solution = (Mass of solute / Mass of solution) ×100

= (40 /360) ×100 = 11.1%

Q14. Classify the following as chemical or physical changes:

cutting of trees, melting of butter in a pan, rusting of almirah, boiling of water to form steam, passing of electric current, through water and the water breaking down into hydrogen and oxygen gases, dissolving common salt in water, making a fruit salad with raw fruits, and burning of paper and wood.

Ans. Physical changes: cutting of trees, melting of butter in a pan, boiling of water to form steam, dissolving common salt in water, making a fruit salad with raw fruits.

Chemical changes: rusting of almirah, passing of electric current, through water and the water breaking down into hydrogen and oxygen gases and burning of paper and wood.

Q15. Explain the following giving examples.

(a) saturated solution

(b) pure substance

(c) colloid

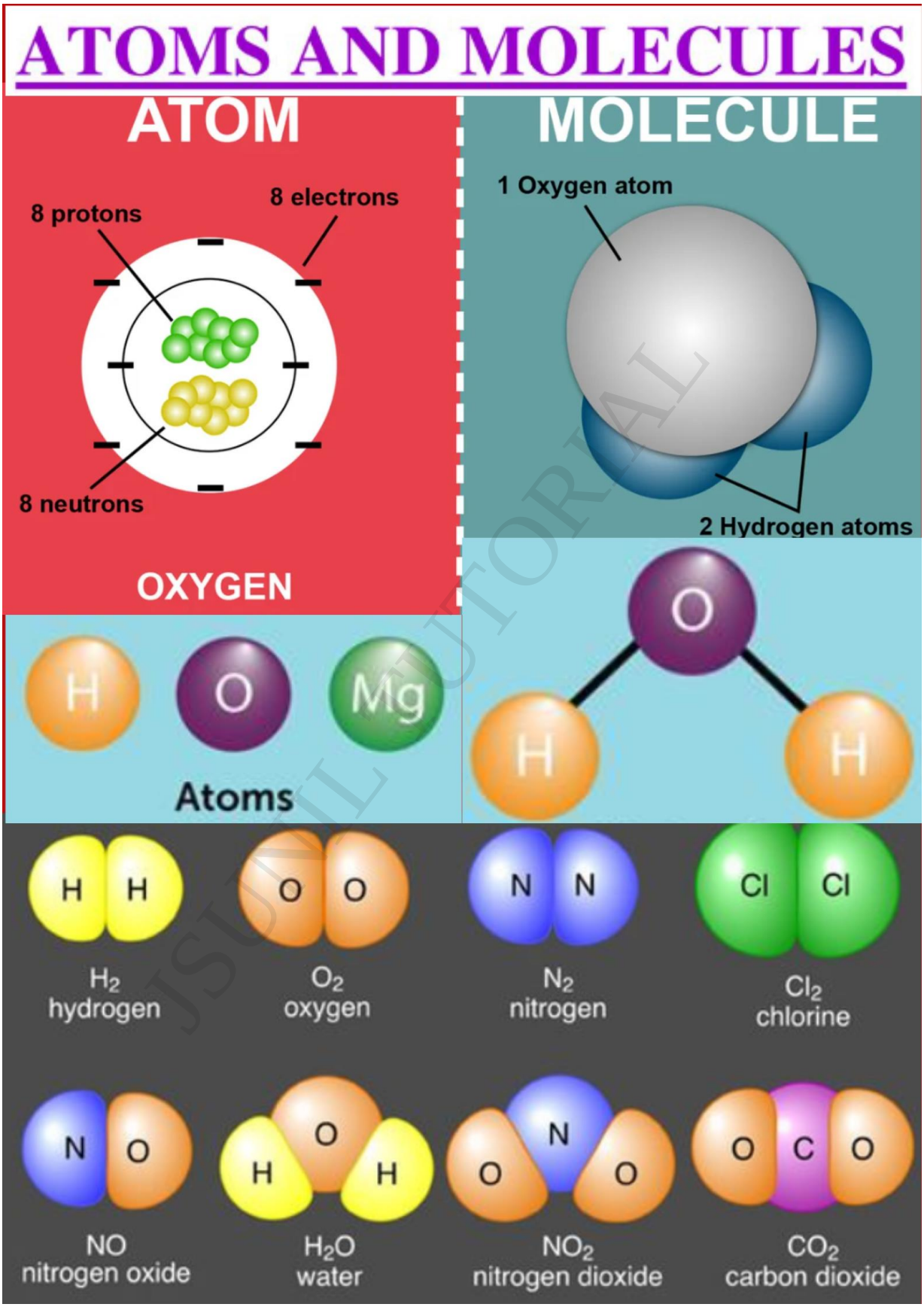
(d) suspension

Ans. (a) Saturated solution: It is that state in a solution at a specific temperature when a solvent is no more soluble without an increase in the temperature. Example: Excess carbon leaves off as bubbles from a carbonated water solution saturated with carbon.

(b) Pure substance: A substance is said to be pure when it comprises of only one kind of molecules, atoms or compounds without adulteration with any other substance or any divergence in the structural arrangement. Example: Sulphur, diamonds

(c) Colloid: A Colloid is an intermediate between solution and suspension. It has particles of various sizes, that ranges between 2 to 1000 nano meters. Colloids can be distinguished from solutions using the Tyndall effect. Tyndall effect is defined as the scattering of light (light beam) through a colloidal solution. Example: Milk, gelatin.

(d) Suspension: It is a heterogeneous mixture that comprises of solute particles that are insoluble but are suspended in the medium. These particles that are suspended are not microscopic but visible to bare eyes and are large enough (usually larger than a micro metre) to undergo sedimentation.


ATOMS AND MOLECULES
ATOM
8 protons
8 electrons
8 neutrons
OXYGEN
MOLECULE
1 Oxygen atom
2 Hydrogen atoms
H
O
Mg
Atoms
O
H
H
H H
H2
hydrogen
O O
O2
oxygen
N N
N2
nitrogen
Cl Cl
Cl2
chlorine
N O
NO
nitrogen oxide
O
H H
H2O
water
N
O O
NO2
nitrogen dioxide
O C O
CO2
carbon dioxide

CHAPTER 3

ATOMS AND MOLECULES

Atoms: Atoms are the smallest particles of an element which can take reaction.
Size of an atom: atomic radius is measured in nanometers.
$1nm = 10^{-9}m$
Atomic radii of hydrogen atom = 1×10^{-10} m.
Symbols of atoms:

Name of the element	Atomic Number	Symbol
Hydrogen	1	H
Helium	2	He
Lithium	3	Li
Beryllium	4	Be
Boron	5	B
Carbon	6	C
Nitrogen	7	N
Oxygen	8	O
Fluorine	9	F
Neon	10	Ne
Sodium	11	Na
Magnesium	12	Mg
Aluminium	13	Al
Silicon	14	Si
Phosphorous	15	P
Sulphur	16	S
Chlorine	17	Cl
Argon	18	Ar
Potassium	19	K
Calcium	20	Ca

Molecules: Molecules are the smallest particle of an element or a compound which can exist independently. Molecules may be monoatomic, di-atomic or polyatomic.
Atomicity: The number of atoms constituting a Molecule is known as its atomicity.

Name of the element	Atomicity	Molecules formula
Helium	Diatomic	He
Neon	Monoatomic	Ne
Argon	Monoatomic	Ar
Sodium	Monoatomic	Na
Aluminium	Monoatomic	Al
Hydrogen	Diatomic	H_2

Nitrogen	Diatomic	N_2
Oxygen	Diatomic	O_2
Chlorine	Diatomic	Cl_2
Phosphorous	Polyatomic	P_4
Sulphur	Polyatomic	S_8

Law of Chemical Combination:
(i) Law of conservation of mass: Mass can neither be created nor destroyed in a chemical reaction. For example,

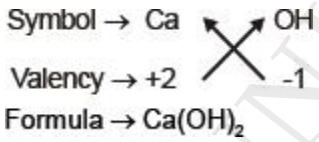
A+B ⟶ C+D
Reactants Products
Mass of reactants = Mass of products

(ii) Law of constant proportion: In a chemical substance the elements are always present in definite proportions by mass. For example, in water,
The ratio of the mass of hydrogen to the mass of oxygen is always 1: 8 respectively.

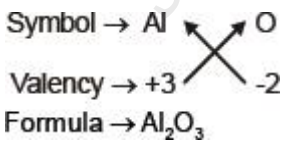
Chemical Formulae:

(i) The valences or charges on the ion must balance.
(ii) A metal and non-metal compound should show the name or symbols of the metal first. For example, $Na^+ Cl^- \rightarrow NaCl$
(iii) If a compound consists of polyatomic ions. The ion before writing the number to indicate the ratio. For example, $[H]^+[SO_4]^{2-} \rightarrow H^+ SO_4^{2-} \rightarrow H_2SO_4$.

Chemical formula of some simple compounds
(a) Calcium hydroxide



(b) Aluminium oxide



Atomic mass: Atom - Atomic mass
Molecular Mass: Molecule - Molecular Mass

Molecular Mass: It is the sum of the atomic masses of all the atoms in a molecule of the substance. It is expressed in atomic mass unit (u). For example,

$2H_2 + O_2 \longrightarrow 2H_2O$
$H_2O = 1 \times 2 + 16 = 18$ u

Formula Unit Mass: It is the sum of the atomic masses of all atoms in a formula unit of a compound. The constituent particles are ions. For example,

$Na^+ + Cl^- \rightarrow NaCl$
$1 \times 23 + 1 \times 35.5 = 58.5$ u

ASSIGNMENT:

MULTIPLE CHOICE QUESTIONS:

1. The atomic symbol of gold is ————————

(a) Si

(b) S

(c) Ag

(d) Au

Ans: (d)

2. The atomic symbol of Mercury is ————————.

(a) H

(b) He

(c) Hg

(d) M

Ans: (c)

3. Which of the following is the incorrect pair of atoms and its atomic symbol?

(a) Sulphur – S

(b) Potassium – P

(c) Phosphorus -P

(d) Sodium- S

Ans: (b) & (d)

4. Atomic mass of Chlorine is ————— (u)

(a) 34

(b) 34.5

(c) 35

(d) 35.5

Ans: (d)

5. The formula of Ammonium Sulphate is ————————

(a) NH_4SO_4

(b) NH_4SO_2

(c) $(NH_4)_2SO_4$

(d) NH_2SO_4

Ans: (c)

6. What is the chemical formula of sodium bicarbonate?

(a) Na_2CO_3

(b) $NaHCO_3$

(c) $NaCO_3$

(d) Na_2HCO_3

Ans: (b)

7. A box contains some identical red colour balls labelled as A each weighing 2 g. Another box contains identical blue-coloured balls, labelled as B, each weighing 5 g. In the combinations AB, AB_2, A_2B and A_2B_3 which is applicable?

(a) Law of Definite proportion

(b) Law of multiple proportion

(c) Law of conservation of mass

(d) None of the above

Ans: (b)

8. What is the value of Avogadro's number?

(a) 6.022×10^{-23}

(b) 6.022×10^{23}

(c) 6.022×10^{-22}

(d) 6.022×10^{22}

Ans: (b)

9. An element X is divalent and another element Y is tetravalent. The compound formed by these two elements will be:

(a) XY

(b) XY_2

(c) X_2Y

(d) XY_4

Ans. (c) X_2Y

10.In a reaction, 5.3 g of sodium carbonate reacted with 6 g of acetic acid. The products were 2.2 g of carbon dioxide, 0.9 g water and 8.2 g of sodium acetate.

Show that these observations are in agreement with the law of conservation of mass.

sodium carbonate + acetic acid → sodium acetate + carbon dioxide + water

Ans. Sodium carbonate + acetic acid → Sodium acetate + carbon dioxide + water

5.3g 6g 8.2g 2.2g 0.9g

As per the law of conservation of mass, the total mass of reactants must be equal to the total mass of products

As per the above reaction, LHS = RHS i.e., 5.3g + 6g = 2.2g + 0.9 g + 8.2 g = 11.3 g

Hence the observations are in agreement with the law of conservation of mass.

11. Hydrogen and oxygen combine in the ratio of 1:8 by mass to form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas?

Ans. We know hydrogen and water mix in the ratio 1: 8.

For every 1g of hydrogen, it is 8g of oxygen.

Therefore, for 3g of hydrogen, the quantity of oxygen = 3 x 8 = 24g

Hence, 24g of oxygen would be required for the complete reaction with 3g of hydrogen gas.

12.Define the atomic mass unit.

Ans. An atomic mass unit is a unit of mass used to express weights of atoms and molecules where one atomic mass is equal to 1/12th the mass of one carbon-12 atom.

13. Write down the formulae of

(i) sodium oxide

(ii) Aluminium chloride

(iii) sodium sulphide

(iv) magnesium hydroxide

Ans. The following are the formulae:

(i) sodium oxide – Na_2O

(ii) Aluminium chloride – $AlCl_3$

(iii) sodium sulphide – Na_2S

(iv) magnesium hydroxide – $Mg(OH)_2$

14. Write down the names of compounds represented by the following formulae:

(i) $Al_2 (SO_4)$

(ii) $CaCl_2$

(iii) $K_2 SO_4$

(iv) KNO_3

(v) $CaCO_3$.

Ans. (i) $Al_2(SO_4)_3$ – Aluminium sulphate

(ii) $CaCl_2$ – Calcium chloride

(iii) K_2SO_4 – Potassium sulphate

(iv) KNO_3 – Potassium nitrate

(v) $CaCO_3$ – Calcium carbonate

15. Calculate the molecular masses of

H_2, O_2, Cl_2, CO_2, CH_4, C_2H_6, C_2H_4, NH_3, CH_3OH.

Ans. The molecular mass of H_2 – 2u

The molecular mass of O_2 = 2 x 16u = 32u

The molecular mass of Cl_2 = 2 x 35.5u = 71u

The molecular mass of CO_2 = 12 + (2 ×16) u = 44u

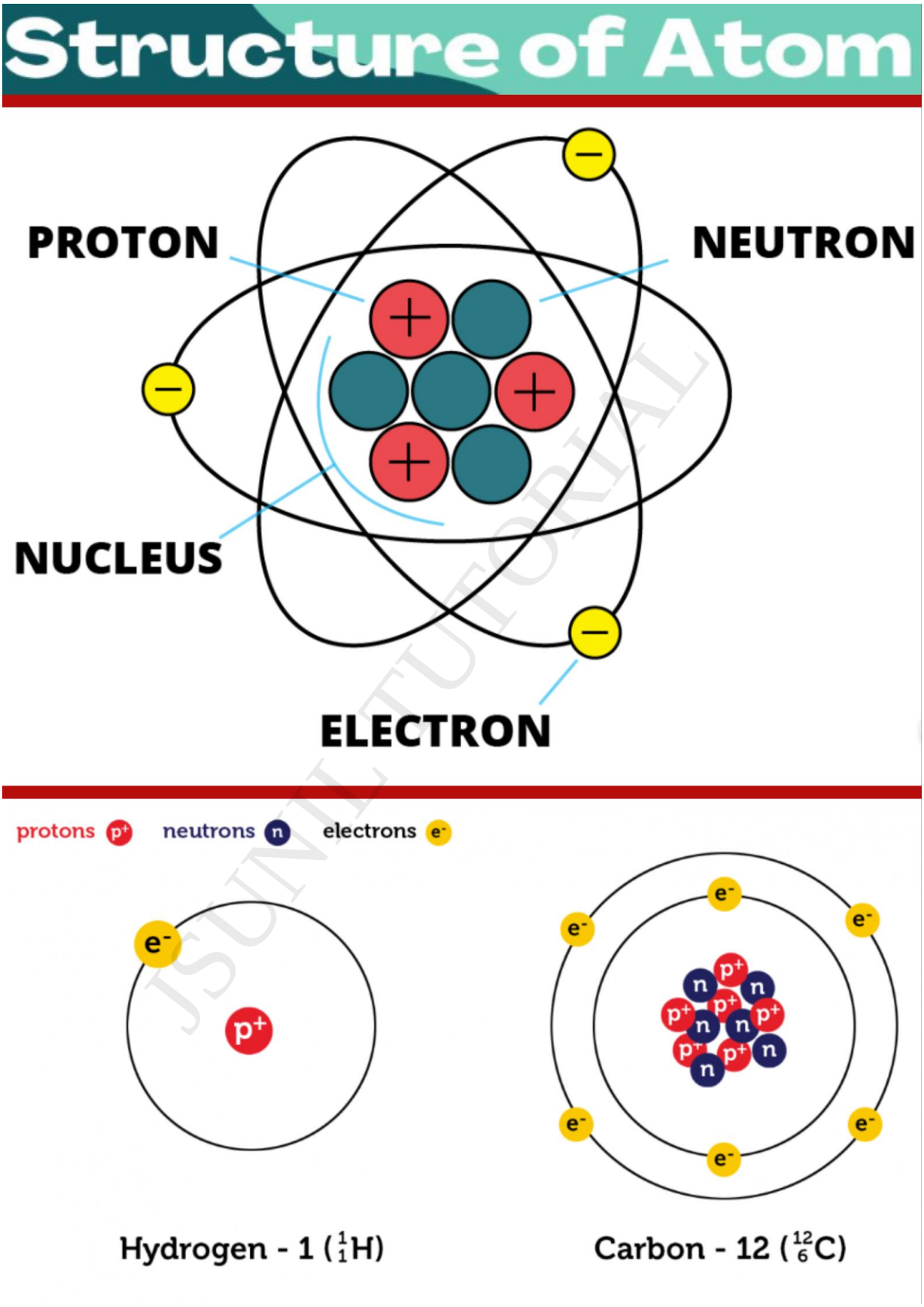
The molecular mass of CH_4 = 12 + (4 x 1) u = 16u

The molecular mass of C_2H_6 = (2 x 12) + (6 x 1) u=24+6=30u

The molecular mass of C_2H_4 = (2 x 12) + (4 x 1) u=24+4=28u

The molecular mass of NH_3 = (14 + 3 x 1) u= 17u

The molecular mass of CH_3OH = (12 + 3×1+16+1) u = 32u

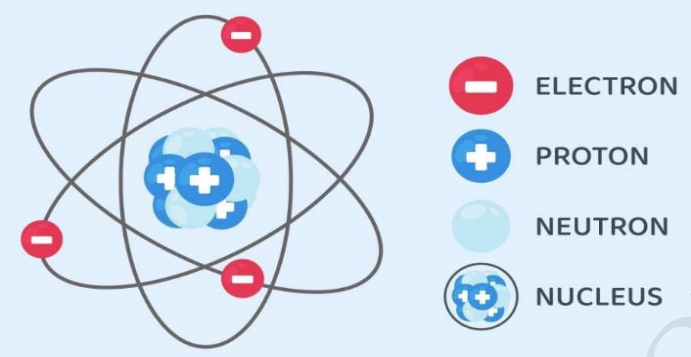

Structure of Atom
PROTON
NEUTRON
NUCLEUS
ELECTRON
protons p+
neutrons n
electrons e-
e-
p+
Hydrogen - 1 (11H)
e-
p+
n
Carbon - 12 (126C)

CHAPTER 4

STRUCTURE OF ATOMS

Structure of atoms: An atom contains three basic particles namely electrons, protons and neutrons.

The nucleus of the atom contains electrons, protons and neutrons where electrons are negatively charged particles, protons are positively charged and neutrons are neutral.



The electrons are located at the outermost regions called the electron shell.

Electron: J. J. Thomson, in 1897, discovered negatively charged particles emitted by the cathode towards the anode in a cathode ray experiment. These **negatively charged** particles are Electrons.

Protons: Ernest Goldstein, in 1886, discovered that with a different condition in the same chamber, anode emitted **positively charged** particles known as Canal rays or later named as Protons.

Neutrons: J. Chadwick discovered a subatomic particle with **no charge** and a mass equivalent to protons in the nucleus of all atoms. These neutrally charged particles are Neutrons.

The properties of electrons, protons, and neutrons:

Property	Electrons	Protons	Neutrons
Charge	Negatively Charged	Positively Charged	No Charge
Affinity	Attracts to positively charged	Attracts to negatively charged	Get attracted neither to positive nor negative
Mass	Mass is negligible	1 a.m.u	1 a.m.u
Location	Outside the nucleus	Within the nucleus	Inside the nucleus

Ions: The charged particles (atoms) are called ions, they charge or negative charge on it:

Negatively charged ion is called anion ($C1^-$).
Positively charge ion is called cation (Na^+).

Valency: The combining capacity of an element is known as its valency.
Valency is used to form a chemical compound.

Name of the element	**Atomic Number**	**Symbol**	Valency
Hydrogen	1	H	1
Helium	2	He	0
Lithium	3	Li	1
Beryllium	4	Be	2
Boron	5	B	3
Carbon	6	C	4
Nitrogen	7	N	3
Oxygen	8	O	2

Atomic Number (Z): The atomic number is equal to the number of protons present in one atom of an element. As the atom is electrically neutral, the number of protons and electrons are the same. The notation *Z* denotes an atomic number. The atomic number of Hydrogen is one as it has only one proton.

Number of Protons present in an atom **= Atomic number (Z)**

Number of Electrons present in an atom**= Atomic number (Z)**

Number of Neutrons **= Mass number (A) - Atomic number (Z)**

Mass Number (A): The mass number is the measure of the total **number of protons and neutrons** in the nucleus of an atom. The notation *A* indicates the **Mass number**. The notation n signifies the total **number of neutrons**.

Mass Number = Atomic Number + Number of Neutrons in the Nucleus

A = Z + n

Isotopes and Isobars:

Isotopes: The atoms of the same elements with the same atomic number and different mass numbers. For Examples,

Hydrogen has three isotopes: Protium ($_1H^1$), Deuterium ($_1H^2$), and Tritium ($_1H^3$)**.**

Isobars: The atoms of different molecules with the same mass number.

For Example, in Argon, atomic number 18, Calcium, atomic number 20, the mass number of both these elements is 40. For example,

$_{18}Ar^{40}$, $_{20}Ca^{40}$

ASSIGNMENT:

MULTIPLE CHOICE QUESTIONS:

1. Who discovered the electron?

(a) Goldstein

(b) J.J Thomson

(c) Chadwick

(d) Eugen Goldstein

Ans: (b)

2.The atomic number of an element is equal to ————

(a) number of neutrons

(b) number of electrons

(c) number of protons

(d) number of neutrons + number of protons

Ans: (c)

3.The mass number of the element is ————

(a) the sum of the number of electrons and protons

(b) the sum of the number of protons and neutrons

(c) the number of neutrons

(d) the number of protons

Ans: (b)

4. The atomic number of sodium is 11 and its mass number is 23. It has

(a) 11 neutrons and 12 protons

(b) 12 protons and 11 electrons

(c) 11 electrons and 12 neutrons

(d) 12 electrons and 11 neutrons

Ans. (c)

5. Which of the following statements about the electron is incorrect?

(a) It is a negatively charged particles

(b) The mass of the electron is equal to the mass of the neutron

(c) It is a basic constituent of all atom

(d) It is a constituent of cathode rays

Ans: (b)

6. How many electrons are occupied in the M shell?

(a) 8

(b) 16

(c) 18

(d) 32

Ans: (c)

Solution: The electrons are occupied in the shell by using the $2n^2$ rule.

For M shell n=3, $2 \times 3^2 = 18$ electrons.

7. The isotope deuterium of hydrogen has

(a) No neutrons and one proton

(b) One neutron and two protons

(c) One electron and two neutrons

(d) One proton and one neutron

Ans. (d)

8. Two atoms are said to be Isobars if ——————

(a) They have same atomic number but different mass number

(b) They have same number of electrons but different number of neutrons

(c) They have the same number of neutrons but different numbers of electrons.

(d) None of the above

Ans: (d) Two atoms are said to be Isobars if they have the same mass number but different atomic numbers.

9. $_{7}N^{15}$ and $_{8}O^{16}$ are pair of ———-

(a) Isotopes

(b) Isobars

(c) Isotones

(d) none of these

Ans: (c)

10. A Tri positive ion has 23 electrons and 30 neutrons. What is the atomic mass of the element?

(a) 56

(b) 53

(c) 50

(d) 55

Ans. (a)

11. Number of valence electrons in Cl^- ion is:

(a) 16

(b) 8

(c) 17

(d) 18

Ans. (b)

12. Which one of the following is a correct electronic configuration of sodium?

(a) 2,8

(b) 8,2,1

(c) 2,1,8

(d) 2,8,1

Ans. (d)

SHORT ANSWER QUESTION:

13.If number of electrons in an atom is 8 and number of protons is also 8, then

(i) what is the atomic number of the atom?

(ii) what is the charge on the atom?

Ans. (i) The atomic number of an atom is the same as the number of protons in that atom, hence its atomic number is 8.

(ii) In an atom, the number of protons is equal to the number of electrons. Hence both the charges – positive and negative neutralize each other. Therefore, the atom does not possess any charge.

14.Explain with examples

(i) Atomic number,

(ii) Mass number,

(iii) Isotopes

(iv) Isobars.

Ans. (i) The number of positively charged protons present in the nucleus of an atom is defined as the atomic number and is denoted by Z. Example: Hydrogen has one proton in its nucleus; hence its atomic number is one.

(ii) The total number of protons and neutrons present in the nucleus of an atom is known as the mass number. It is denoted by A. $_{20}Ca^{40}$. Mass number is 40. Atomic number is 20.

(iii) The atoms which have the same number of protons but different number of neutrons are referred to as isotopes. Hence the mass number varies.

Example: The simplest example is the Carbon molecule which exists as $_{6}C^{12}$ and $_{6}C^{14}$

(iv) Isobars: Isobars are atoms which have the same mass number but differ in the atomic number.

Examples are, $_{20}Ca^{40}$and $_{18}Ar^{40}$

15. Which of the following set of elements ratio of atomic numbers is 1:2:3:4?
(a) H, He, Li, B
(b) He, Be, C, Ne
(c) Be, O, Mg, Ca
(d) B, Ne, P, Ca
Ans. (d) B, Ne, P, Ca

16. The correct electronic configuration of potassium is _____?
(a) 2, 8, 4
(b) 2, 8, 8, 6
(c) 2, 8, 8, 1
(d) 2, 8, 8, 18
Ans. (c) 2, 8, 8, 1

17.**Complete the following table:**

Atomic Number	Mass Number	Number of Neutrons	Number of Protons	Number of Electrons	Name of the atomic species
9	-	10	-	-	-
16	32	-	-	-	Sulphur
-	24	-	12	-	-
-	2	-	1	-	-
-	1	0	1	0	-

Ans.

Atomic Number	Mass Number	Number of Neutrons	Number of Protons	Number of Electrons	Name of the atomic species
9	19	10	9	9	Fluorine
16	32	16	16	16	Sulphur
12	24	12	12	12	Magnesium
1	2	1	1	1	Deuterium
1	1	0	1	0	Hydrogen

18. **Match column A with column B.**

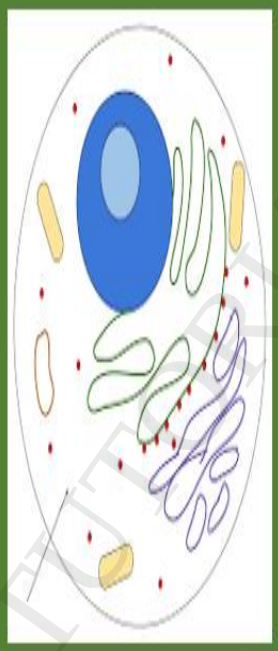
Column A (Atomic number)	**Column B (**Valency)
(A) 12	(i) 3
(B) 17	(ii) 0
(C) 10	(iii) 2

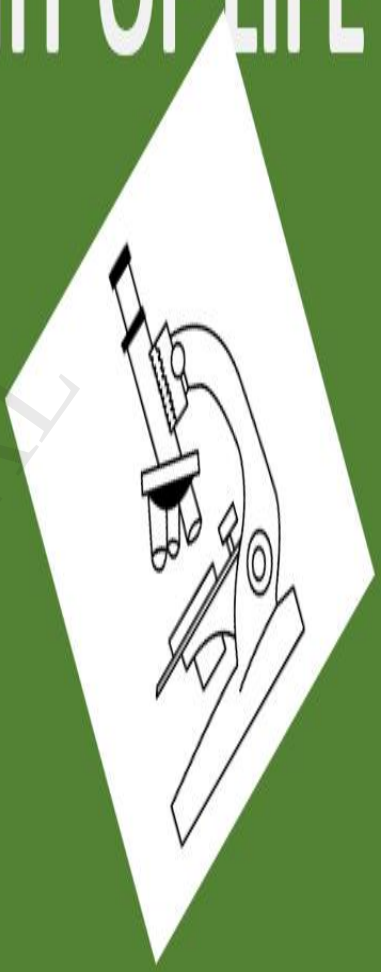
(D) 15	(iv) 1

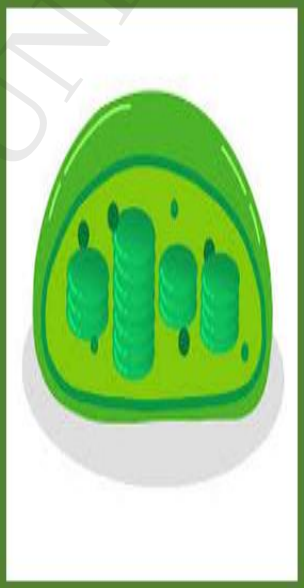
(a) A → ii, B → iv, C → iii, D → i
(b) A → iii, B → iv, C → ii, D → i
(c) A → iii, B → iv, C → i, D → ii
(d) A → iii, B → ii, C → i, D → iv

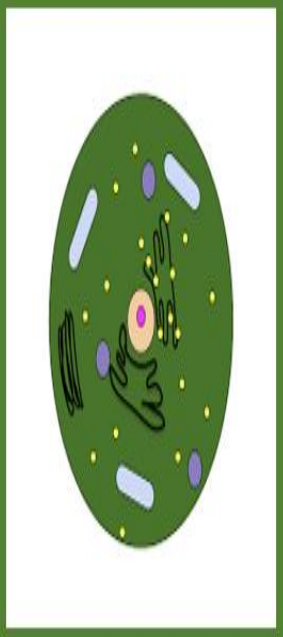
Ans. (b) A → iii, B → iv, C → ii, D → i

FUNDAMENTAL UNIT OF LIFE









CHAPTER- 5

FUNDAMENTAL UNIT OF LIFE

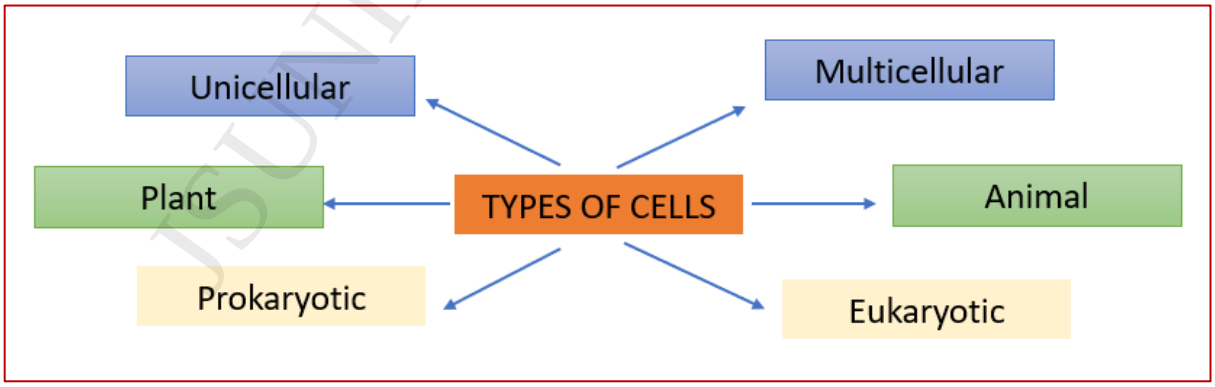
- Cells are the smallest unit of life that can exist independently and are the basic functional unit of all living things. Each living cell has the capacity to perform certain basic functions that are
  characteristic of all living forms
- The study of cells is known as cytology and is possible with the help of a microscope.
- Microscopes mainly perform two functions-

i- Magnification
ii- Resolution

The given table illustrates the contribution of various scientists-

Anton Von Leeuwenhoek	**First saw and described a live cell.**
Robert Hook (1665)	Discovered cell in cork slice with the help of a primitive microscope.
Robert Brown (1831)	Discover nucleus.
Schleiden and Schwan	Proposed cell theory
Purkinje (1839)	Coined the term protoplasm
Rudolf Virchow (1855)	Omnis cellula-e cellula

TYPES OF CELLS

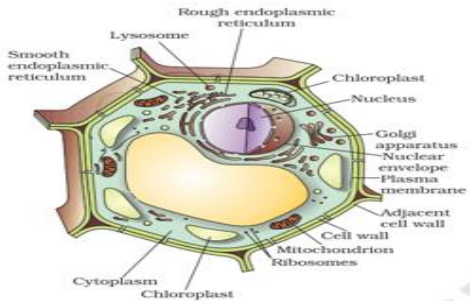


* Unicellular – Single-celled organisms like Amoeba
* Multicellular – Have many cells like Human
* Plant cell- Have cell walls Like Mango plant
* Animal cell- Do not have cell wall like Human
* Prokaryotic cell- Do not have nuclear membranes like Bacteria
* Eukaryotic cell – Have nuclear membranes like Human

DIFFERENCE BETWEEN PLANT CELL AND ANIMAL CELL

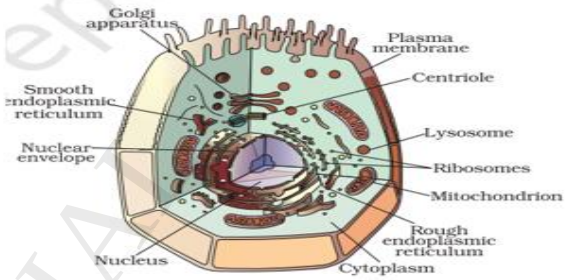
Plant Cell

- Have cell wall
- Usually posses Chloroplast
- Autotrophic
- No lysosome
- Centriole present only in few lower plants
- Vacuole – one large

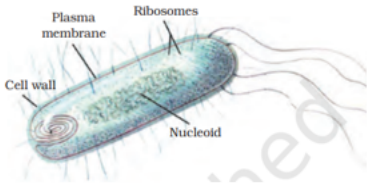


Animal cell

- Do not have a cell wall
- No chloroplast
- Heterotrophic
- Lysosome present
- Centriole present
- Vacuole- many and small



DIFFERENCE BETWEEN PROKARYOTIC CELL AND EUKARYOTIC CELL



PROKARYOTIC CELL

PROKARYOTIC CELL

- No nuclear membrane
- No nucleolus
- Ribosome 70 S type
- Unicellular
- Double membraned cell organelles absent
- Genetic material is circular

Example- Bacteria

EUKARYOTIC CELL

- Nuclear membrane present
- Nucleolus present
- Ribosome 80 S type
- Both unicellular and multicellular
- Present
- Linear

Example- Plant and animal cells

CELL ORGANELLES

PLASMA MEMBRANE

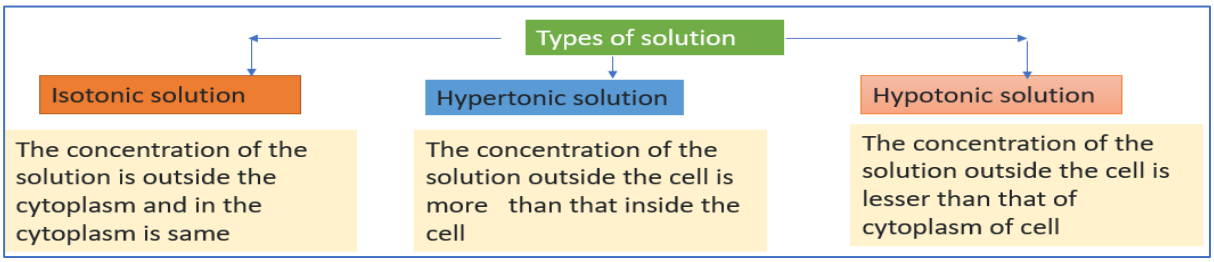
- It is the outermost covering of the cell.
- It plants another covering (cell wall) that is present which is absent in animal cells.
- It is a selectively permeable membrane (it only allows specific molecules to pass)
- The plasma membrane is made up of lipids and proteins.
- The plasma membrane acts as a mechanical barrier to protect protoplasmic structures.
- Across the plasma membrane the transport of the molecules occurs in the following manner-
  a- Diffusion
  b- Osmosis

a- Diffusion- The movement of solutes or ions from a higher concentration to a lower concentration is called as diffusion.

b- Osmosis- The movement of solvent/ water from their higher concentration region to a region with lower concentration through a semipermeable membrane is called osmosis

Osmosis is a biological process and is slower than diffusion.

c- Plasmolysis: When a living plant cell loses water through osmosis there is shrinkage or contraction of the contents of the cell away from the cell wall. This phenomenon is known as plasmolysis.

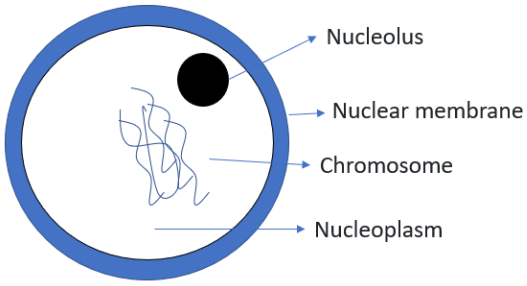


CELL WALL

- It is the outermost rigid layer in plant cells, fungi and bacteria.
- Plant, bacterial and fungal cell wall is composed of cellulose, peptidoglycan and chitin respectively.
- Cell walls provide rigidity, protect from pathogens, and help in transport.

NUCLEUS

- The nucleus is a small and round structure.
- It may be covered by a nuclear membrane (in eukaryotes) or without a nuclear membrane (in prokaryotic cells). The prokaryotic nucleus is known as a nucleoid.
- In eukaryotic cells, the nucleoplasm of the nucleus contains nucleolus and nucleic acid (genetic material) in it.



- The nucleus contains chromosomes. Nondividing chromosomes are known as chromatins. The chromosomes contain genetic information in the form of DNA (Deoxyribose Nucleic Acid) molecules.
- Chromosomes are composed of DNA and protein.
- The functional segments of DNA are called genes.

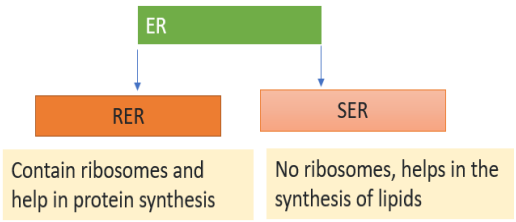
Function-

- Nucleus is the control centre of the cell
- It is responsible for the transmission of hereditary traits.
- In cell division
- It controls all the metabolic activities of the cell.

CYTOPLASM

- The cytoplasm is the fluid content inside the plasma membrane
- It jelly-like substance in which cell organelles are situated.
- It contains various cell organelles like the Endoplasmic reticulum, Mitochondria, Golgi complex, Ribosome, Vacuoles, Lysosome, Plastids etc.

ENDOPLASMIC RETICULUM (ER)

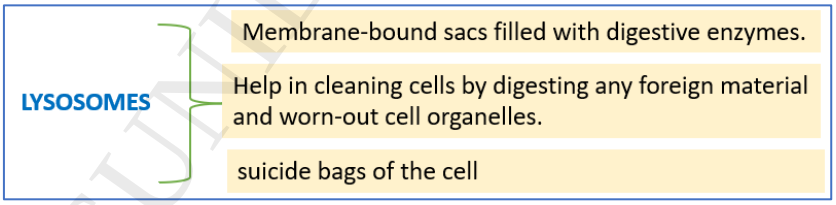


- ER are absent in prokaryotic cells and RBCs of mammals.
- It is the network of membranes present in the cytoplasm.
- It continues with the outer nuclear membrane.
- It has three main components- Cisternae, Vesicles and tubules.
- Some of these proteins and lipids synthesized with the help of ER are helpful in building the cell membrane. This process is known as membrane biogenesis
- ER is to serve as a channel for the transport of materials (especially proteins) between various regions of the cytoplasm or between the cytoplasm and the nucleus.
- ER also functions as a cytoplasmic framework providing a surface for some of the biochemical activities of the cell.
- In the liver cells of vertebrates, SER helps in the detoxification of poisons and drugs.

GOLGI APPARATUS

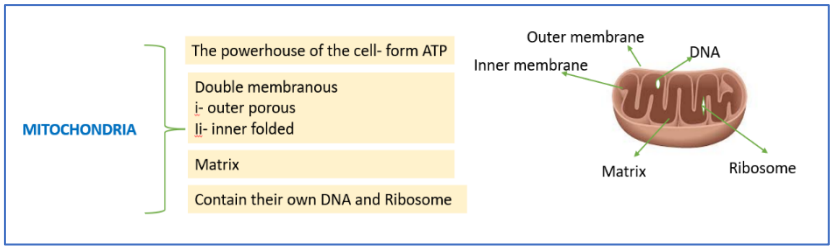
- It is first observed by Camillo Golgi (1898).
- The Golgi apparatus consists of many flat, disc-shaped sacs or cisternae.
- These structures are situated parallel to each other. The cisternae have interconnected - **cis** (convex or farming face) and **trans** (maturing face) faces.
- The Golgi apparatus remains in close association with the endoplasmic reticulum.
- The Golgi body is involved in packaging materials, modification of proteins, and formation of glycoproteins and glycolipids.
- The material synthesized near the ER is packaged and dispatched to various targets inside and outside the cell through the Golgi apparatus. Its functions include the storage, modification, and packaging of products in vesicles.
- It is also involved in the formation of lysosomes

LYSOSOMES



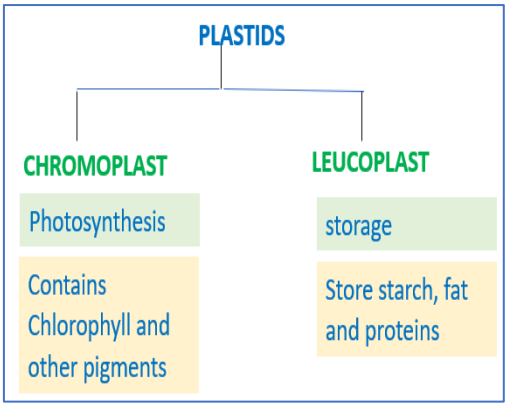
- When a cell gets damaged, then the lysosomes burst and release digestive enzymes. These enzymes digest their own cell leading to the death of that cell. Therefore, lysosomes are also known as suicide bags of the cell.

MITOCHONDRIA



PLASTIDES

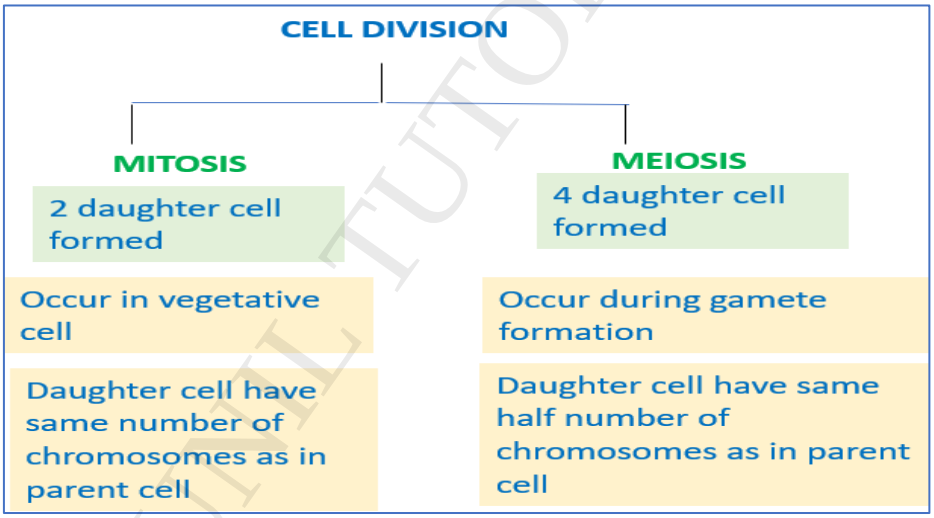
- These are present only in plant cells.
- Chloroplasts are the main chromoplast and are the main pigment for photosynthesis in plants.
- Chloroplast is a double membrane containing organelles.
- It has a stroma in which numerous membrane layers are embedded.
- Plastids also have their own DNA and ribosomes.

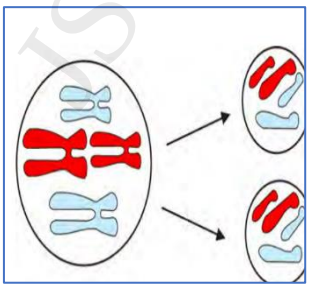


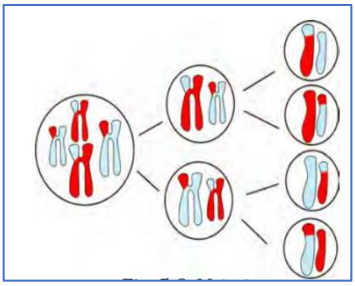
VACUOLES

- Vacuoles are storage sacs for solid or liquid contents.
- Vacuoles are small-sized in animal cells while plant cells have very large vacuoles.
- Vacuoles are storage sacs for solid or liquid contents.
- Remove and store nutrients as well as waste produced

CELL DIVISION







IMPORTANT QUESTIONS

MCQs and Very Short Answer Questions

1- **Which plastid has no colour –**
   a- Chromoplast b- Chloroplast c- Leucoplast d- Chlorophyll
   Ans: c

2- **In the formation of male gamete sperm which type of cell division occur-**
   a- Mitosis b- Meiosis c- Amitosis d- Both a and b
   Ans: b

3- **Which of the following movement is a biological process-**
   a- Brownian movement
   b- Diffusion
   c- Osmosis
   d- None of these
   Ans: c

4- **ATP synthesis takes place in-**
   a- Mitochondria
   b- Chloroplast
   c- Ribosome
   d- SER
   Ans: a

5- **The function of expelling excess water and some wastes from the cell is takes place by**
   a- RER
   b- Vacuole
   c- Lysosome
   d- All of these
   Ans: b

6- **What are the components of the plasma membrane?**
   Ans: Lipid and protein

7- **Write one role of the Smooth Endoplasmic Reticulum.**
   Ans: SER plays a crucial role in detoxifying many poisons and drugs.

8- **What is the component of the cell wall of plants and fungi?**
   Ans: Plant- cellulose, Fungi- Chitin

9- **Who coined the term protoplasm?**
   Ans: Purkinje

10- **Give two examples of unicellular organisms except bacteria.**
   Ans: Amoeba, Paramecium

Short Answer Questions

1- **Mention the name of different types of cell division. Also, write one difference in these.**
   Ans: Cell divisions- Mitosis and Meiosis
   Difference- In mitosis 2 daughter cells are formed while in Meiosis 4 daughter cells are formed

2- **Which cell organelles are termed suicidal bags and why?**

Ans: Lysosomes are known as suicidal bags.
These contain digestive enzymes. When a lysosome bursts the digestive enzymes digest the cell.

3- **What are the two basic properties of microscopes?**
Ans: i- Magnification ii- Resolving power

4- **Write the full form of DNA and ATP.**
And: Deoxyribose nucleic acid, Adenosine triphosphates

5- **What is the function of chromosome?**
Ans: Chromosome contains DNA it it. DNA is the main genetic material.
Chromosomes carries these genetic materials from one generation to the other.

Long Answer Questions

1- **Write five differences between prokaryotic and eukaryotic cell.**
Ans:
Prokaryotic cell- nuclear membrane absent, Unicellular, Double membrane cell organelles are absent, Ribosome – 70 S types, DNA- Circular
Eukaryotic cell- nuclear membrane present, mostly multicellular, Double membrane cell organelles are present, Ribosome – 80 S types, DNA- Linear

2- **Daw well labelled diagram of plant cell and describe roles of mitochondria, rough endoplasmic reticulum.**
Ans: Fig. 5.6: Plant cell, Page 56 NCERT
Mitochondria- ATP synthesis
Rough endoplasmic reticulum- Protein synthesis

3- **a- Write two differences between diffusion and osmosis.**
b- How plasma membrane differs from cell wall?

Ans: a- Diffusion- It occurs in any medium, Diffusing molecules may be solid, liquid or gaseous solutes.
Osmosis- It occurs in liquid medium only; it involves movement of solvent molecules only.
b- It holds cellular contents and controls passage of materials in and out of cell.
It gives protection, strength and rigidity to the cell.

4- **Describe the structure of Golgi body. Also mention two roles of the Golgi body**.
Ans:
It is membrane-bound fluid-filled vesicles, vacuoles and cisternae.
Plant cell has more Golgi apparatus than animal cells.
It is made of tubular structures.
Functions:
i- transport and modification of protein, lipids as well as carbohydrates.
ii- formation of cell plate during cell division.
iii- Transport of materials

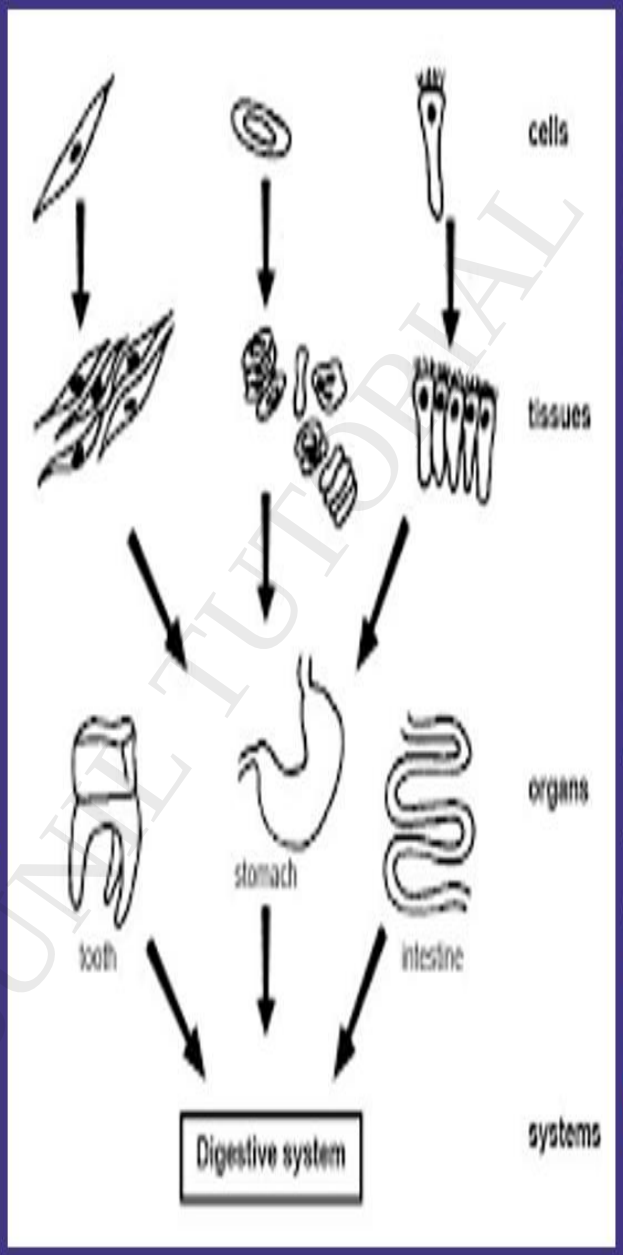
5- Draw a neat labelled diagram of an animal cell and compare it with animal cell and prokaryotic cell.
Ans: : Fig. 5.6: Plant cell, Page 56, NCERT
Fig. 5.5: Animal cell., Page 55, NCERT
Fig. 5.4: Prokaryotic cell, Page 54, NCERT

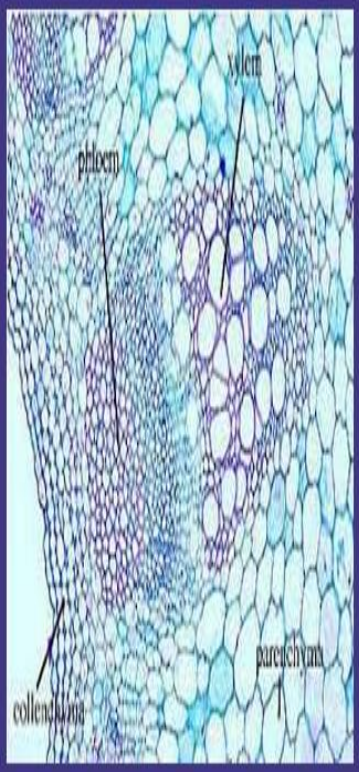
TISSUE

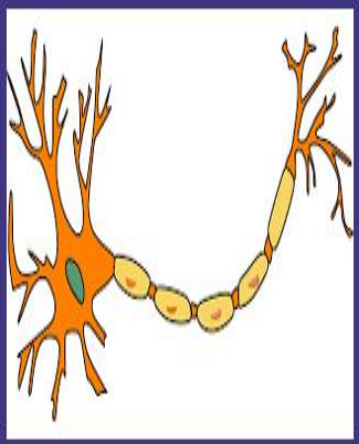
TISSUE

ORGAN

ORGAN SYSTEM





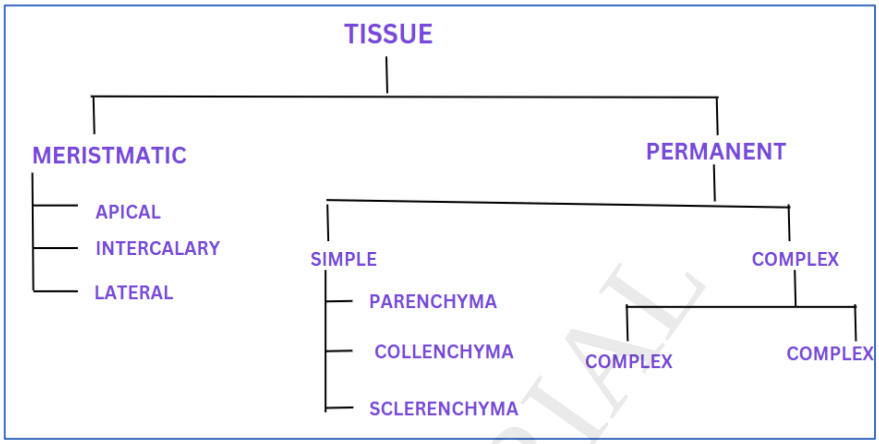


CHAPTER- 6
TISSUE

- A group of cells having a common origin and similar function is termed tissue.

CELL ⟶ TISSUE ⟶ ORGAN ⟶ ORGAN SYSTEM

- The **plant tissue** can be grouped as under-

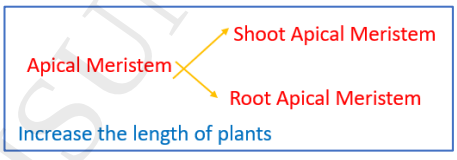


MERISTEMATIC TISSUE

- Divide continuously to form new cells.
- Found in growing regions like the tip of the shoot and root.
- Cells of meristematic tissue are very active, they have dense cytoplasm, thin cellulose walls and prominent nuclei.
- They lack vacuoles.

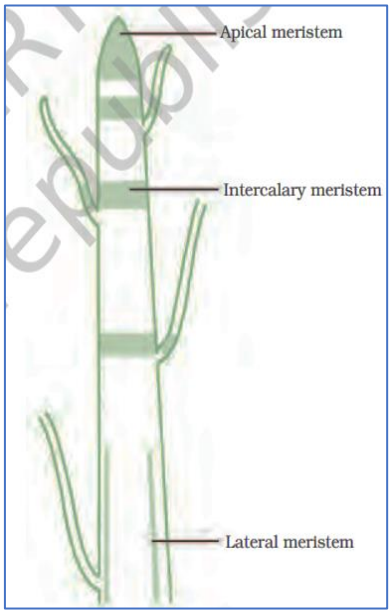
There are three main types of meristems-

1- Apical Meristem- Apical meristem is present at the growing tips of stems and roots and increases the length of the stem and the root.



2- Intercalary Meristem- It is located in the leaves and internodes at the intercalary position. This help to increase the length of the internode. The intercalary meristem promotes the growth of plants by elongating the nodes and internodes present at the leaves and stems.

3- Lateral Meristem- It is located on the lateral side of the stems and roots
It increases the girth/ thickness of the plant. Example- Vascular cambium and cork cambium



PERMANENT TISSUE

Through the process of differentiation, the meristematic cells lose the capacity to divide. Such tissues are known as permanent tissues.

Meristematic tissue ⟶ Differentiation process Permanent Tissues

SIMPLE PERMANENT TISSUE

- These are made of the same cells performing a similar function.
- They have thin cell walls with intercellular spaces.
  Examples- Parenchyma, Collenchyma and Sclerenchyma

PARENCHYMA

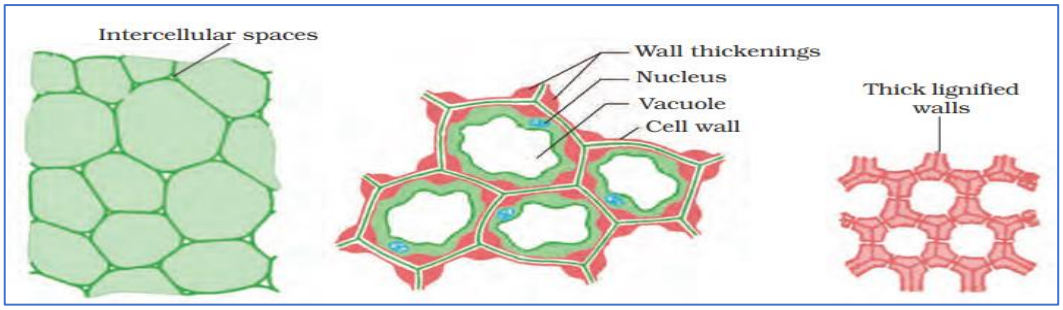
- Cells are living, loosely arranged with large intercellular space.
- Sometimes they also perform photosynthesis (chlorenchyma).
- In aquatic plants, large air cavities are present in the parenchyma to help them float (aerenchyma).
  They store food.
- Parenchyma also provides mechanical support to the plants.

COLLENCHYMA

- The cells are living, elongated and thickened at corners.
- Intercellular spaces are very less.
- It allows the bending of various parts of a plant like tendrils and stems.
- It also provides mechanical support.
- The cells of this tissue are living, elongated
- and irregularly thickened at the
- corners. There is very little intercellular space

CHLORENCHYMA

- The cells are dead, long and narrow.
- No intercellular space present.
- Cell walls of this tissue are uniformly thickened due to lignin.
- E.g., Jute and coir fibres.
- This tissue is present in stems, around vascular bundles, in the veins of leaves and in the hard covering of seeds and nuts.
- It provides strength to the plant parts.



EPIDERMIS

Single Layered
In dry area the epidermis is thicker and protect plant against water loss
It protects all the parts of the plant.
The outer and side walls are thicker than the inner wall
The epidermis of leaves have minute pores (stomata)

Stomata are enclosed by two kidney-shaped cells called guard cells.
Stomata also helps in exchanging gases and transpiration

SIMPLE PERMANENT TISSUE

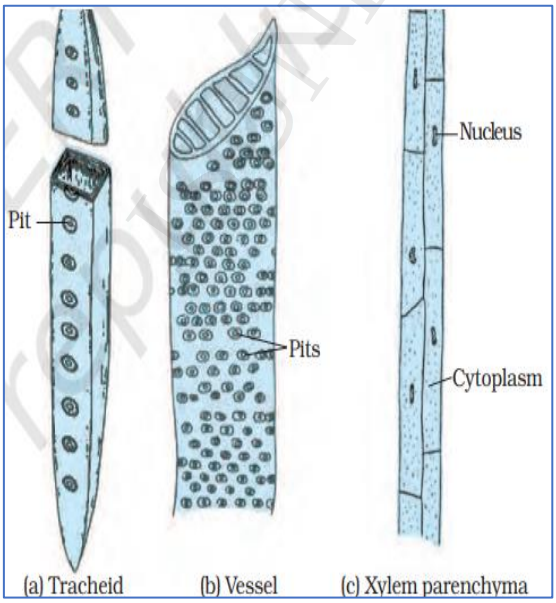
i- **Xylem**
ii- **Phloem**

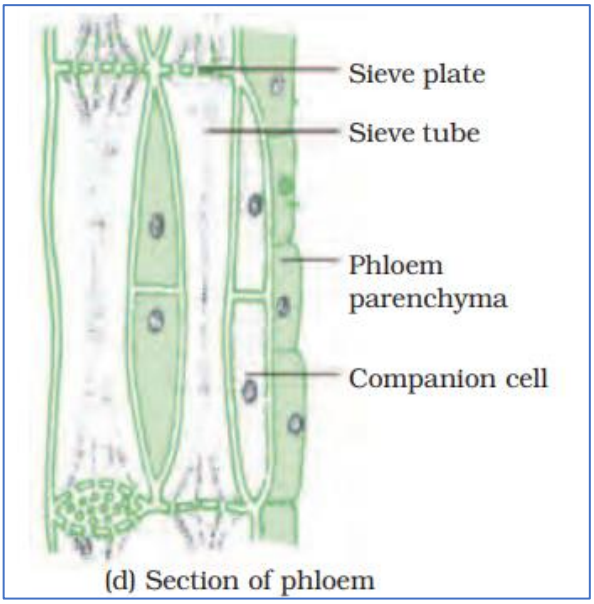
XYLEM

- Xylem consists of tracheids, vessels, xylem, parenchyma and xylem fibers.
- Tracheids and vessels are thick-walled tubular structures. These help in the transport of water and minerals vertically.
- The Xylem parenchyma stores food while Xylem fibres are supportive in function.

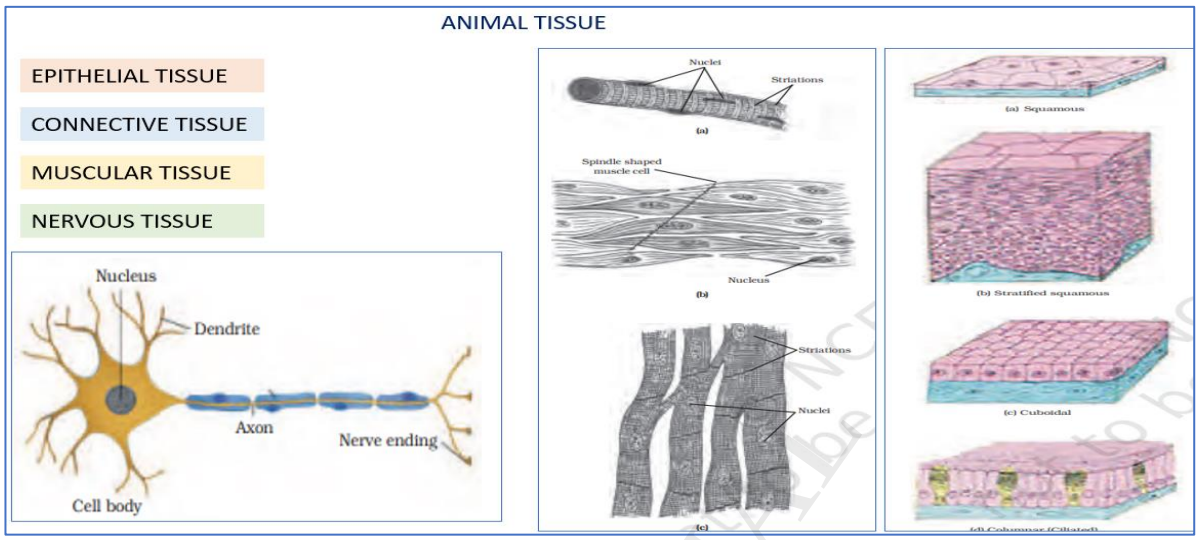
PHLOEM

- Phloem consists of sieve cells, sieve tubes, companion cells, phloem fibres and the phloem. All cells are living except phloem fibre.
- Sieve tubes are tubular cells with perforated walls.
- The phloem transports food from leaves to other parts of the plant.





ANIMAL TISSUES

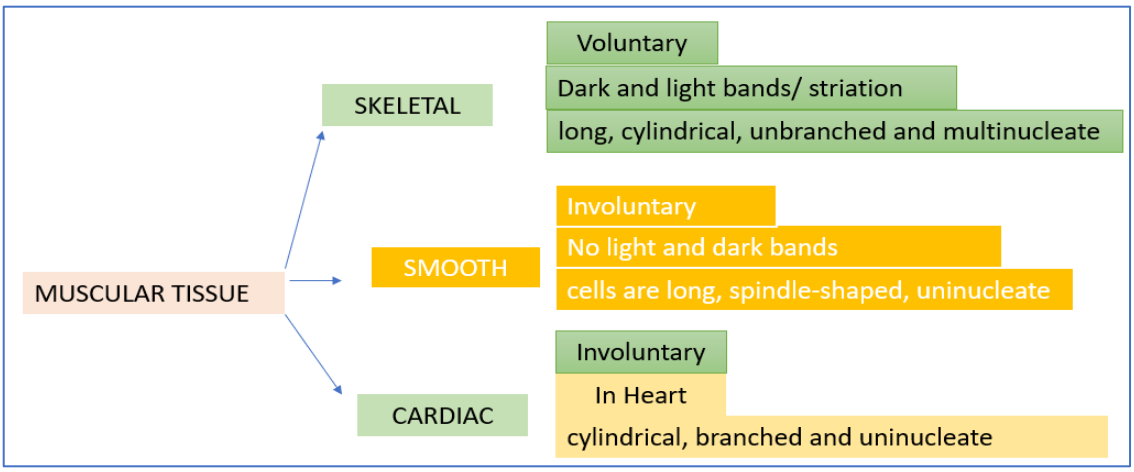


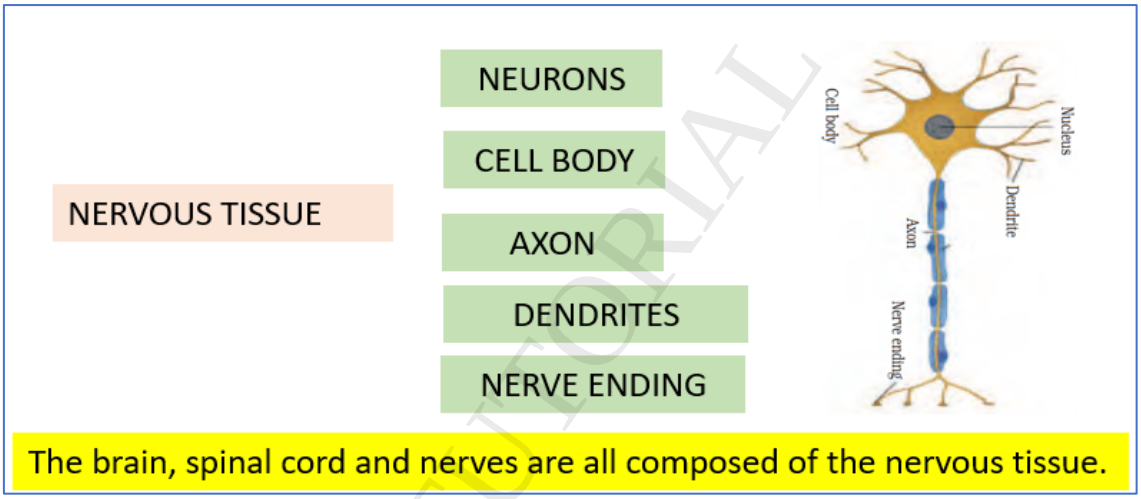
- Forms covering of animal body are epithelial tissues.
- Tightly packed, no intercellular spaces
- Helps in the exchange of materials in and out of the cell

Squamous epithelium- Simple flat, lning in bloodvssels and alveoli. oesophagus., mouth
Stratified squamous epithelium – as layers, skin
Columnar epithelial tissue pillar like, intestine
Ciliated columnar epithelium- bear cilia, respiratory tract
Cuboidal epithelium- cube like, Kidney, salivary gland
Glandular epithelium – in glands

CONNECTIVE TISSUE	BLOOD	(RBC, WBC, PLATELETS)
	BONE	calcium and phosphorus compounds
	CARTILAGE	Soft Bone

- Ligaments: Connects bone with bone
- Tendons: Connect bones with muscles.
- Areolar connective tissue: Present in between the skin and muscles, around blood vessels, and nerves and in the bone marrow. It fills the space inside the organs, supports internal organs and helps in the repair of tissues.
- Adipose tissue: store fat





IMPORTANT QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1- Which animal tissue performs the storage of fat-
   a- Aerenchyma
   b- Striated muscles
   c- Adipose tissue
   d- Glandular epithelium
   Ans: c

2- Which muscle is striated type-
   a- Skeletal
   b- Smooth
   c- Cardiac
   d- Nervous
   Ans: a

3- Which structure connects bones and muscles-
   a- Ligament
   b- Tendon
   c- Both a and b
   d- None of these

Ans: b

4- In a respiratory system which types of epithelium are present-
   a- Columnar
   b- Ciliary
   c- Squamous
   d- Glandular
   Ans: b
5- In the spinal cord which tissue is present-
   a- Cardiac tissue
   b- Nervous tissue
   c- Skeletal tissue
   d- None of these

SHORT ANSWER TYPE QUESTIONS

1- Give two differences between bone and cartilage.
   Ans: Bones- Hard, inelastic
   Cartilage- Soft and flexible
2- Mention one difference between the xylem and the phloem on the basis of their function.
   Ans: Xylem- water conducting tissue
   Phloem- Food conducting tissue
3- Blood is found in a liquid state even though it is called connective tissue. Give reason.
   Ans: Blood connects the requirement of body systems to fulfill the requirement for oxygen, nutrients, hormones, etc.
4- Write any roles of the epidermis.
   Ans: Protection, Pore in epidermis forms stomata
5- Draw a well labelled diagram of the neuron.
   Ans: Fig. 6.12, Page 69, NCERT

LONG ANSWER TYPE QUESTIONS

1- a- Explain the process of message transfer within the body.
   b- Draw the diagram of the responsible tissue for this purpose.
   Ans: Dendrites receive the information and pass it to the axon through the cell body. In the axon, a nerve impulse travels as an electric current which passes to the next neuron through chemical messengers present in between two neurons.
   b- Fig. 6.12, Page 69, NCERT
2- describe the different types of complex tissues of plants with a suitable diagram.
   Ans: Xylem consists of tracheids, vessels, xylem, parenchyma and xylem fibers.
   - Tracheids and vessels are thick-walled tubular structures. These help in the transport of water and minerals vertically.
   - The Xylem parenchyma stores food while Xylem fibers are supportive in function.
     PHLOEM
   - Phloem consists of sieve cells, sieve tubes, companion cells, phloem fibres and the phloem. All cells are living except phloem fibre.
   - Sieve tubes are tubular cells with perforated walls.

- The phloem transports food from leaves to other parts of the plant

Fig. 6.7, Page 64, NCERT

3- Identify the following tissues-
(a) Form cilia in the respiratory tract.
(b) Tissue that connects muscle to muscle
(c) Dead part of phloem
(f) Tissue presents in the brain
Ans: a- epithelial cell b- Ligament c- phloem fiber d- nervous tissue

4- Write two differences between
a- parenchyma and collenchyma
b- Collenchyma and Sclerenchyma
Also make the diagrams of these tissues.

Ans: a- Parenchyma- Thin-walled, with no thickening at the corner, loosely packed
Collenchyma- thickening at the corner, compactly packed
Sclerenchyma- dead cell and lignifies
Fig. 6.4: Page 61, NCERT

5- Give diagrammatic difference between different types of skeletal muscles.
Ans: Fig. 6.11: Types of muscles fibres: (a) striated muscle,
(b) smooth muscle, (c) cardiac muscle, Page 68 NCERT

CHAPTER 7
MOTION

Understanding Motion

Reference Point and Reference Frame

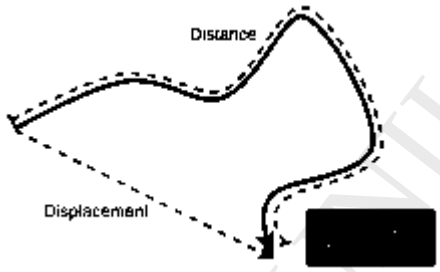
- To describe the position of an object, we need a reference point or origin. An object may seem to be moving to one observer and stationary to another.
- Example: A passenger inside a bus sees the other passengers to be at rest, whereas an observer outside the bus sees the passengers to be in motion.
- In order to make observations easy, a convention or a common reference point or frame is needed. All objects must be in the same reference frame.

Distance and Displacement

The magnitude of the length covered by a moving object is called distance. It has no direction.

Displacement is the shortest distance between two points or the distance between the starting and final positions with respect to time. It has magnitude as well as direction.

Displacement can be zero, but distance cannot.



Distance VS Displacement

Magnitude

Magnitude is the size or extent of a physical quantity. In physics, we have scalar and vector quantities.

Scalar quantities are only expressed as magnitude. E.g.: time, distance, mass, temperature, area, volume

Vector quantities are expressed in magnitude as well as the direction of the object. E.g.: Velocity, displacement, weight, momentum, force, acceleration, etc.

Time, Average Speed, and Velocity

Time and speed

Time is the duration of an event that is expressed in seconds. Most physical phenomena occur with respect to time. It is a scalar quantity.

Speed is the rate of change in distance. If a body covers a certain distance in a certain amount of time, its speed is given by

Speed=Distance Time
The instantaneous speed is the speed of an object at a particular moment in time.

Average speed is stated as the distance covered by the object within a period of time.

Average speed = Total distance traveled / Total time taken

The below table lists the difference between Average Speed and Instantaneous Speed.

Average Speed	Instantaneous Speed
It is defined as the total distance travelled divided by the total time elapsed.	It is defined as the speed at a particular instant of time.
It is constant.	It is not constant.
Measured by calculating the speed for an entire journey.	It is measured by a speedometer.
Example: A car traveling with a speed of 45 km/h. Thus, the average speed of the car is 45 km per hour.	Example: A car traveling at a certain speed at an instant of time can be given by a speedometer.

Uniform motion and non-uniform motion

When an object covers equal distances in equal intervals of time, it is in uniform motion.

Examples of Uniform Motion

- Movement of the ceiling/table/standing fan’s blades.
- Motion of planets around the sun
- Clock Pendulum with equivalent amplitude on either side

When an object covers unequal distances in equal intervals of time, it is said to be in non-uniform motion.

- Bouncing ball
- Running dog
- Moving car

Velocity

The Rate of change of displacement is velocity. It is a vector quantity. Here the direction of motion is specified.

Velocity=Displacement Time

Average Velocity	**Instantaneous Velocity**
Average velocity is defined as the displacement (Δx) divided by the time intervals (Δt) in which the displacement occurs.	Instantaneous velocity is the rate of change of position for a time interval that is very small, i.e. almost zero.
Average velocity is calculated by dividing the rate of displacement by the time elapsed.	Instantaneous velocity is calculated by dividing displacement by time at that instant.
If Jack took a total of 1 hour to travel 10 km from his house to school, then his average velocity will be 10 km/hr.	In Jack's case, on his way to school, while he is sitting and waiting for the train to pass, his instantaneous velocity will be zero. Though the instantaneous velocity was zero for a small part of the journey, the average velocity will not be zero.

Acceleration

The rate of change of velocity is called acceleration. It is a vector quantity. In non-uniform motion, velocity varies with time, i.e., the change in velocity is not 0. It is denoted by "a"

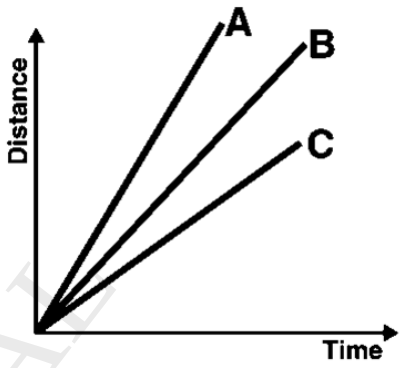
Acceleration = Change in Velocity / Time

(OR)

$a=v-u/t$

Where t (time taken), v (final velocity) and u (initial velocity).

Distance-Time Graph for Uniform Motion



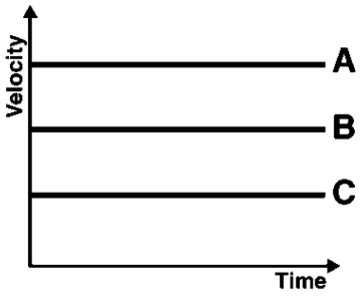
Let us now consider a distance-time graph in which the body is moving with uniform motion. A body is said to be in uniform motion when the body covers an equal distance in equal time intervals. Let's consider a time interval of 1 second, If a body covers 10 meters in the first 1-second then it should cover 10 meters in every second from there on, this will indicate that the body is in uniform motion. Let's draw a graph for uniform motion.

As in uniform motion, the distance-time graph would be a straight line, because the equal distance is covered in equal units of time.

You can see that there are three bodies A, B, and C, all of them are in uniform motion then why do they have different slopes?

It is because the slope of a distance-time graph determines the speed of that body, so the steeper the slope greater will be the speed of the body. From the above graph, we can come to the conclusion that body A has the highest speed and body C has the least speed.

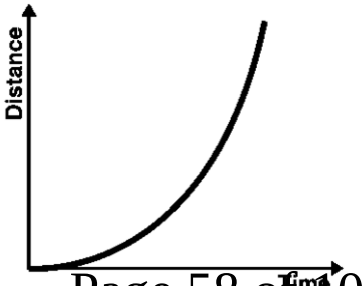
Velocity-Time Graph



It is the graph of velocity against time; it shows us how the velocity changes with respect to time. The slope of a velocity-time graph determines its acceleration.

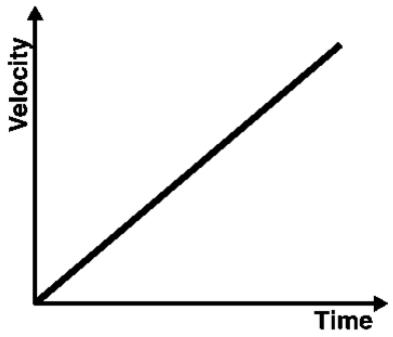
Above is the velocity-time graph for three objects A, B, and C. A flat horizontal line in a velocity-time graph states that the body is moving at a constant velocity. If the straight line has a slope, then that indicates the body is changing its velocity at a constant rate, or it means that the body has constant acceleration.

Distance-Time Graph for Uniformly Accelerated Motion



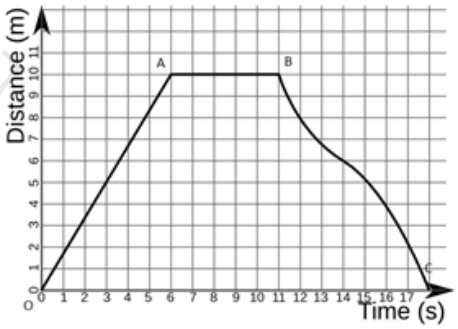
The distance-time graph for a uniformly accelerated motion looks as shown in the graph above, consider how the distance is changing exponentially indicating that the velocity is changing at a constant rate or there is constant acceleration. But in the

velocity-time graph, as velocity changes at a constant rate with respect to time in uniformly accelerating motion, the graph would be a straight line with its slope indicating the amount of acceleration.



Distance-Time Graph

- Distance-Time graphs show the change in the position of an object with respect to time.
- Linear variation = uniform motion and non-linear variations imply non-uniform motion
- The slope gives us speed



OA implies uniform motion with constant speed as the slope is constant

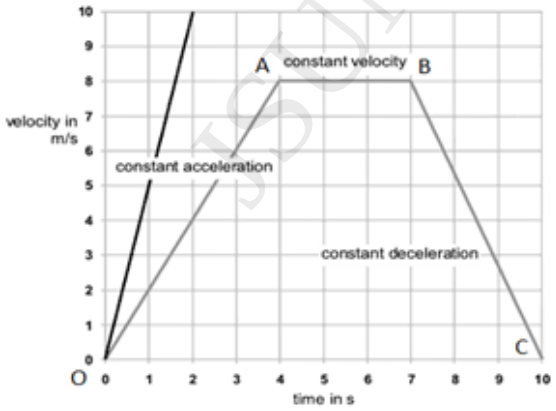
AB implies the body is at rest as the slope is zero

Distance – Time Graph

- B to C is a non-uniform motion

Velocity-Time Graph

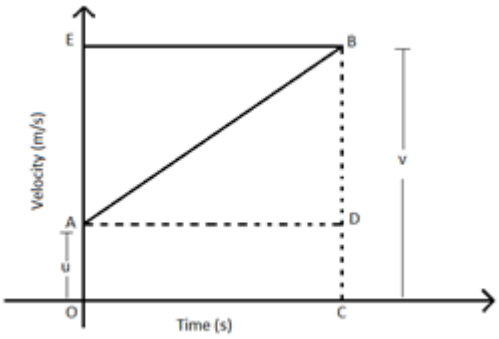
- Velocity-Time graphs show the change in velocity with respect to time.
- Slope gives acceleration
- The area under the curve gives the displacement
- Line parallel to x-axis implies constant velocity-



Velocity – Time Graph

OA = constant acceleration, AB = constant velocity, BC = constant retardation

Equations of Motion



The motion of an object moving at uniform acceleration can be described with the help of three equations, namely

(i) $v = u + at$

(ii) $v^2 - u^2 = 2as$

(iii) $s = ut + (1/2)at^2$

where u is the initial velocity, v is the final velocity, t is the time, a is the acceleration and s is the displacement.

Derivation of Velocity-Time Relation by Graphical Method

Velocity – Time Graph

A body starts with some initial non-zero velocity at A and goes to B with constant acceleration a.

From the graph BD = v (final velocity) – DC = u (initial velocity)……..(eq 1).

BD = BC – DC……..(*eq 2*).

We know acceleration a=slope=BD/AD or AD=OC=t(time taken to reach point B)

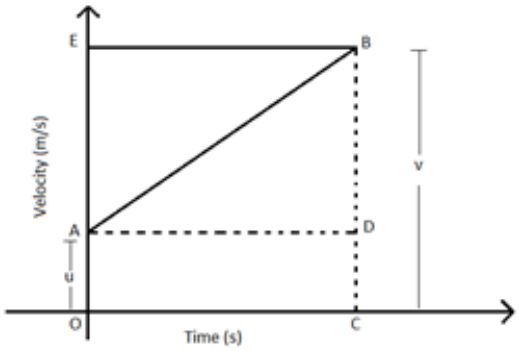
.

Therefore BD = at…….(eq 3).

Substitute everything, we get: at = v – u.

Rearrange to get **v = u + at.**

Derivation of Position-Time Relation by Graphical Method



Velocity – Time Graph

A body starts with some initial non-zero velocity at A and goes to B with constant acceleration a

The area under the graph gives Displacement as follows:

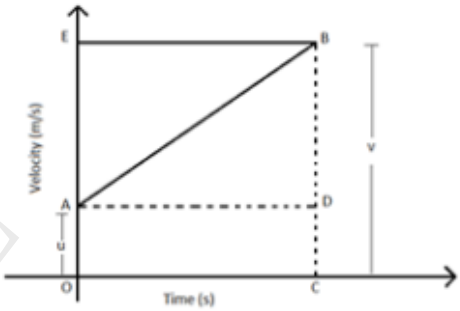
Ar(ΔABD)+Ar(OADC)=1/2(AD×BD)+(OA×OC)….(1)

OA = u , OC = t and BD = at

Substituting in (eqn 1) we get $\mathbf{s= ut +{}^{1}/_{2}at^{2}}$

Derivation of Position-Velocity Relation by Graphical Method

Velocity – Time Graph



A body starts with some initial non-zero velocity at A and goes to B with constant acceleration a

The displacement covered will be the area under the curve which is the trapezium OABC.

We know the area of the trapezium is

$s=(OA+BC)/2*OC$

OA = u and BC = v and OC = t

Therefore, $s=(v+u)/2*t$……(1)
We also know that $t=(v-u)/a$……..(2)

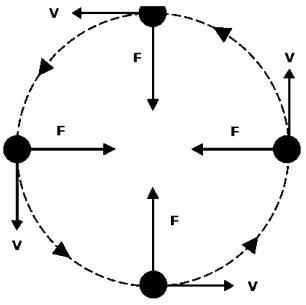
Substitute (eq 2) in (eq 1) and arrange to get $\mathbf{v^2-u^2=2as}$

Uniform Circular Motion

- If an object moves in a circular path with uniform speed, its motion is called uniform circular motion.
- Velocity changes as direction keeps changing.
- Acceleration is constant.

Uniform Circular Motion Examples

- The motion of artificial satellites around the Earth is an example of uniform circular motion.
- The motion of electrons around its nucleus.
- The motion of the blades of the windmills.
- The tip of the second hand of a watch with a circular dial shows uniform circular motion.



QUESTIONS WITH ANSWERS

Question 1. The phenomenon of motion was placed on a sound scientific footing by two scientists. Write their names.
Answer: Galileo Galilei and Isaac Newton.
Question 2. Are rest and motion absolute or relative terms?
Answer: They are relative terms.
Question 3. Suppose a ball is thrown vertically upwards from a position P above the ground. It rises to the highest point Q and returns to the same point P. What is the net displacement and distance traveled by the ball?
Answer: Displacement is zero. Distance is twice the distance between positions P and Q.
Question 4. Which speed is greater: 54 m/s or 54 km/h?
Answer: 30 m/s
Question 5. What do you mean by 2 m/s^2?
Answer: The velocity of the body increases by 2 m/s after every second.
Question 6. Can uniform linear motion be accelerated?
Answer: No
Question 7. Define one radian.
Answer: It is the angle that is subtended at the center by an arc having a length equal to the radius of the circle.
Question 8. What is the relation between linear velocity and angular velocity?
Answer: Linear velocity = Angular velocity × Radius of the circular path.
Question 9. Give an example when we infer the motion indirectly.
Answer: We infer the motion of air by observing the movement of dust particles or leaves and branches of trees, or simply by feeling the blowing air on our faces.
Question 10. What is essential to describe the position of an object?
Answer: We need to specify a reference point called the origin.
Question 11. What is the simplest type of motion?
Answer: Motion in a straight line.
Question 12. What indicates the motion of the earth?
Answer: The phenomenon like day and night indicates the motion of the earth.
Question 13. If the displacement of a body is zero, is it necessary that the distance covered by it is also zero?
Answer: No. When the body comes back to the same position after travelling a distance, its displacement is zero though it has travelled some distance.
Question 14. Can the displacement be greater than the distance travelled by an object?
Answer: No, it is always either equal to or less than the distance travelled by the object.
Question 15. When do the distance and displacement of a moving object have the same magnitude?
Answer: The magnitude of distance and displacement of a moving object are same when the object moves along the same straight line in the same fixed direction.
Question 16. Does the speedometer of a car measure its average speed?
Answer: No. It measures its instantaneous speed.
Question 17. A body is moving with a velocity of 16 m/s. If the motion is uniform, what will be the velocity after 20 s?
Answer: As the motion is uniform, the velocity remains 16 m/s after 20 s.

Question 18. Can a body have constant speed but variable velocity?
Answer: Yes, e.g. a body in uniform circular motion has constant speed but due to the change in the direction of motion, its velocity changes at every point.
Question 19. When is the acceleration taken as negative?
Answer: Acceleration is taken as negative if it is in the direction opposite to the direction of velocity.
Question 20. What is uniform acceleration?
Answer: The acceleration of an object is said to be uniform if it travels in a straight line and its velocity increases or decreases by equal amounts in equal intervals of time.For example, the motion of a freely falling body.
Question 21.
Give an example of a body which may appear to be moving for one person and stationary for the other.
Answer: The passengers in a moving bus observe that the trees, buildings as well as the people on the roadside appear to be moving backwards. Similarly, a person standing on the roadside observes that the bus (along with its passengers) is moving in forward direction. But, at the same time, each passenger in a moving bus or train observes, his fellow passengers sitting and not moving. Thus, we can tell that motion is relative.
Question 22. How can we describe the location of an object?
Answer: To describe the position of an object we need to specify a reference point called the origin.
For example, suppose that a cafe in a city is 4 km south of the hospital. We have specified the position of the cafe with respect to the hospital i.e., in this case, the hospital acts as the reference point.
Question 3. What do you mean by average speed? What are its units?
Answer: Average speed is defined as the average distance travelled per unit time and is obtained by dividing the total distance travelled by the total time taken.
The unit of average speed is the same as that of the speed, that is, ms^{-1}.
Question 4. What is the difference between uniform velocity and non-uniform velocity?
Answer: Uniform velocity: An object with uniform velocity covers equal distances in equal intervals of time in a specified direction, e.g., an object moving with the speed of 40 km/h towards west has uniform velocity.
Non-uniform velocity: When an object covers unequal distances in equal intervals of time in a specified direction, or if the direction of motion changes, it is said to be moving with a non-uniform or variable velocity, e.g., revolving fan at a constant speed has variable velocity.
Question 5. What do you understand by instantaneous velocity?
Answer: Instantaneous velocity is the velocity of a body at any particular instant during its motion. For example, the instantaneous velocity of a motorcycle at a particular instant is 40 kmh^{-1} if it is moving at 40 kmh^{-1} at that particular instant. It is measured by the speedometers on the vehicles.

NUMERICAL FOR PRACTICE

Question 1
An airplane accelerates down a runway at 3.20 m/s^2 for 32.8 s until is finally lifts off the ground. Determine the distance travelled before taking off.

Question 2
A Jeep starts from rest and accelerates uniformly over a time of 5.21 seconds for a distance of 110 m. Determine the acceleration of the Jeep.
Question 3
John is riding the Giant Drop at Canada. If John free falls for 2.6 seconds, what will be his final velocity and how far will he fall?
Question 4
A racing car accelerates uniformly from 18.5 m/s to 46.1 m/s in 2.47 seconds. Determine the acceleration of the car and the distance travelled.
Question 5
A feather is dropped on a planet other than Earth which has very low acceleration due to gravity from a height of 1.40 meters. The acceleration of gravity on the other planet is 1.67 m/s^2. Determine the time of feather to fall to the surface of the other planet
Question 6
Rocket-powered sleds are used to test the human response to acceleration. If a rocket-powered sled is accelerated to a speed of 444 m/s in 1.8 seconds, then what is the acceleration and what is the distance that the sled travels?
Question 7
Motorbike accelerates uniformly from rest to a speed of 7.10 m/s over a distance of 35.4 m. Determine the acceleration of the bike.
Question 8
A Civil engineer is designing the runway for an airport. Of the planes that will use the airport, the lowest acceleration rate is likely to be 3 m/s^2. The take-off speed for this plane will be 65 m/s. Assuming this minimum acceleration, what is the minimum allowed length for the runway?
Question 9
A car traveling at 22.4 m/s skids to a stop in 2.55 s. Determine the skidding distance of the car (assume uniform acceleration)
Question 11
If Rahul has a vertical leap of 1.29 m, then what is his take-off speed and his hang time (the total time to move upwards to the peak and then return to the ground)?
Question 12
A bullet leaves a rifle with a muzzle velocity of 521 m/s. While accelerating through the barrel of the riffle, the bullet moves a distance of 0.840 m. Determine the acceleration of the bullet (a uniform acceleration).
Question 13
A baseball is popped straight up into the air and has a hang-time of 6.25 s. Determine the height to which the ball rises before it reaches its peak. (Hint: the time to rise to the peak is one-half the total hang time.)
Question 14
The observation deck of the tall skyscraper 370 m above the street. Determine the time required for a penny to free fall from the deck to the street below.

CHAPTER 8
FORCE AND LAWS OF MOTION

Introduction to Force

A force is an effort that changes the state of an object at rest or at motion. It can change an object's direction and velocity. Force can also change the shape of an object.

Effects of Force

Some effects of force include the following:

- Force moves stationary objects
- Force stops objects from moving
- Force changes the shape of a body
- Force changes the direction of motion

Push is defined as an action of force that causes an object to move from its place. The following are examples of push:

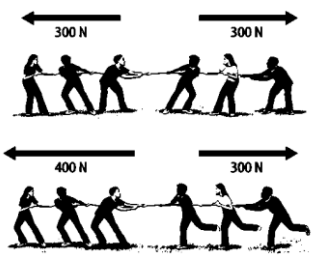
- Opening and closing the door
- Pushing the table
- Pushing a car
- Pushing of thumb pins
- Walking

Pull is defined as an action to make something move by either tugging or dragging. The following are examples of pull:

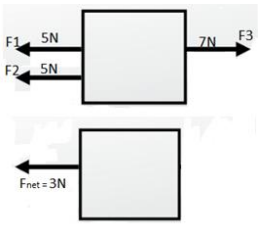
- Plucking the string of a guitar
- Pulling ropes while playing tug of war
- Opening the drawer
- Pulling the window curtain
- Opening and closing the doors

Balanced and Unbalanced Forces

When balanced forces are applied to an object, there will be no net effective force acting on the object. Balanced forces do not cause a change in motion.



Unbalanced forces acting on an object change its speed and/or direction of motion. It moves in the direction of the force with the highest magnitude.



Net Force

When multiple forces act on a body, they can be resolved into one component known as the net force acting on the object. The net force decides the direction of motion.

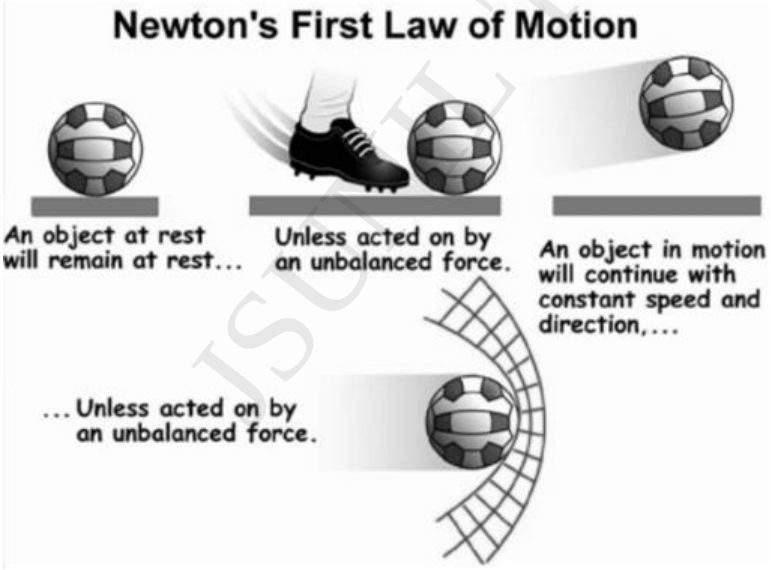
Frictional Force

The force that opposes relative motion is called friction. It arises between the surfaces in contact.

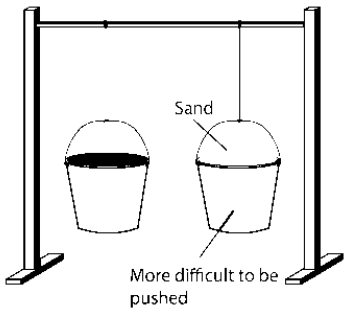
Example: When we try to push a table and it does not move is because it is balanced by the frictional force.

First Law of Motion

A body continues to be in the state of rest or uniform motion in a straight line unless acted upon by an external unbalanced force. The First Law is also called the Law of Inertia.



Inertia



Basically, all objects have a tendency to resist the change in the state of motion or rest. This tendency is called inertia. All bodies do not have the same inertia. Inertia depends on the mass of a body. The mass of an object is the measure of its inertia.

More mass → more inertia and vice versa.

Inertia of Rest

An object stays at rest, and it remains at rest until an external force affects it. Example: When a car accelerates, passengers may feel as though their bodies are moving backward. In reality, inertia is making their bodies stay in place as the car moves forward.

Inertia of Motion

An object will continue to be in motion until a force acts on it. Example: A hockey puck will continue to slide across the ice until acted upon by an outside force.

Second Law of Motion

In order to understand the Second Law, we need to first understand momentum.

Momentum

Impacts produced by objects depend on their mass and velocity. The momentum of an object is defined as the product of its mass and velocity. p = mv. A vector quantity has direction and magnitude. An example of momentum is a baseball flying through the air and a bullet fired from a gun.

Conservation of Momentum

Concept of System

- The part of the universe chosen for analysis is called a system.
- Everything outside the system is called an environment.
- For example, a car moving with constant velocity can be considered a system. All the forces within the car are internal forces, and all forces acting on the car from the environment are external forces like friction.

Conservation of Momentum

- The total momentum of an isolated system is conserved.
- Isolated system → net external force on the system is zero.
- Example: Collision of 2 balls, A and B.

From Newtons 3rd law F_{AB} = -F_{BA}

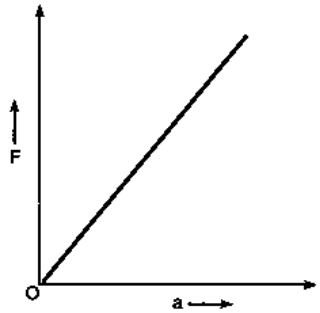
Third Law of Motion

Newton's 3rd law states that every action has an equal and opposite reaction. Action and reaction forces are equal, opposite, and acting on different bodies.

QUESTIONS WITH ANSWERS

Question 1. Name the scientist who proved for the first time that objects move with constant speed when no force acts on them.
Answer: Galileo.
Question 2. Why do bicycles begin to slow down when we stop pedalling?
Answer: This is because of the frictional forces acting opposite to the direction of motion.
Question 3. Which law of motion gives the measure of force?
Answer: Newton's second law of motion.
Question 4. Write the C.G.S unit of force.
Answer: dyne.
Question 5. Can every force produce motion in every object?
Answer: No.
Question 6. When a force is applied to a body, what are the two essential effects it can produce?
Answer: It can bring about a change in the state of motion of a body or It can deform a body, i.e., it can change its shape.
Question 7.
Define 1 newton force.
Answer: 1 newton is the magnitude of force that produces an acceleration of 1 m/s2 in a body of mass 1 kg.
Question 8. What do you mean by an impact force?
Answer: The force produced by the impact of a fast-moving object on another is called impact force.
Question 9. Define force of friction.
Answer: The force acting between any two surfaces in contact and tending to oppose motion is called force of friction.
Question 10. Define electrostatic force.
Answer: The force exerted by an electrically charged body is called electrostatic force.
Question 11. If the body is found to be accelerated, is the force acting on it balanced or unbalanced?
Answer: Unbalanced.

Question 12. What do balanced forces usually do to a body?
Answer: Balanced forces usually produce a change in the shape of the body.
Question 13. When a body moves on flat surface, will its speed change?
Answer: No.
Question 14. What did Galileo conclude on the basis of his experiments on the motion of objects?
Answer: A body continues to move with the same velocity if no unbalanced force acts on it.
Question 15. What do you mean by a resultant force?
Answer: When two or more forces act on a body simultaneously, then the single force which produces the same effect as produced by all the forces acting together is known as the resultant force.
Question 16. Do action and reaction act on the same body?
Answer: No, action and reaction act on different bodies.
Question 17. Plot a graph between the force applied on a body and the acceleration produced in the given mass, assuming that the magnitude of the force is constantly changing.
Answer:



Question 18. Write the SI unit of impulse.
Answer: Ns.
Question 19. What is the total momentum of a bullet and a gun before firing?
Answer: Zero.
Question 20. Name the principle on which a rocket works.
Answer: Newton's third law of motion
Question 21. What is the ratio of SI units to CGS units of momentum? How do you measure the effect of an impulsive force on the body?
Answer: A ratio of SI units to CGS units of momentum is (kg m/s)/(g cm/s) i.e., 10s.
The effect of an impulse force on the body is measured only in terms of impulse.
Question 22. On which factors does friction depend?
Answer: The force of friction is directly proportional to the weight of the body sliding over the surface. The force of friction also depends on the nature of the surfaces in contact.
Question 23. A bullet fired against a glass window pane makes a hole in it, and the glass pane is not cracked. But on the other hand, when a stone strikes the same glass pane, it gets smashed. Why is it so?
Answer: When the bullet strikes the glass pane, the part of the glass pane which comes in contact with the bullet immediately shares the large velocity of bullet and makes a hole, while the remaining part of the glass remains at rest and is therefore not smashed due to inertia of rest. But when a slow-moving stone strikes the same glass pane, the various parts of the glass pane get enough time to share the velocity of the stone, and the glass is smashed.

Question 24. Why can a small mass such as a bullet kill a person when fired from a gun?
Answer: It is so because even if the mass of the bullet is small, it moves out of the gun with a very high velocity, due to which the momentum produced is high (p = mv). This high momentum of the bullet kills a person.
Question 25. Why does a boat tend to leave the shore, when passengers are alighting from it?
Answer: When the passengers alight from the boat, they push the boat in the backward direction. As a result, the boat has a tendency to slip back into the water. This difficulty is usually overcome by the boatman by tying the boat to some rigid support.
Question 26. Describe our walking in terms of Newton's third law of motion.
Answer: When we walk on the ground or road, our foot pushes the ground backward (action) and the ground pushes our foot forward (reaction). Thus, the forward reaction exerted by the ground on our foot makes us walk forward.
Question 27. There are three solids made up of aluminium, steel, and wood, of the same shape and same volume. Which of them would have the highest inertia?
Answer: Steel has the highest inertia. As the mass is a measure of inertia, the ball of the same shape and size, having more mass than other balls will have the highest inertia. Since steel has the greatest density and greatest mass, therefore, it has the highest inertia.
Question 28. Why does a cricket player move his hand backward while catching the ball?
Answer: A fast-moving cricket ball has a large momentum. In stopping or catching this ball, its momentum has reduced to be zero. Now, when a cricket player moves back his hands on catching the fastball, then the time taken to reduce the momentum of the ball to zero is increased. Due to more time taken to stop the ball, the rate of change of momentum of the ball is decreased and hence a small force is exerted on the hands of the player. So, the hands of the player do not get hurt.
Question 29. Two identical bullets are fired one by a light rifle and the other by a heavy rifle with the same force. Which rifle will hurt the shoulder more and why?
Answer: According to the conservation of momentum, the rifle recoils with the same momentum as that of the bullet. As momentum = mass X velocity; so light rifle will recoil with a larger velocity and hence, will hurt the shoulder more.
Question 30. The water sprinkler used for grass lawns begins to rotate as soon as the water is supplied. Explain the principle on which it works.
Answer: The working of the rotation of the sprinkler is based on the third law of motion. As the water comes out of the nozzle of the sprinkler, an equal and opposite reaction force comes into play. So the sprinkler starts rotating.

NUMERICALS FOR PRACTICE

Q.1. A force of 100 N is applied on an object of area of 2 m^2. Calculate the pressure.

Q.2. The force on a phonogram needle is 1.2 N. The point has a circular cross-section of a radius 0.1mm. What pressure does it exert on the record in (i) Pa (ii) atm?

Q.3. A nail is driven into a wooden board by using a hammer. The impact of the hammer on the head of nail produces a thrust of 25 N. If the area of the head is 0.5 mm^2 and of the tip 0.1 mm^2, find the pressure on the head and the tip of the nail.

Q.4. A force of 15 N is uniformly distributed over an area of 150 m^2. Find the pressure in Pascals.

Q.5. A block of wood is kept on a tabletop. The mass of the wooden block is 5 kg and its dimension are 40 cm x 20 cm x 10 cm. Find the pressure exerted by the wooden block on the tabletop if it is made to lie on the table with its sides of dimensions (a) 20 cm x 10 cm (b) 40 cm x 20 cm. Given $g = 9.8\ m/s^2$.

Q.6. How much force should be applied on an area of 1 cm^2 to get a pressure of 15 Pa?

Q.7. A block weighing 1.0 kg is in the shape of a cube of length 10 cm. It is kept on a horizontal table. Find the pressure on the portion of the table where the block is kept.

Q.8. Find the thrust acting on the human body due to atmospheric pressure. Take the surface area of a man of middle size to be 1.5 m^2 and atmospheric pressure (1 atm) = 1.013×10^5 Pa.

Q.9. A boy weighing 60 kg f is wearing shoes with heel area of cross section 20 cm^2 while a girl weighing 45 kg f is wearing shoes with heel of area of cross section 1.5 cm^2. Compare the pressure exerted on ground by their heels when they stand on the heel of one floor.

Q.10. A cube of edge length 10 cm is placed inside a liquid. The pressure at the center of the face is 15 Pa. Find the force exerted by the liquid on this face.

Q.11. A force of 16 N is distributed uniformly on one surface of a cube of edge 8 cm. Find the pressure on this surface.

Q.12. A car weighs 1200 kg. This weight is evenly distributed on 4 wheels. If the pressure in each tyre is 15 kg wf/cm^2, what is the area of each tire in contact?

Q.13. Calculate the greatest and the least pressure exerted by a metal block of size 20 cm x 8 cm x 5 cm and has a mass of 5 kg.

Q.14. A hydraulic automobile lift is designed to lift cars with a maximum mass of 3000 kg. The area of the piston carrying the load is 425 cm^2. What maximum pressure would the smaller piston have to bear?

CHAPTER 9
GRAVITATION

Introduction to Gravitation

This chapter discusses gravitation and the Universal Law of Gravitation. The motion of objects under the influence of gravitational force on Earth is also examined closely. Students will also understand how weight varies from place to place and the conditions required for objects to float on water.

What Is Gravitation?

Gravitation or just gravity is the force of attraction between any two bodies. All the objects in the universe attract each other with a certain amount of force, but in most cases, the force is too weak to be observed due to the very large distance of separation. Besides, gravity's range is infinite but the effect becomes weaker as objects move away.

Some examples of gravity are:

- The force that causes the ball to come down is known as gravity
- Gravity keeps the planets in orbit around the sun.
- Gravity is the force that causes a rock to roll downhill.

Type of Forces

There are four fundamental forces in the universe and they are:

- Gravitational force
- Electromagnetic force
- Strong nuclear force
- Weak nuclear force

Gravitational Force

Gravitational force is the weakest force out of the four forces. When gravitational force is considered for massive objects, such as the sun, or giant planets, the gravitational force is considered to be strong as the masses of these objects are also large. On an atomic level, this force is considered weak.

Electromagnetic Force

Electromagnetic force is a type of physical interaction that occurs between electrically charged particles. It acts between charged particles and is a combination of magnetic and electrical forces. Electromagnetic force can be attractive or repulsive.

Strong Nuclear Force

The strong force holds together quarks, the fundamental particles that make up the protons and neutrons of the atomic nucleus, and further holds together protons and neutrons to form atomic nuclei.

Weak Nuclear Force

The weak force is the force existing between the elementary particles which are responsible for certain processes to take place at a low probability.

The Universal Law of Gravitation

Newton's Law of gravitation states that every object in the universe attracts every other object by a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

$\Rightarrow F \propto M * m$

$F \alpha 1/d^2$

$F = \frac{G\,Mm}{R^2}$ where G is the universal gravitation constant.

Value of $G = 6.673 * 10^{-11} Nm^2Kg^{-2}$

Acceleration due to Gravity

F=mg and also, $F = \frac{GMm}{R^2}$

$g = \frac{GMm}{R^2}$

Plug the values of G ($6.673 \times 10^{-11} Nm^2Kg^{-2}$)

M (mass of Earth) = 6×10^{24} kg and R= 6×10^6 m, to get the value of

$g \approx 9.8 ms^{-2}$

This is the acceleration due to gravity and the acceleration felt by any freely falling body toward the Earth.

The value of g keeps changing due to the variation of Earth's radius.

Centripetal Force

When a body undergoes circular motion, it experiences a force that acts toward the center of the circle. This center-seeking force is called a centripetal force. Centripetal force is given by the following equation:

$F = \frac{mv^2}{r}$

Free Fall and Motion

When an object is in free fall, acceleration due to gravity is constant at $g = 9.8 ms^{-2}$.

The value of g does not depend on mass i.e. any object big or small experiences the same acceleration due to gravity under free fall. All three equations of motion are valid for freely falling objects as it is under uniform motion.

The sign of convention → towards earth g is +ve / away from earth g is -ve.

Weight and Mass

The mass of an object is the measure of its inertia and is constant throughout the universe. The weight of an object keeps changing as the value of g changes. Weight is nothing but a force of attraction of the Earth on an object and is given by the following equation:
W=mg
The weight of an object on the Moon is 1/6 times the weight on Earth.

Thrust and Pressure

Force acting on an object perpendicular to the surface is called thrust. The effect of thrust depends on the area of contact. The pressure is thrust per unit area. SI unit is Pascal (Pa). Force acting on a smaller area applies more pressure than the same force acting on a larger area.

Pressure in Fluids

The pressure exerted by a fluid in a container is transmitted undiminished in all directions on the walls of the container.

Archimedes' Principle –

The upward force exerted by a fluid on an object is known as upthrust or buoyant force.
The magnitude of buoyancy depends on the density of the fluid. If the density of an object is less than the fluid, it will float. If the density of the object is greater than the fluid, it will sink.
According to Archimedes' principle, when a body is immersed fully or partially in a fluid, it experiences an upward force that is equal to the weight of the fluid displaced by it.

Relative Density

Relative density = $\frac{\textbf{Density of a substance}}{\textbf{Density of water}}$

QUESTIONS WITH ANSWERS

Question 1. What will happen to the gravitational force between two bodies if the masses of one body is doubled?
Answer:If the mass of one body is doubled, force is also doubled.

Question 2. Why is 'G' called the universal gravitational constant?
Answer: The constant 'G' is universal because it is independent of the nature and sizes of bodies, the space where they are kept and at the time at which the force is considered.

Question 3.Who formulated the universal law of gravitation?
Answer: Isaac Newton

Question 4. How is gravitation different from gravity?
Answer: Gravitation is the force of attraction between any two bodies while gravity refers to attraction between any body and the earth.

Question 5. What does a small value of G indicate?
Answer: A small value of G indicates that the force of gravitational attraction between two ordinary sized objects is a very weak force.

Question 6.At what place on the earth's surface is the weight of a body maximum?
Answer: At the poles.

Question 7. At what place on the earth's surface is the weight of a body minimum?
Answer: At the equator.

Question 8. If the mass of a body is 9.8 kg on the Earth, what would be its mass on the Moon?
Answer: It will remain the same on the moon, i.e., 9.8 kg.

Question 9. Do fluids possess weight?
Answer: Yes, fluids have weight.

Question 10. Why can one jump higher on the surface of the moon than on the earth?
Answer: Because the value of acceleration due to gravity (g) on the moon's surface is nearly l/6th to that of the surface of the earth.

Question 11. Define the standard kilogram.
Answer: The standard kilogram is the mass of a block of a platinum alloy kept at the international bureau of Weights and Measures near Paris in France.

Question 12.If the earth attracts two objects with equal force, can we say that their masses must be equal?
Answer: No

Question 13. Is weight a force?
Answer: Yes.

Question 14. What keeps the moon in a uniform circular motion around the Earth?
Answer: Gravitational force between the moon and the Earth keeps the moon in a uniform circular motion around the Earth.

Question 15. When a body is dropped from a height, what is its initial velocity?
Answer: Zero.

Question 16. When a body is thrown vertically upwards, what is its final velocity?
Answer: Zero.

Question 17.Is the time taken by a body to rise to the highest point equal to the time taken to fall from the same height?
Answer: Yes.

Question 18. Is the acceleration due to gravity acting on a freely falling body directly proportional to the (a) mass of the body? (b) time of fall of the body?
Answer: (a) No (b) No

Question 19. Suppose the gravity of the earth suddenly becomes zero, then in which direction will the moon begin to move if no other celestial body affects it?
Answer: The moon will begin to move in a straight line in the direction in which it was moving at that instant because the circular motion of the moon is due to the centripetal force provided by the gravitational force of the earth.

Question 20. The earth is acted upon by the gravitation of the sun, even though it does not fall into the sun. Why?
Answer: The gravitational force is responsible for providing the necessary centripetal force which allows the Earth to move around the sun at the defined path or orbit. So, the earth does not fall into the sun.

Question 21. If small and big stones are dropped from the roof of a house simultaneously, they will reach the ground at the same time. Why?
Answer: The acceleration due to gravity does not depend upon the mass of the stone or body. Both bodies fall with the same acceleration toward the surface of the earth. Thus a big stone will fall with the same acceleration as a small stone. So, both the stones will reach the ground at the same time when dropped simultaneously.

Question 22. The earth attracts an apple. Does the apple also attract the earth? If it does, why does the earth not move toward the apple?
Answer: According to Newton's third law of motion, action and reaction are equal and opposite. It means that the force on the apple due to the earth's attraction is equal to that on the earth due to the apple's attraction. But we know, acceleration $\propto 1/m$.
As the mass of the earth is very large as compared to that of the apple, the acceleration experienced by the earth will be so small that it will not be noticeable.

Question 23. Mention any four phenomena that the universal law of gravitation was able to explain.
Answer: The universal law of gravitation was able to explain successfully

- the force that binds us to the earth.

- the motion of the moon around the earth.
- the motion of planets around the sun.
- the tides due to the moon and the sun.

Question 24. When does an object show weightlessness?
Answer: Weightlessness is a state when an object does not weigh anything. It occurs only when a body is in a state of free fall under the effect of gravity alone.

Question 25. Why does a body reach the ground quicker at the poles than at the equator when dropped from the same height?
Answer: The acceleration due to gravity is more at the poles than at the equator. The time taken for a body is less if the acceleration due to gravity is more when the initial velocities and the distance travelled are the same. So, when dropped from the same height a body reaches the ground quicker at the poles than at the equator.

Question 26. Give three differences between acceleration due to gravity (g) and universal gravitational constant (G).
Answer: Differences between g and G

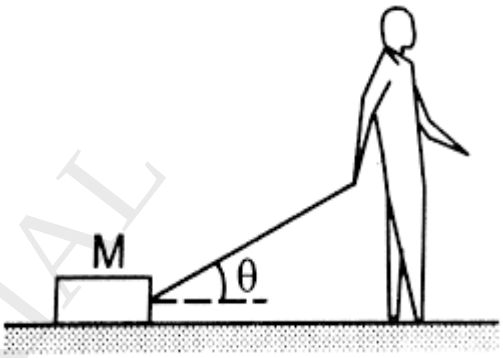
Acceleration due to gravity (g)	**Universal gravitational constant (G)**
1. Acceleration due to gravity is the acceleration acquired by a body due to the earth's gravitational pull on it 2. g is a vector quantity. 3. It is different at different places on the surface of the earth. Its value also varies from one celestial body to another.	1. Gravitational constant is numerically equal to the force of attraction between two masses of 1 kg that are separated by a distance of 1 m. 2. G is a scalar quantity. 3. The 'G' is a universal constant, i.e., its value is the same (i.e. 6.7×10^{-11} Nm^2 kg^{-2}) everywhere in the universe.

CHAPTER 10

WORK & ENERGY

Work

Work done on an object is defined as the product of the magnitude of the force acting on the body and the displacement in the direction of the force.
W = F.s. The SI unit of force is Newton.
If a force acting on a body causes no displacement, the work done is 0. For example, pushing a wall.



The force component F cos θ gives the component of force along the direction in which the body is displaced.
Cos θ is the angle between the force vector and displacement vector.

Energy

Energy is defined as the ability to do work. Its unit is the same as that of work. Energy is a scalar quantity.
SI unit of energy or work = Joule (Nm) or Kgm^2s^{-2}.

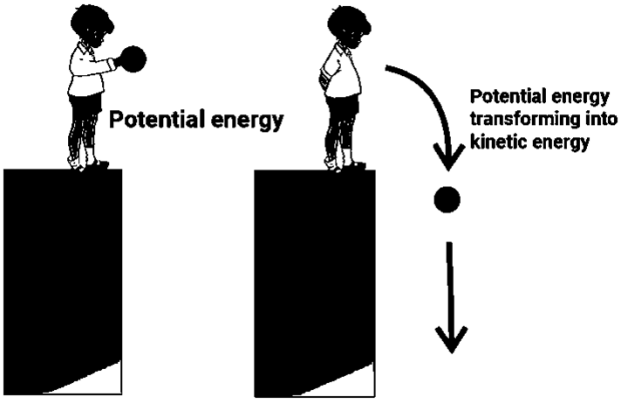
Forms of Energy

Energy has different forms: Light, heat, chemical, electrical or mechanical.
Mechanical energy is the sum of
(i) Kinetic energy (K.E)
(ii) Potential energy (P.E)

Kinetic Energy

Objects in motion possess energy and can-do work. This energy is called Kinetic Energy.
F=ma
Also, W=Fs
From the second equation of motion, we know that $v^2-u^2=2as$
Substituting equation for work done by a moving body, $W=(m\times a)\ (v^2-u^2/2a)$

Taking initial velocity as zero, we get $KE=1/2\ mv^2$, When two identical bodies are in motion, the body with a higher velocity has more KE.



Work-Energy Theorem

The work-energy theorem states that the net work done by a moving body can be calculated by finding the change in KE.

$\Rightarrow W_{net} = KE_{final} - KE_{initial}$

$\Rightarrow W_{net} = \frac{1}{2}m[v^2 - u^2]$

Factors Affecting Kinetic Energy

- Mass
- Velocity
- Momentum

Potential Energy

Energy can get stored in an object when work is done on it.

For example, stretching a rubber string. The energy that is possessed by a body by virtue of its configuration or change in position is known as Potential Energy.

The potential energy of an object at a height

When an object is raised to a certain height, work is done against gravity to change its position. This energy is stored as Potential Energy.

$\Rightarrow W = F.s$

$\Rightarrow F = ma$

In the case of increasing the height, $F = mg$

Therefore, $W (P.E) = mgh$

$\Rightarrow \Delta PE = mg (h_{final} - h_{initial})$

Law of Conservation of Energy

Law of conservation of energy states that energy can neither be created nor destroyed but can be transferred from one form to another. The total energy before and after the transformation remains constant.

Total energy = KE + PE

where, $1/2\ mv^2 + mgh = constant$

For example: consider a ball falling freely from a height. At height h, it has only PE = mgh. By the time it is about to hit the ground, it has a velocity and therefore has KE= $1/2\ mv^2$ Therefore, energy gets transferred from PE to KE, while the total energy remains the same.

Power

The rate of doing work or the rate of transfer of energy is called power. It is denoted by P

$\Rightarrow P = Wt$

SI unit is Watt (Js^{-1}).

Average power = Total energy consumed/Total time taken

Commercial Unit of Power

The commercial unit of power is kWh, i.e. energy used in 1 hour at 1000 Joules/second.

$1kWh=3.6\times10^6J$

QUESTIONS WITH ANSWERS

Question.1 Does work done depend upon the velocity of the body?
Answer. No.
Question.2 State the law of conservation of energy.
Answer. It states that energy can neither be created nor destroyed. It can only change its form.
Question.3 In a tug-of-war one team gives way to the other. What work is being done and by whom?
Answer.
The winning team does work. The work is equal to the product of the resultant force and the displacement undergone by the losing team.
Question.4 What will cause a greater change in the kinetic energy of a body? Changing its mass or changing its velocity?
Answer. Changing its velocity.
Question.5 List two essential conditions for work to be done. [SAII-2010]
Answer. (i) A force must act and (ii) There should be displacement in the body.
Question.6 When is 1 joule of work said to be done?
Answer. When a force of 1 newton acting on a body displaces it in its own direction.

Question.7 What is the SI unit of work done and power?
Answer. Joule and Watt.
Question.8 What is power? What is its SI unit?
Answer. It is defined as the rate of doing work. Its unit is watt.
Question.9 Find the energy in kWh consumed in 10 hours by a machine of power 500 W.
Answer. W = P x t = 500 x 10 = 5000 Wh =5 kWh.
Question.10. When is work said to be done against the force of gravity?
Answer. When a body lifted the work is done against the force of gravity.
Question.11 Write an expression for the work done in lifting a body of mass 'm' through a vertical height 'h'. [SAll-2012]
Answer. Work done W = mgh, where g is acceleration due to gravity.
Question.12 When a book is lifted from a table, against which force work is done?
Answer. Work is done against the force of gravity.
Question.13 Will work be done by a man who pushes a wall?
Answer. No.
Question.14 What is the work done when the force acting on the body and the displacement produced in the body are at right angles to each other?
Answer. Zero.
Question.15 Is it possible that some force is acting on a body but still the work done is zero?
Answer. Yes, when force acts at an angle of 90° with the displacement.
Question.16 What is the work done on a body moving in a circular path?
Answer. Zero, because force and displacement are perpendicular to each other.
Question.17 Does every change in energy of the body involve work?
Answer. Yes.
Question.18 A light and a heavy body have equal kinetic energy. Which one is moving fast ? [
Answer. The lighter body is moving fast.

Question.19 A force of 7 N acts on an object. The displacement is, say 8 m, in the direction of the force. Let us take it that the force acts on the object through displacement. What is the work done in this case ?
Answer. Given, displacement = 8 m,
Force = 7N
Now, Work done = Force x Displacement
= 7 x 8 = 56 J
Question.20 When do we say that work is done?
Answer. Work is said to be done when a force causes displacement of an object in the direction of applied force.
Question.21 Write an expression for the work done when a force is acting on an object in the direction of its displacement.
Answer.Work done = Force x Displacement
Question.22 A pair of bullocks exert a force of 140 N on a plough. The field being ploughed is 15 m long. How much work is done in ploughing the length of the field ?
Answer. Work done = Force x Displacement = 140 x 15 = 2100 J
Question.23 What is the kinetic energy of an object?
Answer. The energy possessed by a body by virtue of its motion is called kinetic energy.

Question.24 Write an expression for the kinetic energy of an object.
Answer. The expression is KE = 1/2 mv^2, where 'm' is the mass and V is the velocity of the body.
Question.25 Define 1 watt of power.
Answer. When a work of 1 joule is done in 1s, the power is said to be one watt.
Question.26 A lamp consumes 1000 J of electrical energy in 10 s. What is its power?
Answer. Given, W = 1000 J, t = 10 s, R = ?
Using p = W/t = 1000/10 = 100 W
Question.27 Define average power.
Answer. When a machine or person does different amounts of work or uses energy in different intervals of time, the ratio between the total work or energy consumed to the total time is average power.
Question.28 Define energy.
Answer. Energy is the ability of a body to do work. It is also defined as the capacity to do work.
Question.29 A body performs no work. Does it imply that the body possesses no energy ?
Answer. When a body does not perform any work, it never implies that the body has no energy. The body may have energy but still does not perform any work, e.g., a book placed on a table has potential energy but is not performing any work.
Question.30 What is the SI unit of energy?
Answer.The SI unit of energy is joule.
Question.31 Does a body at rest possess any kinetic energy ?
Answer.No.
Question.32 What will happen to the kinetic energy of a body if its mass is doubled ?
Answer. Its kinetic energy will be doubled.
Question.33 What will happen to the kinetic energy of a body if its velocity is halved ?
Answer. The kinetic energy of the body will become one-fourth.
Question.34 By how much will the speed of a body, of fixed mass, increase if its kinetic energy becomes four times its initial kinetic energy?
Answer. The speed is doubled.
Question.35 Can a body possess energy even if it is not in motion?
Answer. Yes, it can possess potential energy.
Question.36 Define potential energy.
Answer. It is defined as the energy possessed by a body by virtue of its position or change in shape.
Question.37 Name the energy possessed by a stretched rubber band lying on the table.
Answer. Potential energy.
Question.38 Give the SI unit of potential energy.
Answer. The SI unit of potential energy is.joule.
Question.39 What do you mean by trans- formation of energy ?
Answer. It is the change of energy from one form of energy into another form of energy.
Question.40 Can energy be destroyed? Can energy be created ?
Answer. No,
Question.41 A cell converts one form of energy into another. Name the two forms.
Answer. It converts chemical energy into electrical energy.
Question.42 Name one unit of power bigger than watt.
Answer. A unit bigger than watt is kilowatt.

Question.43 When an arrow is shot from its bow, it has kinetic energy. From where does it get the kinetic energy ?
Answer. A stretched bow possesses potential energy on account of a change in its shape. To shoot an arrow; the bow is released. The potential energy of the bow is converted into the kinetic energy of the arrow.
Question.44 Name at least three commonly used units of energy.
Answer. (i) Joule (ii) Erg (iii) Kilowatt hour.
Question.45 Name the practical unit of power in engineering.
Answer. Horsepower.
Question.46 Name at least six forms of energy.
Answer.
(i) Chemical energy
(ii) Heat energy
(iii) Light energy
(iv) Electrical energy
(v) Sound energy
(vi)Solar energy
Question.47 How many watt are there in 1 horsepower?
Answer. 746 watt.
Question.48 What is horsepower?
Answer. It is a unit of power.
Question.49 State the relation between kW h and joule. Define 1 watt.
Answer.
1 kW h – 1000 W h = 1000 Js^{-1} x 60 x 60 s = 3.6 x 10^6 J
1 watt is the power of an agent which can do one joule of work in one second.
Question.50 Is it possible that a body be in accelerated motion under a force acting on the body, yet no work is being done by the force? Explain your answer giving a suitable example.
Answer. Yes, it is possible, when the force is perpendicular to the direction of motion. The moon revolving round the earth under the centripetal force of attraction of the earth but earth does not do any work on the motion of The moon.
Question.51 Define work. How is work measured? When is work done by a force negative?
Answer. Work is said to be done if force acting on an object displaces it through a certain distance.
It is measured as the product of force and displacement.
Work done is negative if force and displacement are in the opposite direction.
Question.52 What is the work done by the force of gravity in the following cases ?
(a) Satellite moving around the earth in a circular orbit of radius 35000 km.
(b) A stone of mass 250 g is thrown up through a height of 2.5 m.
Answer.
(a) Zero, as the displacement in one complete revolution is zero.
(b) Given m = 250 g = 0.25 kg, h = 2.5 m, g = 10 ms^{-2}, W = ?
Now, W = FS = mg x h = 0.25 x 10 x 2.5 = 6.25 J
Question.53 A mass of 10 kg is at a point A on a table. It is moved to a point B. If the line joining A and B is horizontal, what is the work done on the object by the gravitational force? Explain your answer.

Answer. The work done is zero. This is because the gravitational force and displacement are perpendicular to each other.

Question.54 The potential energy of a freely falling object decreases progressively. Does this violate the law of conservation of energy? Why? [SAII-2010]

Answer. It does not violate the law of conservation of energy. Whatever, is the decrease in PE due to loss of height, same is the increase in the KE due to increase in velocity of the body.

Question.55 What are the various energy transformations that occur when you are riding a bicycle?

Answer. The chemical energy of the food changes into heat and then to muscular energy. On paddling, the muscular energy changes into mechanical energy.

CHAPTER 11
SOUND

A wave is a disturbance in a medium which moves from one point to another and carries energy without a net movement of particles. It may take the form of elastic deformation or a variation of pressure.

E.g. A rubber cork on the water that goes up and down when a rock falls into the water creates a ripple.

Particle Motion of Mechanical Waves

(i) Transverse Waves

Particle motion is perpendicular to the direction of wave motion. This type of wave is a mechanical wave.

E.g. Light and Mexican wave in a stadium.

(ii) Longitudinal waves

Particles travel parallel to the direction of wave motion by means of successive compressions or elongations. This is also a mechanical wave.

E.g. Sound waves in the air.

Sound Properties

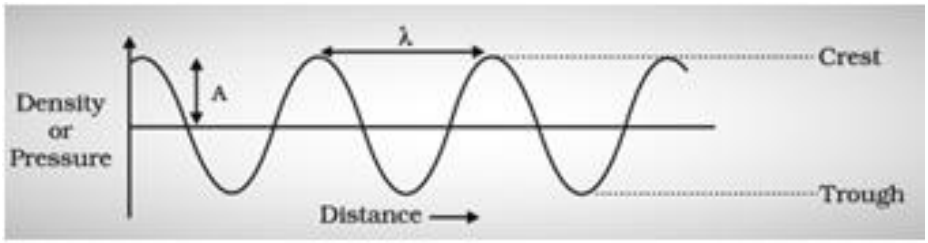
Introduction to Sound Waves

Sound needs a medium to propagate. The matter or material through which sound propagates is called a medium. When particles vibrate about their mean positions, it pushes a region of compressed air, creating a region of high pressure, followed by a region of low pressure as the particle retreats to its mean position. The sound wave propagates by compressions and rarefactions of particles in a medium. Sound propagation can be visualised as the propagation of pressure variations in the medium.

Characteristics of Sound Waves

Wavelength

The distance between two successive crests or troughs (or) successive compressions and rarefactions is called wavelength (λ). The SI unit of wavelength is metre (m).



Time period

The time taken by two consecutive compressions or rarefactions to cross a fixed point is called a Time period (T). The SI unit of time in seconds (s).

Frequency

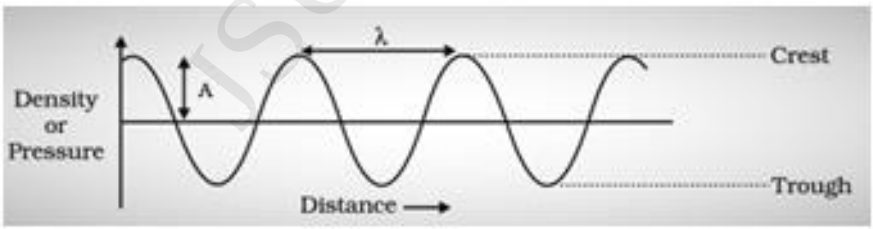
The number of compressions or rarefactions per unit time is called frequency (**ν**).
The SI unit of frequency is Hertz. The SI unit is Hertz (s−1)

$v=1T$

Speed (v), wavelength (λ) and frequency (**ν**) are related as $v=\lambda\boldsymbol{\nu}$

Amplitude

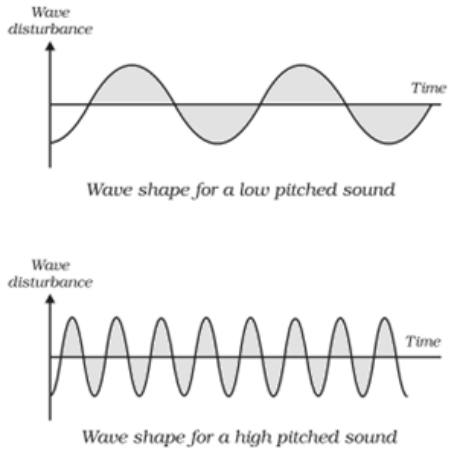
The magnitude of disturbance in a medium on either side of the mean value is called an amplitude (A).
As shown in the figure below, the unit of amplitude will be the density or pressure. Distance between mean position and crest (maximum displacement).



Amplitude (A)

Pitch

The number of compressions or rarefactions per unit time. Directly proportional to frequency.



Representation of low and high pitch

Note and Tone

A sound of a single frequency is called a tone. A sound produced with a mixture of several frequencies is called a note.

Quality of Sound

The richness or timber of sound is called quality. Sound with the same pitch and loudness can be distinguished based on the quality. Music is pleasant to the ears, while noise is not. However, they both can have the same loudness and pitch.

Speed of Sound

Sound travels through different media at different speeds. The speed of sound depends on the properties of the medium: pressure, density and temperature.

Speed of Sound: Solids > Liquids > Gases

Speed of sound in air = 331 m/s at 0^0C and 344 m/s at 22◦ C

When a source emits sound with a speed greater than the speed of sound in air, it creates a sonic boom which produces shockwaves with lots of energy. They produce a very loud noise which is enough to shatter glass and damage buildings.

Reflection of Sound Waves

Like light, sound also follows laws of reflection, it bounces off the surface of solid and liquid.

Echo

The phenomenon where a sound produced is heard again due to reflection is called an echo. E.g. Clapping or shouting near a tall building or a mountain.

To hear a distinct echo sound, the time interval between the original and reflected sound must be at least 0.1s, as sound persists in our brain for about 0.1s. The minimum distance for obstruction or reflective surface to hear an echo should be 17.2 m. Multiple echoes can be heard due to multiple reflections.

Sonar and Radar

SONAR – Sound Navigation And Ranging.

It is a technique that uses sound or ultrasonic waves to measure distance. The human range of hearing is 20Hz- 20kHz.

What Are Ultrasonic Sounds?

Ultrasonic sounds are high-frequency sounds having a frequency greater than 20kHz (inaudible range).

Applications of Ultrasound

(i) Scanning images of human organs
(ii) Detecting cracks in metal blocks
(iii) Cleaning parts that are hard to reach
(iv) Navigating, communicating or detecting objects on or under the surface of the water (SONAR).

Sonar consists of a transmitter and detector mounted on a boat or ship. The transmitter sends ultrasonic sound waves to the seabed, which get reflected back and picked up by the detector. Knowing the speed of sound in water, distance can be measured using: **$2d=v\times t$.** This method is called echolocation or echo ranging.

Reverberation

The persistence of sound because of multiple reflections is called reverberation. Examples: Auditorium and a big hall.
Excessive reverberation is undesirable, and to reduce this, halls and auditoriums have sound-absorbing materials on the walls and roofs. E.g. Fibreboard and rough plaster.

Doppler's Effect

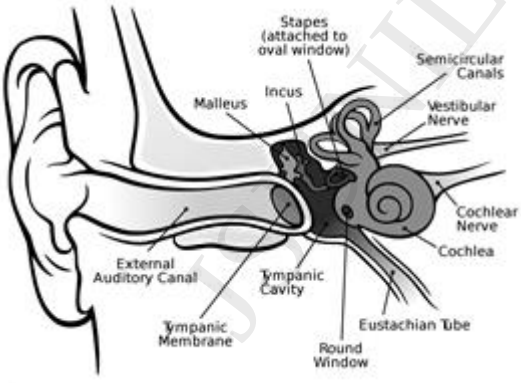
If either the source of sound or the observer is moving, then there will be a change in frequency and wavelength for the observer. The frequency will be higher when the observer moves toward the source, and it decreases when the observer moves away from the source.

Example: If one is standing on a street corner and an ambulance approach with its siren blaring, the sound of the siren steadily gains in pitch as it comes closer and then, as it passes, the pitch suddenly lowers.

Human Ear

The ear is a sensitive organ of the human body. It is mainly involved with detecting, transmitting and transducing sound and maintaining a sense of balance is another important function of the human ear. The human ear includes:

- The outer ear, or the visible part of the ear, is called the pinna.
- Pinna collects sound from the surroundings.
- Sound passes through a tube called an auditory canal.
- Eardrum (tympanic membrane) vibrates in response to incident sound waves.
- Vibrations are amplified and transmitted further by three bones hammer, anvil and stirrup in the middle ear to the inner ear.
- In the inner ear, the cochlea converts pressure signals into electrical signals.
- Electrical signals are transmitted by the auditory nerve to the brain for interpretation.



Human Ear

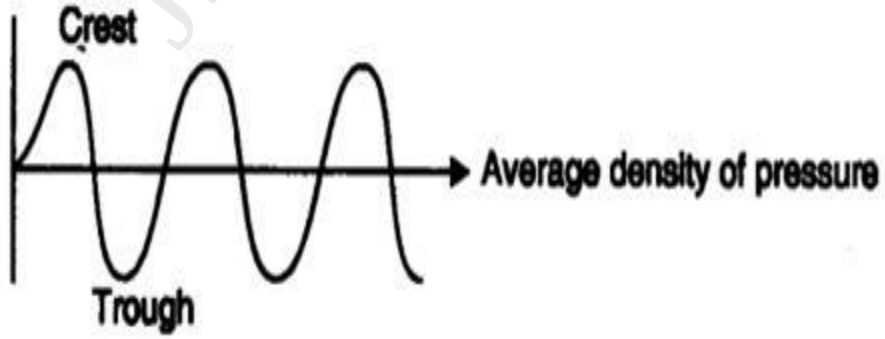
QUESTIONS WITH ANSWERS

Question 1: Is sound wave longitudinal or transverse?
Answer: Sound wave is longitudinal in nature.
Question 2: What is the relation between frequency (v) and time period of a sound wave?
Answer: v = 1/T
Frequency is inversely proportional to time period.
Question 3: In which of the three media air, water or steel does sound travel the fastest?
Answer: Sound travels fastest in steel.
Question 4: Which has a higher pitch—the sound of a whistle or that of a drum?
Answer: The sound of whistle has higher pitch.
Question 5: What is pitch?
Answer: The way our brain interprets the frequency of an emitted sound is called the pitch.
Question 6: How can we distinguish one sound from another having the same pitch and loudness?
Answer: The quality or timber of sound helps us to distinguish one sound from another having the same pitch and loudness.
Question 7: What is the audible range of frequency for human beings?
Answer: The audible range of frequencies for human beings is 20 Hz to 20,000 Hz.
Question 8: What is one Hz?
Answer: Hz is the unit of frequency, called as Hertz. One Hertz is equal to one cycle per second.
Question 9: Define speed of sound.
Answer: The speed of sound is defined as the distance travelled per unit time by compression or rarefaction.
Question 10: What is 'note' of sound?
Answer: The sound produced due to a mixture of several frequencies is called a note, it is pleasant to listen to.
Question 11: Find the frequency of a wave whose time period is 0.002 second.
Answer: Frequency = 1/ Time period
Frequency = 1/0.002 = 500 Hz
Question 12: What is the time period-of sound wave?
Answer: The time taken by two consecutive compressions or rarefactions to cross a fixed points is called the time period of the wave.
Question 13: What is the minimum distance required to hear distinct echo?
Answer: The minimum distance of the obstacle from the source of sound should be 17.2 m.
Question 14: What is reverberation?
Answer: The repeated reflection that results in the persistence of sound is called reverberation.
Question 15: What is SONAR?
Answer: SONAR is—Sound Navigation and Ranging. It is a device that uses ultrasonic waves to measure the distance, direction and speed of underwater objects by getting the reflection of sound.
Question 16: What is 'ultrasonic' and 'infrasonic' sound wave?
Answer: Sound waves with frequencies below the audible range (less than 20 Hz) are termed as "infrasonic" and those sound waves with frequencies above the audible range (more than 20000 Hz) are termed as "ultrasonic".

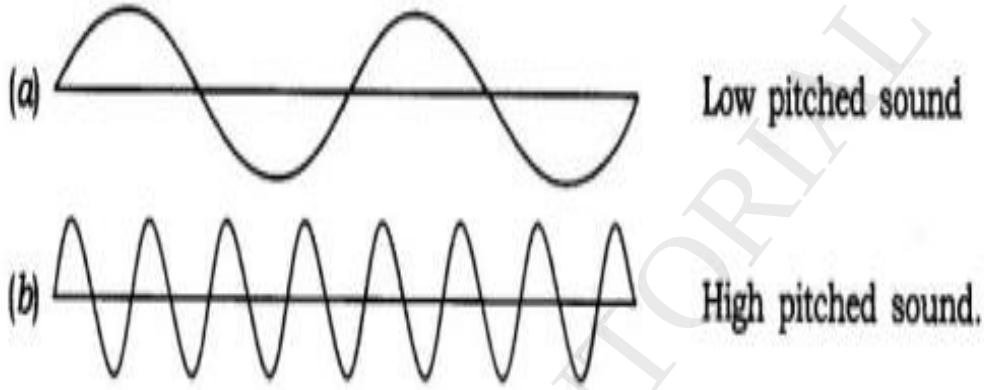
Question 17: What should be the time interval between the originated sound and the reflected sound to be heard distinctly?
Answer: To hear a distinct sound the time interval between the originated sound and the reflected sound must be at least 0.1 second.
Question 18: What is a medium? Give two examples.
Answer: The matter or substance through which sound is transmitted is called a medium. It can be solid, liquid or gas. Example, air, water, metals.
Question 19: Define wave-motion.
Answer: A wave is a disturbance that moves through a medium when the particles of the medium set neighbouring particles into motion. The particles of the medium do not move forward but the disturbance is carried forward.
Question 20: What is 'sonic boom'?
Answer: When an object just attains a supersonic speed, it causes shock waves in air. As a result there is large change in air pressure. This results in sonic boom.
Question 21: Why does sound become faint with distance?
Answer: Sound is a form of energy. As it moves away from the source its amplitude as well as its loudness decreases. The energy also get transformed in vibration of the particles of the medium.
Question 22: Why do we say that sound waves are longitudinal?
Answer: Longitudinal waves need a medium for propagation. The sound energy travel in the same line as the particles oscillate. It forms compression and rarefaction for the longitudinal wave motion. A sound wave shows all the characteristics of the longitudinal wave so it is called as longitudinal wave.
Question 23. Differentiate between longitudinal wave and transverse wave.
Answer:

Longitudinal Wave	Transverse Wave
It needs medium for propagation.	It may or may not need medium for propagation.
Particles of the medium move in a direction parallel to the direction of propagation of the disturbance. Example, sound wave.	Particles of the medium move in the perpendicular direction of propagation of the disturbance. Example, light wave seismic wave.

Question 24: What is crest and trough?
Answer: When a wave is propagated as represented below. A peak is called the crest and a valley is called the trough of a wave.



Question 25: The maximum oscillation disturbance of particles of air forms crest and trough. What is an echo? Why don't we get an echo in a small room?
Answer: The distinct sound heard after reflection of sound from the source is called echo. For echo, the distance of reflecting surface from the source should be more than 17.2 m.
Question 26: What is velocity of sound? Why does sound travel faster in summer season than in winter?
Answer: Velocity of sound is- the speed of sound in a given medium at a given temperature. As the temperature increases the speed of sound also increases, hence in summer the sound travels faster than in winter.
Question 27: Draw a graphical representation of the wave shape for
(a) low pitched sound
(b) a high pitched sound.



Question 29: Give two applications of echo/reflection of sound.
Answer: (i) Ships use the reflection of sound technique "SONAR" which helps in locating the depth, distance, direction and speed of underwater objects.
(ii) Ceilings of concert halls are curved so that sound after reflection reaches all comers of the hall.
Question 30: Define the amplitude time period and frequency of sound wave.
Answer: Amplitude: The magnitude of the maximum disturbance in the medium on either side of the mean value is called amplitude of the wave. Its unit is meter.
Time Period: The time taken by two consecutive compressions or rarefactions to cross a fixed point is called the time period of the wave.
Frequency: The number of oscillation, occurring per unit time is called the frequency of sound wave.
Question 31: A sound wave causes the density of air at a place to oscillate 1200 times in 2 minutes. Find the time period and frequency of the wave.
Answer: Frequency = 1200/2 × 60 = 10Hz
Time period = ?
Frequency = 1/T
∴ T = 1/Frequency
= 1/10
= 0.1 s.
Question 32: Give 3 uses of ultrasound.
Answer: Use of ultrasound:
1. Ultrasound is used to detect cracks and flaws in metal blocks.
2. It is used in 'echo-cardiography', the ultrasonic waves are made to reflect from various parts

of the heart and form the image of the heart.
3. It is used in 'ultrasonography', to detect the image of organs or to detect the abnormalities in the organs. It is also used to examine the foetus during pregnancy to detect congenital defects.
Question 33 What is the function of the middle ear?
Answer: Middle ear consists of three small bones called a hammer, anvil, and stirrup. These three bones receive the sound vibrations and increase the strength of these vibrations to amplify the vibrations received by the eardrum. These amplified vibrations are further passed to the inner ear.
A ship sends out an ultrasound that returns from the seabed and is detected after 3.42 s.
Question 34: If the speed of ultrasound through seawater is 1531 m/s. What is the distance of the seabed from the ship?
Answer: Time between transmission and detection t = 342 s.
Speed of ultrasound in seawater = 1531 m/s.
Distance travelled by the ultra sound = 2 × depth of sea = 2d
2d = speed of sound × time
= 1531 × 3.42
= 5236 m
∴ d = 5236/2
= 2618 m.
The distance of the seabed from the ship is 2618 m.
Question 35: Distinguish between tone, note and noise.
Answer: Tone: A sound of single frequency is called a tone.
Note: The sound which is produced due to a mixture of several frequencies is called a note.
Noise: The sound which is produced due to a mixture of several frequencies but is unpleasant to the ear is called noise.

IMPROVEMENT IN FOOD RESOURCES






CHAPTER 12-
IMPROVEMENT IN FOOD RESOURCES

Improvement in Crop Yields

- Cereals- wheat, rice, maize, millet and sorghum provide us with carbohydrates
- Pulses – gram, pea, black gram (urad), green gram (moong), pigeon pea (arhar), lentil (masoor), provide us with protein.
- Oil seeds- soybean, ground nut, sesame, castor, mustard, linseed and sunflower provide us with fat.
- Vegetables, spices and fruits- provide a range of vitamins and minerals in addition to small amounts of proteins, carbohydrates and fats.
- Fodder crops- berseem, oats or Sudan grass
- Kharif season (June to October)- Paddy, soybean, pigeon, pea, maize, cotton, green gram and black gram
- Rabi Season (November to April)- wheat, gram, peas, mustard, linseed

The main groups of activities for improving crop yields can be classified as:

• Crop variety improvement

• Crop production improvement

• Crop protection management.

CROP VARIETY IMPROVEMENT

- Various crops show disease resistance, response to fertilizers, product quality and high yields.
- This can be achieved by hybridization and genetic engineering (creating GMOS; genetically modified organisms).

Hybridization (crossing between genetically dissimilar plants):-

a- Intraspecific/ intervarietal (between different varieties)
b- Interspecific (between two different species of the same genus)
c- Intergeneric (between different genera).

Some of the factors for which variety improvement is done are: -

- Higher yield
- Improved quality- For example- baking quality is important in wheat, protein quality in pulses, oil quality in oilseeds and preserving quality in fruits and vegetables.
- Biotic (organisms) and abiotic (drought, salinity, water logging, heat, cold and frost resistance)
- Change in maturity duration: Early maturation leads to multiple crop production and cast effective
- Wider adaptability: One variety can then be grown under different climatic conditions in different areas.
- Desirable agronomic characteristics: Tallness and profuse branching (fodder crops), Dwarfness (cereals, so that fewer nutrients are consumed by these crops).

CROP PRODUCTION MANAGEMENT

i- NUTRIENT MANAGEMENT- Manure, Fertilizer
ii- IRRIGATION
iii- CROPPING PATTERNS

Source	Nutrients
Air	carbon, oxygen
Water	hydrogen, oxygen
Soil	(i) *Macronutrients*: nitrogen, phosphorus, potassium, calcium, magnesium, sulphur (ii) *Micronutrients:* iron, manganese, boron, zinc, copper, molybdenum, chlorine

NUTRIENT MANAGEMENT- Manure, Fertilizer

- Nutrients are supplied to plants by air, water and soil.
- Macronutrients- required in large quantity
  Micronutrients- required in less quantity
- The deficiency of these nutrients affects the growth and development of crops.
- These nutrients are added in soil as manure and fertilizers.

MANURE

NUTRIENT

MANURE	FERTILIZER	ORGANIC FARMING
prepared by the decomposition of animal excreta and plant waste. Manure helps in enriching soil with nutrients and organic matter and increasing soil fertility. It also improves soil texture. In sandy soil- increases water holding capacity In clayey soil - help in drainage and in avoiding water logging.	Fertilizers are made in a factory and supply nitrogen, phosphorus and potassium. Fertilizers may cause soil and water pollution. continuous use of fertilizers in an area can destroy soil fertility.	Organic farming- no or minimal use of chemicals as fertilizers, herbicides, pesticides, etc. Maximum use of organic manures, recycled farm-wastes, use of bio-agents (biofertilizer, biopesticide) in crop production
Compost- is formed by the decomposition of biodegradable wastes like cow dung, vegetable waste, etc. Vermicompost- Use of earthworms for preparation of compost.	Green manure: These are green plants like sun hemp or guar which are ploughed with soil	Biofertilizer: Blue-green algae, Rhizobium bacteria Biopesticide: Neem Leaves

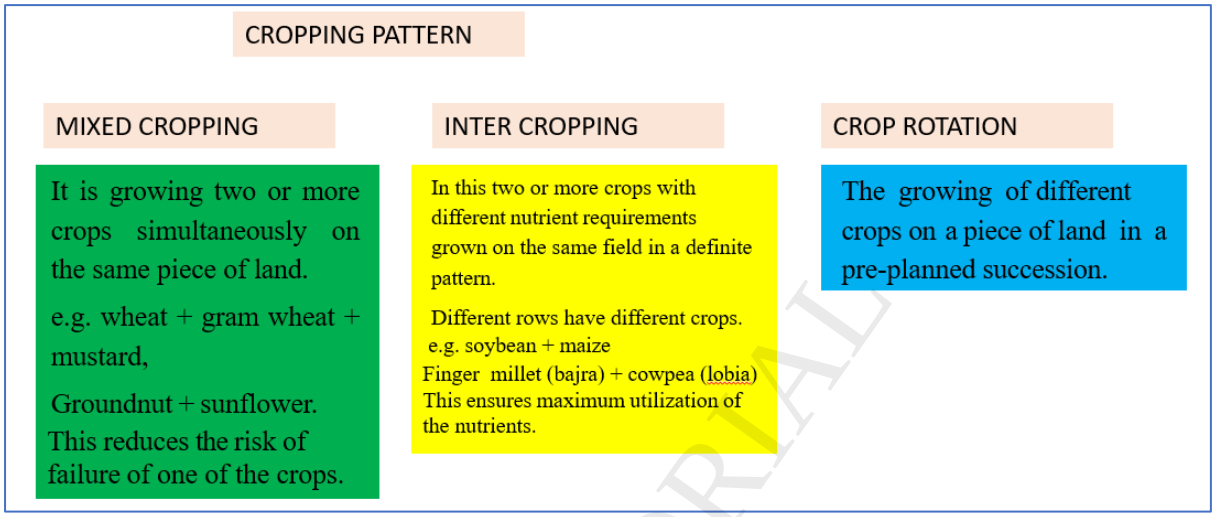
IRRIGATION

Irrigation is the artificial application of water to the soil through various systems of tubes, pumps, and sprays.

- **Wells**: (dug wells and tube wells) – Water is collected from water-bearing strata in a dug well. Tube wells can tap water from the deeper strata.
- **Canals**: In this system, canals receive water from reservoirs/ rivers and distributed it to the field.
- **River Lift Systems**: In water deficient areas water is directly drawn from the rivers for supplying irrigation in areas close to rivers.
- **Tanks**: These are used to irrigate the smaller area

- **Rainwater harvesting and watershed management**- This involves building small check-dams that increase ground water levels. The check-dams stop the rainwater from flowing away and also reduce soil erosion.

CROPPING PATTERN



CROP PROTECTION MANAGEMENT

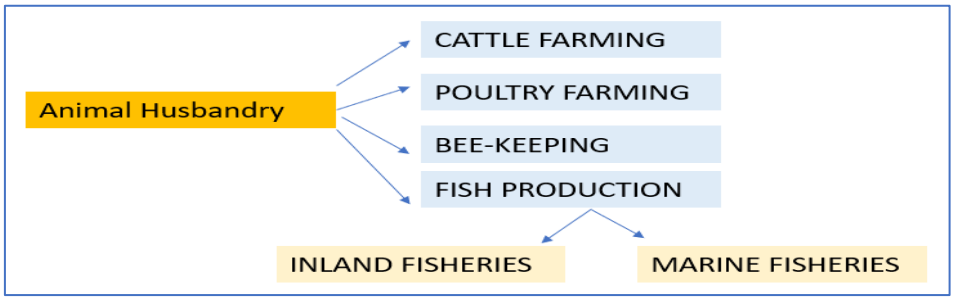
- **Weeds**: These are unwanted plants in the crop field. The weeds compete with crop plants for food, space, and light. Weeds take up nutrients and reduce the growth of the crop. Examples- Xanthium (gokhroo), Parthenium (gajar ghas), Cyperinus rotundus (motha).
- **Pest**- Insect pests cut the root, stem and leaf, bore into stem and fruits, and suck the cell sap.
- **Pathogens**: These are disease causing organisms like Bacteria, fungi and viruses and can be transmitted through the soil, water and air.
- **Pesticides**: These include herbicides, insecticides and fungicides. Pesticides are chemicals used to control weeds, pests and pathogens. These are toxic and cause pollution

STORAGE OF GRAINS

- Factors responsible for loss in productivity are- Biotic (insects, rodents, fungi, mites, bacteria) and abiotic (inappropriate moisture, temperatures).
- These factors cause degradation in quality, loss in weight, poor germinability, discolouration of produce etc.
- Therefore, proper treatment and systematic management is required like cleaning the produce before storage, proper drying, fumigation by pesticides etc.

ANIMAL HUSBANDRY

- Animal husbandry is the scientific management of animal livestock. Example- cattle, goat, sheep, poultry and fish farming. It includes various aspects such as feeding, breeding and disease control.

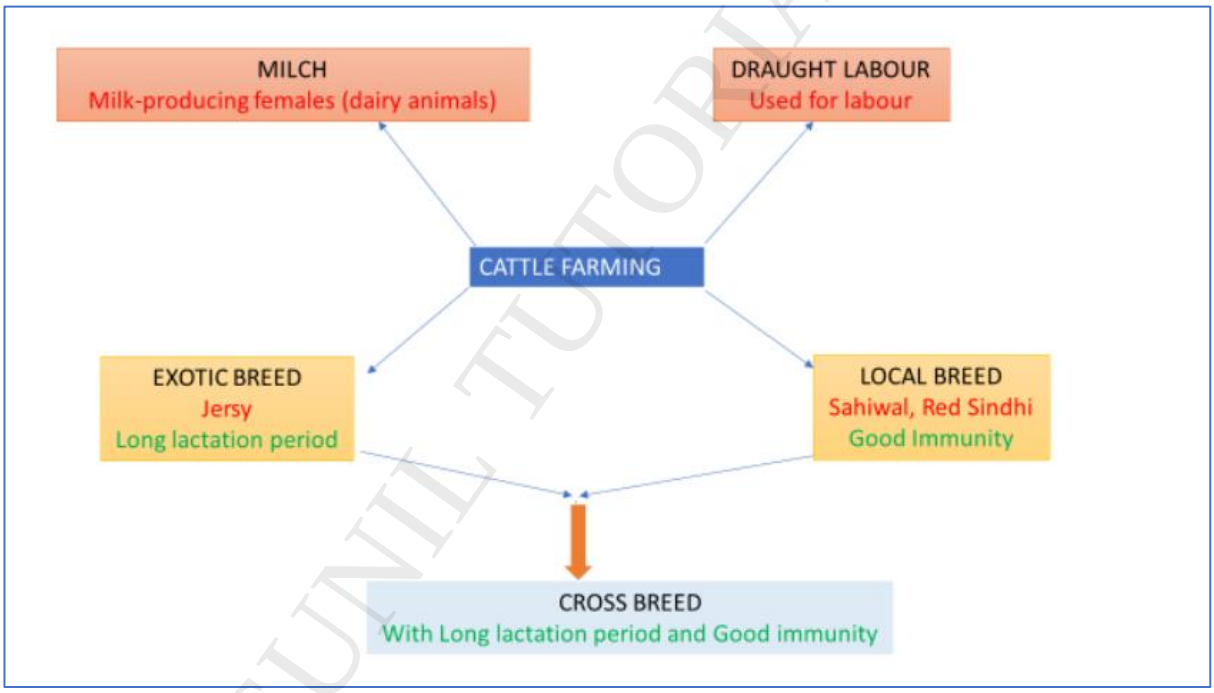


CATTLE FARMING

Purpose- milk and draught labour (for agricultural work)

Main Indian species- Cow (Bos indicus) and buffaloes (Bos bubalis).

Factors on which milk production depends- duration of the lactation period, It can be increased by increasing the lactation period.



Management-

- Proper cleaning and shelter facilities
- Production of clean milk
- Well-ventilated roofed sheds
- Proper feeding

  Food requirements of dairy animals are of two types:

  (a) maintenance requirement- to support the animal to live a healthy life
  (b) food required during the lactation period.
- Animal feed- (a) roughage, which is largely fibre, and (b) concentrates, which are low in fibre and contain relatively high levels of proteins and other nutrients.

- feed additives containing micronutrients
- Medical assistant and vaccination

POULTRY FARMING

- To raise domestic fowl for egg production and chicken meat.
- Layers- eggs
  Broilers- meat
- The cross-breeding between Indian (Aseel) and foreign (Leghorn) to develop new varieties for the following desirable traits—

(i) number and quality of chicks
(ii) dwarf broiler parent for commercial chick production
(iii) Summer adaptation capacity/ tolerance to high temperature
(iv) low maintenance requirements
(v) reduction in the size of the egg-laying bird with the ability to utilize more fibrous cheaper diets formulated using agricultural by-products.

- Management- Healthy food example- food for broilers should be protein rich with adequate fat. The level of vitamins A and K is kept high in the poultry feeds.
- Medical heath and vaccination
- Proper cleaning, sanitation, and spraying of disinfectants at regular intervals.

FISH PRODUCTION

- Fish production includes the finned true fish as well as shellfish such as prawns and molluscs.
- Marine fishery- pomphret, mackerel, tuna, sardines, Bombay duck, finned fishes (mullets, bhetki), prawns, mussels and oysters.
- Inland fisheries: Catla, Silver carp, Rohu, Grass, Mrigal, common Carp.
- Composite fish culture- Culture of fish in a rice field.
- A combination of five or six fish species is used in a single fishpond. These species are selected so that they do not compete for food among them have different types of food habits.
  Examples- Catlas (surface feeders), Rohus (feed in the middle zone), Mrigals and Common Carps (bottom feeders), and Grass Carps (feed on the weeds).

BEE-KEEPING

For the production of honey bee-keeping is carried out at large scale.

- Indian bee: Apis cerana indica
- Rock bee: A. dorsata
- Little bee: A. flora
- Italian bee: A. mellifera

The value or quality of honey depends upon-

- Flowers available to the bees for nectar
- Pollen collection

IMPORTANT QUESTIONS

VERY SHORT ANSWER QUESTIONS

1- The months of November to April is better for-
   a- Rabi crop b- Kharif crop c- Zayad crop d- Both b and c
   Ans: a
2- What collective name is given for herbicides, insecticides and fungicides?
   a- Weedicide b- Fumigation c- Vermicomposting d- Pesticides
   Ans: d
3- Apis mellifera is an example of-
   a- Broiler b- Milch c- Honey bee d- Inland fish
4- Identify the fodder crop-
   a- Rice and Maize b- Berseem, Oats c- Wheat and Carrot d- All of these
5- Dwarfness is desired characteristic in-
   a- Cereals b- Fodder crops c- Sugarcanes d- Timbers
   Ans: a
6- Which nutrient is supplied by air to the crops?
   Ans: carbon, oxygen
7- Sometimes exotic breeds are preferred to local breeds. Give reason.
   Ans: Exotic breeds have long lactation periods and more yield.
8- Name any two marine fish varieties.
   Ans: Pomphret, mackerel
9- Name the scientific name of Indian bees and Rock bees.
   Ans: Indian bee: Apis cerana indica
   Rock bee: A. dorsata
10- Write any two natural manures which are widely used in agriculture.
   Ans: compost and vermicompost

SHORT ANSWER QUESTIONS

1- What is apiculture? Write two advantages of the product of apiculture.
   Ans: rearing of honey bees for the production of honey is known as apiculture
   Honey is used in medicines and also used as food as it contains iron and calcium, it also helps in the growth of the body.
2- Give two examples of each of micronutrients and macronutrients.
   Ans: (i) Macronutrients: nitrogen, phosphorus
   (ii) Micronutrients: iron, manganese
3- Which method is commonly used for improving cattle breeds and why?
   Ans: Cross-breeding is widely used to improve cattle breeds. Through these two good cattle varieties will lead to a new, improved variety.
4- Explain two types of animal feed and write their functions.
   Ans: Roughage: These are rich in fibre; e.g., cowpea, berseem, etc.
   Concentrates: These are nutrient-rich and low on fibres; e.g., oats, maize, etc.
5- Describe hybridization and its types.
   Ans: Hybridisation – It is crossing between genetically dissimilar plants.
   Types- intervarietal (between different varieties), Interspecific (between two different species of the same genus), Intergeneric (between different genera).

6- Explain composite fish culture and write its advantage.
Ans: Composite fish culture is a method in which 5-6 fish species are grown together in a single fish pond. By this survival rate of fish and their yield increases without affecting the other species.

7- If there is low rainfall in a village throughout the year, what measures will you suggest to the farmers for better cropping?
Ans: (i) using drought-resistant and early maturing varieties of crops.
(ii) add more humus to the soil as it increases the water-holding capacity and retains water for longer.

8- Organic matters are supposed to be very important for crop production. Give two reasons.
Ans: It helps in improving soil structure.
It helps in increasing the water-holding capacity of sandy soil.

9- Differentiate between compost and vermicompost.
Answer: Compost is prepared by a degradation process carried out by microorganisms. In this farm waste materials are decomposed and used as manure. Vermicompost: This is prepared by the decomposition of organic matter with the help of earthworms.

10- What are fodder crops? Write two examples.
Ans: fodder crops are used for feeding cattle.
e.g. - berseem, oats

LONG ANSWER QUESTIONS

1- Write different ways by which insect damages the crops in the field. Suggest one method of effective control.
Ans: (i) they cut the root, stem, and leaf
They suck the cell sap from various parts of the plant
They bore into stems and fruits.
The insect pest can be controlled by the spray of insecticide.

2- Describe the main irrigation systems that are adopted in India.
Ans- Wells: (dug wells and tube wells) – Water is collected from water-bearing strata in a dug well. Tube wells can tap water from the deeper strata.
Canals: In this system, canals receive water from reservoirs/ rivers and distributed it to the field.
River Lift Systems: In water deficient areas water is directly drawn from the rivers for supplying irrigation in areas close to rivers.
Tanks: These are used to irrigate the smaller area
Rainwater harvesting and watershed management involve building small check-dams that increase groundwater levels. The check-dams stop the rainwater from flowing away and also reduce soil erosion.

3- What are weeds? List any two ways by which they affect crop growth. Give two examples of weeds.
Ans: weds are undesirable plants in the cultivated field. They compete for food, space, and light.
Weeds take up nutrients and reduce the growth of the crop.
Examples: Xanthium (gokhroo), Parthenium (gajar ghas), Cyperinus rotundus (motha).

4- Compare mixed cropping and intercropping by giving suitable examples. Illustrate their advantage too.

Ans: Mixed cropping- It is growing two or more crops simultaneously on the same piece of land.

E.g., Wheat + gram, wheat + mustard, Groundnut + sunflower. This reduces the risk of failure of one of the crops.

Intercropping: In these two or more crops with different nutrient requirements are grown on the same field in a definite pattern. Different rows have different crops.

e.g. soybean + maize, millet (bajra) + cowpea (lobia) This ensures maximum utilization of the nutrients.

5- Explain any four factors on the basis of which crop production is done.

Ans: Higher yield and improved quality Improved quality like protein (pulses), baking quality (wheat), oil quality (oilseeds), and preserving quality (fruits and vegetables).

Biotic & abiotic resistance- Production of resistant crops to biotic (diseases, insects and nematodes) and abiotic (drought/ salinity/ water-logging/ heat/ cold/ frost) stresses.

Less maturity duration- Producing crops with less duration of maturity period. This allows farmers to grow multiple rounds of crops in a year.

Desirable agronomic characteristics- Like Tallness and profuse branching are desirable characteristics for fodder crops. Dwarfness is desired in cereal.

6- Explain the differences between broilers and layers. What necessary steps have to be taken to prevent the occurrence of infectious diseases in poultry farms?

Ans: Broilers birds are used for meat production and egg-laying birds are called layers. The requirement of the broilers is protein and fat-rich food. The level of vitamin A and vitamin K is kept high in their feed.

Care is taken to avoid mortality and to maintain the feathering and carcass quality. The layers require enough space, proper light, and hygienic conditions.

Necessary steps for prevention of infectious diseases are:

Proper cleaning and sanitation

Effective vaccination to prevent infectious diseases.

Spraying of disinfectants at regular intervals