STUDY MATERIAL
2014-15

SA –1&2

SCIENCE
CLASS IX
PREFACE

Kendriya Vidyalaya is a pioneer organization which caters to the all round round development of the students. Time to time various strategies have been adopted to adorn the students with academic excellence. Keeping in view of the implementation of CCE it is desired to prepare study/ support material for Class IX to guide the students in the right direction and to equip the students to face the challenges with ease.

This support material is one such effort by Kendriya Vidyalaya Sangathan, an empirical endeavor to help students learn more effectively and efficiently. It is designed to give proper platform to students for better practice and understanding of the chapters. This can suitably be used during revision. Ample opportunity has been provided to students through master cards and question banks to expose them to the CBSE pattern. It is also suggested to students to keep in consideration the time-management aspect as well.

I extend my heartiest gratitude to the Kendriya Vidyalaya Sangathan authorities for providing the support material to the students prepared by various Regions. The same has been reviewed by the Regional Subject Committee of Patna Region who have worked arduously to bring out the best for the students. I also convey my regards to the staff of Regional Office, Patna for their genuine cooperation.

In the end, I earnestly hop that this material will not only improve the academic result of the students but also inculcate learning habit in them.

M.S. Chauhan
Deputy Commissioner
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# COURSE STRUCTURE

## FIRST TERM

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<tr>
<th>UNITS</th>
<th>Marks</th>
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</thead>
<tbody>
<tr>
<td>I. Food</td>
<td>13</td>
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<td>➢ Ch. 15 - Improvement in food resources</td>
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<tr>
<td>II. Matter - Its nature and behaviour</td>
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<td>➢ Ch.1- Matter in our surroundings</td>
<td></td>
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<td>➢ Ch.2- Is matter around us pure</td>
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<td>III. Organisation in living world</td>
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<td>➢ Ch.5 - Fundamental unit of life</td>
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<td>➢ Ch.6 – Tissues</td>
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<tr>
<td>IV. Motion, Force and Work</td>
<td>30</td>
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<tr>
<td>➢ Ch.8 - Motion</td>
<td></td>
</tr>
<tr>
<td>➢ Ch.9 - Force and Law of motion</td>
<td></td>
</tr>
<tr>
<td>➢ Ch.10 – Gravitation</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>90</td>
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</table>

## SECOND TERM

<table>
<thead>
<tr>
<th>UNITS</th>
<th>Marks</th>
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</thead>
<tbody>
<tr>
<td>I. Matter - Its nature and behavior</td>
<td>17</td>
</tr>
<tr>
<td>➢ Ch.3 - Atom &amp; Molecules</td>
<td></td>
</tr>
<tr>
<td>➢ Ch.4 - Structure of atom</td>
<td></td>
</tr>
<tr>
<td>II. Organisation in the living world</td>
<td>25</td>
</tr>
<tr>
<td>➢ Ch.7 - Diversity in living organisms</td>
<td></td>
</tr>
<tr>
<td>➢ Ch.13 – Why do we fall ill ?</td>
<td></td>
</tr>
<tr>
<td>III. Motion, Force and Work</td>
<td>36</td>
</tr>
<tr>
<td>➢ Ch.10 - Gravitation (Floatation)</td>
<td></td>
</tr>
<tr>
<td>➢ Ch.11- Work</td>
<td></td>
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<tr>
<td>➢ Ch.12 –Sound</td>
<td></td>
</tr>
<tr>
<td>IV Our Environment</td>
<td>12</td>
</tr>
<tr>
<td>➢ Ch.14 - Natural Resources</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>90</td>
</tr>
</tbody>
</table>
Theme : Food (10 Periods)
Unit : Food
Plant and animal breeding and selection for quality improvement and management; use of fertilizers, manures; protection from pests and diseases; organic farming.

Theme : Materials (22 Periods)
Unit : 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.

Theme: The World of The Living (22 Periods)
Unit: 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; 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 (four types in animals; meristematic and permanent tissues in plants).

Theme : Moving Things, People and Ideas (36 Periods)
Unit : 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, equations of motion by graphical method; elementary idea of uniform circular motion.
Force and Newton's laws: Force and motion, Newton's laws of motion, inertia of a body, inertia and mass, momentum, force and acceleration. Elementary idea of conservation of momentum, action and reaction forces.
Gravitation : Gravitation; universal law of gravitation, force of gravitation of the earth (gravity), acceleration due to gravity; mass and weight; free fall.
SECTION: CHEMISTRY
CHAPTER – 1 “Matter in our Surroundings”

CONCEPT DETAILS

KEY CONCEPTS: [ *rating as per the significance of concept]

<table>
<thead>
<tr>
<th>Concept Details</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Particle nature of Matter</td>
<td>***</td>
</tr>
<tr>
<td>2. States of Matter</td>
<td>****</td>
</tr>
<tr>
<td>3. Interchange in states of Matter</td>
<td>*****</td>
</tr>
<tr>
<td>4. Evaporation &amp; Boiling</td>
<td>****</td>
</tr>
<tr>
<td>5. Kelvin, Celsius scale</td>
<td>***</td>
</tr>
</tbody>
</table>

Pre requisites

- Definition of matter.
- Elementary idea of three physical states of matter.

SURVEY ANALYSIS

Conceptual levels of comprehension on the basis of feedback taken from the students
1. Particle Nature of Matter

[refer NCERT text book activities 1.1 to 1.8]

Anything that occupies space and has mass and is felt by senses is called matter.

Matter is the form of five basic elements the Panchtatva – air, earth, fire, sky and water.

Characteristics of particles of matter

- Made of tiny particles.
- Vacant spaces exist in particles.
- Particles are in continuous motion.
- Particles are held together by forces of attraction.

Q.1 Define matter.
Q.2 What happens if you put copper sulphate crystals in water?

2. States of Matter

[refer NCERT text book activities 1.9 to 1.11]

Basis of Classification of Types

- Based upon particle arrangement
- Based upon energy of particles
- Based upon distance between particles

Five states of matter
### (i) SOLID
- Fixed shape and definite volume.
- Inter particle distances are smallest.
- Negligible compressibility.
- High density and do not diffuse.
- Constituent particles are very closely packed.

### (ii) LIQUID
- Not fixed shape but definite volume.
- Inter particle distances are larger.
- Almost incompressible.
- Density is lower than solid and diffuse.
- Constituent particles are less closely packed.

### (iii) GAS
- Neither fixed shape nor fixed volume.
- Inter particle distances are largest.
- Highly compressible.
- Density is least and diffuse.
- Constituent particles are free to move.

### (iv) Plasma (non–evaluative)
- A plasma is an ionized gas.
- A plasma is a very good conductor of electricity and is affected by magnetic fields.
- Plasma, like gases have an indefinite shape and an indefinite volume. Ex. Ionized gas

### (v) Bose-Einstein condensate (non–evaluative)
- A **BEC** is a state of matter that can arise at very low temperatures.
- The scientists who worked with the Bose-Einstein condensate received a Nobel Prize for their work in 1995.
- The BEC is all about molecules that are really close to each other (even closer than atoms in a solid).
Microscopic Explanation for Properties of Solids

- Solids have a definite shape and a definite volume because the particles are locked into place.
- Solids do not flow easily because the particles cannot move/slide past one another.
- Solids are not easily compressible because there is little free space between particles.

Microscopic Explanation for Properties of Liquids

- Liquids are not easily compressible and have a definite volume because there is little free space between particles.
- Liquids have an indefinite shape because the particles can slide past one another.
- Liquids flow easily because the particles can move/slide past one another.

Microscopic Explanation for Properties of Gases

- Gases are easily compressible because there is a great deal of free space between particles.
- Gases flow very easily because the particles randomly move past one another.
- Gases have an indefinite shape and an indefinite volume because the particles can move past one another.

(Non–evaluative)↓

Microscopic Explanation for Properties of Plasmas

- Plasmas have an indefinite shape and an indefinite volume because the particles can move past one another.
- Plasmas are easily compressible because there is a great deal of free space between particles.
- Plasmas are good conductors of electricity & are affected by magnetic fields because they are composed of ions.

Microscopic Explanation for Properties of BEC

- Particles are less energetic than solids because they exist at very low temperature.
- Particles are literally indistinguishable because they are locked into the same space.
- BEC shows superfluidity because particles can flow without friction.
Q.1 A substance has a definite volume but no definite shape? State whether this substance is a solid, a liquid or a gas.
Q.2 Arrange the following substances in increasing order of force of attraction between the particles. (a) Milk (b) Salt (c) Oxygen.
Q.3 A substance has neither a fixed shape nor a fixed volume. State whether it is a solid, a liquid or a gas.
Q.4 The melting point of a substance is below the room temperature. Predict its physical state.

3. Interchange in states of matter
[ refer NCERT text book activities 1.12 to 1.14 ]

Matter Can Change its State

Water can exist in three states of matter –

• Solid, as ice,
• Liquid, as the familiar water, and
• Gas, as water vapour.

Sublimation: The changing of solid directly into vapour on heating & vapour into solid on cooling. Ex. Ammonium chloride, camphor & iodine.

a) Effect of change in temperature

The temperature effect on heating a solid varies depending on the nature of the solid & the conditions required in bringing the change.

• On increasing the temperature of solids, the kinetic energy of the particles increases which overcomes the forces of attraction between the particles thereby solid melts and is converted to a liquid.
• The temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point.
• The melting point of ice is 273.16 K.
• The process of melting, that is, change of solid state into liquid state is also known as fusion.

b) Effect of Change of Pressure

• Increasing or decreasing the pressure can change the state of matter. Applying pressure and reducing temperature can liquefy gases.
Solid carbon dioxide \((CO_2)\) is stored under high pressure. Solid \(CO_2\) gets converted directly to gaseous state on decrease of pressure to 1 atmosphere without coming into liquid state. This is the reason that solid carbon dioxide is also known as dry ice.

**Latent Heat:** The hidden heat which breaks the force of attraction between the molecules during change of state.

<table>
<thead>
<tr>
<th>Fusion</th>
<th>Vaporisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat energy required to change 1kg of solid into liquid.</td>
<td>Heat energy required to change 1kg of liquid to gas at atmospheric pressure at It’s boiling point.</td>
</tr>
</tbody>
</table>

Thus, we can say that pressure and temperature determine the state of a substance, whether it will be solid, liquid or gas.

[refer fig. 1.9 NCERT Text Book, page-8]

Q.1 What is vapour?
Q.2 Name the temperature at which the solid and liquid states of substance can exist together.
Q.3 What is the effect of pressure on boiling point?
Q.4 Name any two substances which sublime.
Q.5 Define Condensation.
Q.6 For any substance, why does the temperature remain constant during the change of state?

4. Evaporation & Boiling

- Particles of matter are always moving and are never at rest.
- At a given temperature in any gas, liquid or solid, there are particles with different amounts of kinetic energy.
- In the case of liquids, a small fraction of particles at the surface, having higher kinetic energy, is able to break away from the forces of attraction of other particles and gets converted into vapour.
- This phenomenon of change of a liquid into vapours at any temperature below its boiling point is called evaporation.
  - **Factors Affecting Evaporation**
    - The rate of evaporation increases with an increase of surface area.
    - With the increase of temperature, more number of particles get enough kinetic energy to go into the vapour state.
Humidity is the amount of water vapour present in air. The air around us cannot hold more than a definite amount of water vapour at a given temperature. If the amount of water in air is already high, the rate of evaporation decreases.

Wind speed: the higher the wind speed, the more evaporation will take place.

Evaporation cause cooling.

The particles of liquid absorb energy from the surrounding to regain the energy lost during evaporation,

Evaporation Vs Boiling

- Boiling is a bulk phenomenon. Particles from the bulk (whole) of the liquid change into vapour state.
- Evaporation is a surface phenomenon. Particles from the surface gain enough energy to overcome the forces of attraction present in the liquid and change into the vapour state.

Q.1 Which is the slow process, Evaporation or Boiling?
Q.2 State the effect of surface area on rate of evaporation.
Q.3 Why are we able to sip hot tea faster from saucer rather than from a cup?

5. Kelvin & Celsius Scale

- Kelvin is the SI unit of temperature, \(0^0C = 273.16\) K. we take \(0^0C = 273\) K.
- SI unit of temperature is Kelvin. \(T (K) = T (^0C) + 273\)
- Kelvin scale of temperature has always positive sign, hence regarded as better scale than Celsius.
- Atmosphere (atm) is a unit of measuring pressure exerted by a gas. The SI unit of pressure is Pascal (Pa):
- 1 atmosphere = \(1.01 \times (10 \text{ to the power } 5)\) Pa. The pressure of air in atmosphere is called atmospheric pressure. The atmospheric pressure at sea level is 1 atmosphere, and is taken as the normal atmospheric pressure.

\[
\frac{C}{5} = \frac{F-32}{9} = \frac{K-273}{5}
\]
Q.1 What is the SI unit of temperature?
Q.2 Kelvin scale of temperature is regarded as better scale than Celsius. Why?
Q.3 Convert \(10^\circ C\) into Kelvin scale.
1 Mark Questions:

1. Pressure on the surface of a gas is increased. What will happen to the inter particle forces?
2. Name the three states of matter.
3. What happens when a liquid is heated?
4. A gas can exert pressure on the walls of the container. Assign reason.
5. Convert the following temperature to Kelvin Scale (a) 100°C (b) 37°C
6. What is meant by density?
7. Give the characteristics of the particles of matter.
8. Water droplets seen on the outer surface of a glass containing ice-cold water is due to ____________.
9. Change of gaseous state directly to solid state without going through liquid state is called ________________.
10. ________________ is a surface phenomenon.

2 Marks Questions:

1. Define Latent heat of vaporisation.
2. Explain why temperature remains constant during the change of state of any substance?
3. Define Sublimation with examples.
4. *Do we sweat more on a dry day or humid day? Justify your reason.
5. Why do we see water droplets on the outer surface of a glass containing ice cold water?
6. Convert the following temperature to the Kelvin scale (a) 25°C (b) 373°C
7. List two properties that liquids have in common with solids.
8. List two properties that liquids have in common with gases.
9. *What will happen to the melting point temperature of ice if some common salt is added to it? Justify your answer.
10. *How will you show that air has maximum compressibility?
11. Why cooling effect of ice at 0°C is more effective than same amount of water at 0°C?
12. Give reason: doctor’s advice to put strips of wet cloth on forehead of person having high temperature.
3 Marks Questions:

1. Define the term (a) Latent heat of fusion (b) Latent heat of vaporisation.
2. State the effect of (i) surface area (ii) nature of the liquid on the rate of evaporation.
3. Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Why?
4. What is the physical state of water at 250°C, 100°C, 0°C?
5. Give reasons:
   i) A sponge can be pressed easily; still it is called a solid.
   ii) Water vapours have more energy than water at same temperature.
6. What are intermolecular forces? How are these related to the three states of matter?
7. Is it possible to liquify atmospheric gases? If yes, suggest a method.
8. Name A, B, C, D, E and F in the following showing state change:

   ![State Change Diagram]

5 marks Questions:

1. a) What is meant by evaporation? What are the factors on which the rate of evaporation depend upon?
   b) How does evaporation cause cooling?
2. State the properties of all the three states of matter in respect of their shape, density, compressibility, force of attraction and rigidity.
3. Define: Melting point, Freezing point & Boiling point

   **You are expected to know........**

   - Particle nature of matter.
   - All five states of matter & their behaviour
   - Inter conversion of states of matter
   - Latent heat
   - Conversion between Kelvin scale, Celsius scale and Fahrenheit scale
CHAPTER – 2 “Is Matter Around Us Pure”

CONCEPT DETAILS

KEY CONCEPTS : [ *rating as per the significance of concept ]

<table>
<thead>
<tr>
<th>Concept</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pure Substance &amp; Mixture</td>
<td>***</td>
</tr>
<tr>
<td>2. Types of Mixtures</td>
<td>****</td>
</tr>
<tr>
<td>3. Methods of Separation of Mixtures</td>
<td>*****</td>
</tr>
<tr>
<td>4. Concentration &amp; Types of Solutions</td>
<td>*****</td>
</tr>
<tr>
<td>5. Physical &amp; Chemical Changes</td>
<td>***</td>
</tr>
<tr>
<td>6. Alloys</td>
<td>**</td>
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</tbody>
</table>

Pre requisites

- Basic knowledge of particle nature of matter
- Different states of matter

SURVEY ANALYSIS

Conceptual levels of comprehension on the basis of feedback taken from the students
1. Pure Substance & Mixture

<table>
<thead>
<tr>
<th>PURE SUBSTANCE</th>
<th>MIXTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Pure substance consists of a single type of substance.</td>
<td>- Mixture consists of two or more pure substances.</td>
</tr>
<tr>
<td>- Pure substance cannot be separated into other substances by physical methods.</td>
<td>- Mixture can be separated into its components by physical methods.</td>
</tr>
<tr>
<td>- Pure substance has its own definite properties.</td>
<td>- Mixture shows the properties of its components.</td>
</tr>
</tbody>
</table>

Elements are made up of one kind of atoms only. Compounds are made up of one kind of molecules only.

Difference between Compound & Mixture
[refer NCERT text Book Tab.2.2, page 26]

Q.1 Is air around us a compound or mixture?
Q.2 Water is a compound. Justify.
Q.3 Classify the following as element, compound and mixture: Iron, sea water, Milk
Q.4 Are the naturally occurring material in nature chemically pure substances?
2. Types of Mixtures
Mixtures can also be grouped

**i) on the basis of their physical states:**

<table>
<thead>
<tr>
<th></th>
<th>SOLID</th>
<th>LIQUID</th>
<th>GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOLID</td>
<td>Salt and sugar</td>
<td>Salt and water</td>
<td>Dust in air</td>
</tr>
<tr>
<td>LIQUID</td>
<td>Mercury and copper</td>
<td>Alcohol and water</td>
<td>Clouds</td>
</tr>
<tr>
<td>GAS</td>
<td>Hydrogen and palladium</td>
<td>Oxygen and water</td>
<td>Air</td>
</tr>
</tbody>
</table>

**ii) on the basis of miscibility:**

<table>
<thead>
<tr>
<th>Homogeneous Mixture</th>
<th>Heterogeneous Mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>It consists of single phase.</td>
<td>It consists of two or more phase.</td>
</tr>
<tr>
<td>Uniform composition.</td>
<td>Does not have uniform composition.</td>
</tr>
<tr>
<td>Example: Sugar dissolved in water</td>
<td>Example: Air, sand and common salt.</td>
</tr>
</tbody>
</table>

Q.1 Give one example for each of the following mixtures: i) Solid/solid (homogeneous)  
Q.2 Classify the following as homogeneous & heterogeneous mixture:  
i) sodium chloride & water  ii) glucose & water  iii) sand & water  iv) air  

4. Separating the components of a mixture

The components of a heterogeneous mixture can be separated by

- **simple methods like** -  
  hand picking, sieving, & Winnowing

- **Special techniques like** -  
  i) **Evaporation**: a mixture of salt and water or sugar and water (Volatile component solvent from non-volatile solute)  
  ii) **Centrifugation**: Butter from curd, Fine mud particles suspended in water. (Denser particle are forced to the bottom and lighter particle stay at the tops.)  
  iii) **Decantation (Using separating funnel)**: Oil from water. (Two immiscible liquids)  
  iv) **Sublimation**: Camphor from salt,  
  v) **Chromatography**: Different pigments from an extract of flower petals. (Technique used for separation of those solute that dissolve in same solvent)  
  vi) **Distillation and fractional distillation**: Separating components of Petroleum (Component of two miscible liquid that boil without decomposition and have sufficient difference in boiling points)  
  vii) **Magnetic separation**: Iron pins from sand.
Q.1 Name the process you would use to:
   i) recover sugar from an aqueous sugar solution.
   ii) separate mixture of salt solution and sand.

Q.2 How will you separate a mixture of sand, water and mustard oil?

5. Concentration of Solution

The amount of solute present in a given amount (mass or volume) of solution.

Concentration of a solution = \( \frac{\text{Amount of solute}}{\text{Amount of solvent}} \)

OR

\( \frac{\text{Amount of solute}}{\text{Amount of solution}} \)

The concentration of a solution can be expressed as mass by mass percentage or as mass by volume percentage.

**Mass by mass** percentage of a solution = \( \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100 \)

**Mass by volume** percentage of a solution = \( \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100 \)

**Types of Solutions**

*a) On the basis of size of solute particles:*

<table>
<thead>
<tr>
<th>True solution</th>
<th>Sol [ Colloid]</th>
<th>Suspension</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Homogeneous</td>
<td>• Heterogeneous</td>
<td>• Heterogeneous</td>
</tr>
<tr>
<td>• Size of solute particles is less than 1 nm or ( 10^{-9} ) m.</td>
<td>• Size of solute particles is between 1 nm to 1000 nm.</td>
<td>• Size of solute particles is more than 1000 nm.</td>
</tr>
<tr>
<td>• Particles cannot pass through filter paper.</td>
<td>• Particles can pass through filter paper.</td>
<td>• Particles cannot pass through filter paper.</td>
</tr>
<tr>
<td>• Stable</td>
<td>• Stable and settle only on centrifugation.</td>
<td>• Unstable and settle down on its own.</td>
</tr>
<tr>
<td>• Solution of sodium chloride in water, sugar &amp; water.</td>
<td>• Milk, Fog</td>
<td>• muddy water, chalk &amp; water, smoke in the air.</td>
</tr>
</tbody>
</table>
Colloidal solution is a heterogeneous mixture. It consists of two phases:

(i) **Dispersed phase**: component present in small proportion

(ii) **Dispersion medium**: component present in large proportion

The particles of colloid are large enough to scatter a beam of light passing through it and make its path visible. Thus, they show **Tyndall effect**.

The colloidal particles are moving at random in a zigzag motion in all directions. This type of zig-zag motion of colloidal particles is called **Brownian movement**.

### b) on the basis of amount of solute:

<table>
<thead>
<tr>
<th>Unsaturated solution</th>
<th>Saturated Solution</th>
<th>Supersaturated solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>A solution which has lesser amount of solute that it can dissolve at a given temperature is known as unsaturated solution.</td>
<td>A solution which has maximum amount of solute that it can dissolve at a given temperature is known as saturated solution.</td>
<td>A solution which can dissolve more amount of solute by increasing temperature of saturated solution is known as supersaturated solution.</td>
</tr>
</tbody>
</table>

### c) on the basis of nature of solvent

<table>
<thead>
<tr>
<th>Aqueous solution</th>
<th>Non-Aqueous solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The solution in which the solvent is water is known as aqueous solution.</td>
<td>The solution in which the solvent is other than water (ether, alcohol or acetone) is known as non-aqueous solution.</td>
</tr>
</tbody>
</table>

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**Q.1** Classify the following substances into true solutions and colloidal solutions. Milk, ink, starch dissolved in water.

**Q.2** A solution has been prepared by dissolving 5g of urea in 95g of water. What is the mass percent of urea in the solution?

**Q.3** Give an example of an aqueous solution in which gas is dissolved.

### 6. Physical & Chemical Changes

**Physical changes** - Changes that do not result in the production of a new substance.

- If you melt a block of ice, you still have H₂O at the end of the change.
- If you break a bottle, you still have glass.

**Examples**: melting, freezing, condensing, breaking, crushing, cutting, and bending.
Chemical changes - Changes that result in the production of another substance.

- As in the case of autumn leaves, a change in colour is due to a chemical change.
- A half-eaten apple that turns brown.

Q.1 Which of the following is an example of physical change?
   a. Mixing baking soda and vinegar together, and this causes bubbles and foam.
   b. A glass cup falls from the counter and shatters on the ground.
   c. Lighting a piece of paper on fire and the paper burns up and leaves ashes.
   d. Baking a birthday cake for your mother.

Q.2. Which of the following is an example of chemical change?
   a. Filling up a balloon with hot air.
   b. Taking a glass of water and freezing it by placing it in the freezer.
   c. A plant collecting sunlight and turning it into food.
   d. Your dog ripping up your homework.

3. Which change can be easily be reversed?
   a. Chemical Change
   b. Physical Change
   c. Both a physical and chemical change
   d. Neither a physical or chemical change

7. Alloys
   A material that has metallic properties and is composed of two or more chemical elements of which at least one is a metal.

   - These cannot be separated into their components by physical methods.
   - However, these are considered as mixture because these show the properties of its constituents and can have variable composition.

   The benefit of alloys is that you can combine metals that have varying characteristics to create an end product that is stronger, more flexible, or otherwise desirable to manufacturers.

   - Aluminium alloys are extensively used in the production of automotive engine parts.
   - Copper alloys have excellent electrical and thermal performance, good corrosion resistance, high ductility and relatively low cost.
   - Stainless steel alloys are used for many commercial applications such as watch straps, cutlery etc.
   - Titanium alloys have high strength, toughness and stiffness & are used in aerospace structures.

Q.1 Why should we use alloys instead of pure metals?

Q.2 State uses of Aluminium & Stainless steel alloys.
**QUESTION BANK [ *HOTS ]**

1 Mark Questions:
1. What is meant by pure substance?
2. What is meant by mass percentage of solution?
3. Name the process of separation of miscible liquids.
4. Arrange the following in decreasing order of size of the particles.
   True Solution, Suspension, Colloid.
5. *Give an example of an aqueous solution in which gas is dissolved.
6. Name the dispersion medium and dispersed phase in the white material inside an egg.
7. What happens when hot saturated solution is cooled?
8. How would you separate a mixture of chalk and water?
9. *How much water should be added to 15 grams of salt to obtain 15 % salt solution?
10. What type of mixtures are separated by technique of crystallization ?

2 Marks Questions:
1. Which of the following materials fall in the category of a pure substance?
   a) Ice       b) Milk    c) Iron    d) Hydrochloric acid
   e) Calcium oxide  f) Mercury  g) Brick  h) Wood.
2. What do you understand by saturated solution and unsaturated solution?
3. *What do you observe when sunlight passes through a dense forest?
4. List two points of differences between homogeneous and heterogeneous mixtures.
5. State the difference between aqueous & non aqueous solution .
6. Which of the following will show “Tyndall Effect” & Why ?
   a) Salt Solution  b) Milk  c) Copper sulphate Solution  d) Starch Solution
7. *How can we obtain pure copper sulphate from an impure sample?
8. Give two differences between compounds and mixtures.
9. Why is hydrogen considered as element? Give two reasons.
10. Why water is a compound and not a mixture?
3 Marks Questions:
1. Classify the following into elements, compounds and mixtures:
   a) Sodium  b) Soil  c) Sugar solution  d) Silver  e) Calcium carbonate  f) Tin
   g) Silicon  h) Coal  i) Air  j) Soap  k) Methane  l) Carbon dioxide  m) Blood.
2. Give any two applications of centrifugation.
3. Which of the following is chemical change?
   a) Growth of a plant  b) Rusting of iron  c) Mixing of iron fillings and sand
   d) Cooking of food  e) Digestion of food  f) Freezing of water  g) Burning of a candle.
4. *State the difference between simple distillation & fractional distillation.
5. * A solution contains 40 ml of ethanol mixed with 100 ml of water. Calculate the concentration in terms of volume by volume percentage of the solution.

5 Marks Questions:
1. *What is meant by Tyndall effect? What is its cause? Illustrate with example.
2. How would you separate the mixture containing sulphur and sand?
3. What is crystallization? Give its two applications.
4. How are sol, solution and suspension different from each other?
5. What is chromatography? How do we obtain coloured components, i.e. dye from blue/black ink? Write any two application of chromatography.

You are expected to know..........

- Types of mixtures.
- Method of Separation of mixtures.
- Types of solutions.
- Concentration terms of solution.
- Physical and Chemical Change.
- Significance of alloys.
CHAPTER - 3 “Atoms and Molecules”

**CONCEPT DETAILS**

**KEY CONCEPTS : [ *rating as per the significance of concept]*

<table>
<thead>
<tr>
<th>Concept</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Laws of Chemical Combination</td>
<td>***</td>
</tr>
<tr>
<td>2. John Daltons Atomic Theory</td>
<td>**</td>
</tr>
<tr>
<td>3. Atoms, ions &amp; Chemical Formula</td>
<td>****</td>
</tr>
<tr>
<td>4. Mole Concept</td>
<td>*****</td>
</tr>
<tr>
<td>5. Molar Mass &amp; Avogadro constant</td>
<td>****</td>
</tr>
</tbody>
</table>

**Pre requisites**

Basic knowledge all states of matter.
Difference in the different states of matter.

**SURVEY ANALYSIS**

*Conceptual levels of comprehension on the basis of feedback taken from the students*

![Survey Graph]

- [ ] Very Difficult
- [ ] Difficult
- [ ] Easy
1. Laws of Chemical Combination

**Law of Conservation of mass:**
- proposed by the French chemist Antoine Lavoisier (1774)
- Mass can neither be created nor destroyed in a chemical reaction.
  - OR
- For any chemical process in a closed system, the mass of the reactants must be equal to the mass of the products.

\[
C + O_2 = CO_2 \quad 12g + 32g = 44g
\]

**Law of definite proportion:**
- proposed by Louis Proust (1799)
- A chemical compound always consists of the same elements combined together in the same ratio, irrespective of the method of preparation or the source from where it is taken.

\[
\text{One molecule of a compound}
\]
\[
\text{water always contains same ratio of Hydrogen and Oxygen by mass i.e.}
\]
\[
H_2O = 2 : 16 = 1 : 8
\]

Verification of “Law of Conservation of mass”
[See Diagram fig 3.1 of text book]

A solution of sodium chloride and silver nitrate are taken separately in the two limbs of an 'H' shaped tube. The tube is sealed and weighed precisely. The two reactants are made to react by inverting the tube. The following reaction takes place.

\[
\text{AgNO}_3(\text{aq}) + \text{NaCl (aq)} \rightarrow \text{AgCl (s)} + \text{NaNO}_3(\text{aq})
\]

The whole tube is kept undisturbed for sometime so that the reaction is complete.

When the tube is weighed again it is observed that:

Weight before the reaction = Weight after the reaction

**Limitation of “Law of definite proportion”**

*This law does not hold good when the compound is obtained by using different isotopes of the combining elements.*

**Q.1 Why chemical reactions are in accordance with the Law of conservation of mass?**
**Q.2 Calculate the ratio of atoms present in 5 g of magnesium and 5 g of iron.**

[Atomic mass of Mg=24 u, Fe=56 u]
2. John Daltons Atomic Theory

[ for postulates ,refer NCERT text book article 3.1.2 -page no.32 ]

Using his theory, Dalton rationalized the various laws of chemical combination which were in existence at that time. However, **he assumed that the simplest compound of two elements must be binary.**

Q.1 In what respect does Dalton’s Atomic theory hold good even today?

Q.2 Which of the following is not the postulate of Dalton’s Atomic theory of matter ?
   a) Each element is made up of extremely small particles called atoms.
   b) Atoms of a given element are identical in chemical properties but have different physical properties.
   c) Atoms cannot be created nor destroyed.
   d) Compounds are formed by the chemical union of atoms of two or more elements in fixed proportion .

3. Atoms, Molecules, Ions & Chemical Formula

<table>
<thead>
<tr>
<th>Atom</th>
<th>Molecule</th>
</tr>
</thead>
<tbody>
<tr>
<td>An atom is the smallest particle of an element which can take part in a chemical reaction. It may or may not exist freely.</td>
<td>The smallest particle of matter (element or compound) which can exist in a free state.</td>
</tr>
<tr>
<td>Each atom of an element shows all the properties of the element.</td>
<td>The properties of a substance are the properties of its molecules.</td>
</tr>
</tbody>
</table>

- **Atoms** are very small, radius measured in nanometers. [1 nm = 10^{-9} m]

- **MOLECULES OF ELEMENT** : The molecules of an element are constituted by the sametype of atoms.

- **MOLECULES OF COMPOUND**: Atoms of different elements join together in definiteproportions to form molecules of compounds.(hetero atomic molecules)

- **ATOMICITY** : The number of atoms contained in a molecule of a substance (element or compound) is called its atomicity.

<table>
<thead>
<tr>
<th>Element</th>
<th>Formula</th>
<th>Atomicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone</td>
<td>O_3</td>
<td>3</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>P_4</td>
<td>4</td>
</tr>
<tr>
<td>Sulphur</td>
<td>S_8</td>
<td>8</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O_2</td>
<td>2</td>
</tr>
</tbody>
</table>
Based upon atomicity molecules can be classified as follows.

**Monoatomic molecules:** Noble gases helium, neon and argon exist as He Ne and Ar respectively.

**Diatomic molecules:** $H_2$, $O_2$, $N_2$, $Cl_2$, $CO$, $HCl$.

**Triatomic molecules:** $O_3$, $CO_2$, $NO_2$.

**SYMBOLS**

[These symbols are approved by International Union of Pure and Applied Chemistry, [IUPAC]]

- The abbreviation used to represent an element is generally the first letter in capital of the English name of element.

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>LATIN NAME</th>
<th>SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>Natrium</td>
<td>Na</td>
</tr>
<tr>
<td>Copper</td>
<td>Cuprum</td>
<td>Cu</td>
</tr>
<tr>
<td>Potassium</td>
<td>Kalium</td>
<td>K</td>
</tr>
<tr>
<td>Iron</td>
<td>Ferrum</td>
<td>Fe</td>
</tr>
<tr>
<td>Mercury</td>
<td>Hydragyrum</td>
<td>Hg</td>
</tr>
<tr>
<td>Tungsten</td>
<td>Wolfram</td>
<td>W</td>
</tr>
</tbody>
</table>

- When the names of two or more elements begin with the same initial letter, the initial letter followed by the letter appearing later in the name is used to symbolize the element.

  - Barium Ba
  - Bismuth Bi

- The first letter of the symbol is always written in capital letter and the second as small letter. Example: Symbol of sodium Na.

  **Symbols of some elements are derived from their Latin names**

Q.1 Give one example each of molecule of element & molecule of compound.

Q.2 How does an atom differ from molecule?

Q.3 Name a triatomic gas.

Q.4 Name the element represented by Hg, Pb, Au.

Q.5 What is the difference between an atom of hydrogen and a molecule of hydrogen?
An ion is a charged particle formed by loss or gain of electrons.

**Cation**
Formed by loss of electron

**Anion**
Formed by gain of electron

---

**Polyatomic Ion**: A group of atoms carrying a charge is a polyatomic ion.

eg: \( \text{NH}_4^+ \) - Ammonium Ion; \( \text{CO}_3^{2-} \) - Carbonate ion

**Valency**: The number of electrons which an atom can lose, gain or share to form a bond.

OR
It is the combining capacity of an atom of the element.

[for valency of various cations & anions, refer NCERT text book table 3.6, page no. 37]

**Chemical Formula**: A chemical formula is a short method of representing chemical elements and compounds.

**Writing a Chemical Formula - CRISS-CROSS rule**

<table>
<thead>
<tr>
<th>RULE 1 [a]</th>
<th>write the correct symbols of two elements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex: Aluminum &amp; Oxygen</td>
<td>Al O</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[ b]</th>
<th>above each symbol, write the correct valence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al(^{3+}) O(^{2-})</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[c]</th>
<th>Criss-cross the valence and drop the algebraic sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al(_2)O(_3)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RULE 2 &gt;</th>
<th>When the subscript is number 1, subscript is not written.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex: Sodium Chloride</td>
<td>- Na(^{1+}) Cl(^{-1}) --- NaCl</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RULE 3&gt;</th>
<th>When the valence of both elements are numerically equal, the subscripts are also not written.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex: Calcium Oxide</td>
<td>- Ca(^{2+}) O(^{2-}) --- CaO</td>
</tr>
</tbody>
</table>
RULE 4 > When there are multiple numbers of an individual polyatomic ion, parentheses must be used to separate the polyatomic ion from the subscript.

\[(\text{NH}_4)^+ \text{SO}_4^2^- \quad \text{.........}(\text{NH}_4)_2\text{SO}_4\]

RULE 5 > All subscripts must be reduced to lowest term (except for molecular or Covalent compound).

<table>
<thead>
<tr>
<th>Ex. Tin (IV) Chloride ~</th>
<th>$\text{Sn}^{4+}\text{O}_2^-$</th>
<th>------</th>
<th>$\text{SnO}_2$</th>
</tr>
</thead>
</table>

**EXAMPLES**

<table>
<thead>
<tr>
<th>CATION</th>
<th>ANION</th>
<th>FORMULA</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{Al}^{3+}$</td>
<td>$\text{SO}_4^{2-}$</td>
<td>$\text{Al}_2(\text{SO}_4)_3$</td>
<td>Aluminiumsulphate</td>
</tr>
<tr>
<td>$\text{Ca}^{2+}$</td>
<td>$\text{HCO}_3^-$</td>
<td>$\text{Ca}(\text{HCO}_3)_2$</td>
<td>Calcium bicarbonate</td>
</tr>
<tr>
<td>$\text{NH}_4^+$</td>
<td>$\text{Cl}^-$</td>
<td>$\text{NH}_4\text{Cl}$</td>
<td>Ammonium chloride</td>
</tr>
<tr>
<td>$\text{Na}^+$</td>
<td>$\text{CO}_3^{2-}$</td>
<td>$\text{Na}_2\text{CO}_3$</td>
<td>Sodium carbonate</td>
</tr>
<tr>
<td>$\text{Mg}^{2+}$</td>
<td>$\text{OH}^-$</td>
<td>$\text{Mg(OH)}_2$</td>
<td>Magnesium hydroxide</td>
</tr>
<tr>
<td>$\text{Na}^+$</td>
<td>$\text{PO}_4^{3-}$</td>
<td>$\text{Na}_3\text{PO}_4$</td>
<td>Sodium phosphate</td>
</tr>
</tbody>
</table>

Q.1 What is the difference between an anion & cation?
Q.2 Write down chemical formula of
   i) Hydrogen peroxide  
   ii) Tin chloride 
   iii) Barium sulphate  
   iv) Silver chloride 
Q.3 Write chemical names of
   i) $\text{Ni(NO}_3)_2$  
   ii) $\text{CdCO}_3$  
   iii) $\text{NaOH}$  
   iv) $\text{NH}_4\text{NO}_2$

4. Mole Concept

The mole (mol) is the amount of a substance that contains as many elementary entities as there are atoms in exactly 12.00 grams of $^{12}\text{C}$

*The Avogadro’s constant is named after the early nineteenth century Italian scientist Amedeo Avogadro.*
I MOLE \equiv 6.022 \times 10^{23} \text{ particles}

Substance > Element || Compound
Particles > Atom || Molecule

Ex. > ELEMENT - SODIUM - Na
I MOLE \equiv 23 \text{ u} / 23 \text{g} / 6.022 \times 10^{23} \text{ atoms of sodium}

Ex. > COMPOUND - WATER - H\text{}_2\text{O}
I MOLE \equiv 18 \text{ u} / 18 \text{g} / 6.022 \times 10^{23} \text{ molecules of water}

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Symbol / formula of atom / molecule</th>
<th>Atomic / molecular mass (u)</th>
<th>1 mole (in g)</th>
<th>Avogadro no.</th>
<th>Molar mass (g mol(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>O</td>
<td>16 u</td>
<td>16 g</td>
<td>6.022 \times 10^{23} \text{ atoms}</td>
<td>16 g mol(^{-1})</td>
</tr>
<tr>
<td>2.</td>
<td>N\text{}_2</td>
<td>28 u</td>
<td>28 g</td>
<td>6.022 \times 10^{23} \text{ molecules}</td>
<td>28 g mol(^{-1})</td>
</tr>
<tr>
<td>3.</td>
<td>HCl</td>
<td>36.5 u</td>
<td>36.5 g</td>
<td>6.022 \times 10^{23} \text{ molecules}</td>
<td>36.5 g mol(^{-1})</td>
</tr>
</tbody>
</table>

**GRAM MOLECULAR MASS**

Gram molecular mass is the mass in grams of one mole of a molecular substance.

**Ex:** The molecular mass of N\text{}_2 is 28, so the gram molecular mass of N\text{}_2 is 28 g.

**ATOMIC MASS UNIT**

An atomic mass unit or amu is one twelfth of the mass of an unbound atom of carbon-12. It is a unit of mass used to express atomic masses and molecular masses.

**Also Known As:** Unified Atomic Mass Unit (u).

**MOLECULAR MASS:** A number equal to the sum of the atomic masses of the atoms in a molecule. The molecular mass gives the mass of a molecule relative to that of the \(^{12}\text{C}\) atom, which is taken to have a mass of 12.
Examples: The molecular mass of C$_2$H$_6$ is approximately 30 or [(2 x 12) + (6 x 1)]. Therefore the molecule is about 2.5 times as heavy as the $^{12}$C atom or about the same mass as the NO atom with a molecular mass of 30 or (14+16).

Q.1 What term is used to represent the mass of 1 mole molecules of a substance? Q.2 What is the gram atomic mass of i) Hydrogen ii) oxygen? Q.3 Calculate molar mass of C$_2$H$_2$.

5. Molar Mass & Avogadro Constant

<table>
<thead>
<tr>
<th>MASS</th>
<th>MOLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molarmass / 1mol</td>
<td>1mol / Molar mass</td>
</tr>
</tbody>
</table>

Ex: i) Convert 35 g of Al into mol.

A: Molar mass of Al = 27 g
27 g = 1mol
1mol
= 35 g x ------
27 g
= 1.3 mol of Al

ii) How many grams of SiO$_2$ are present in 0.8 mol?

A: Molar mass of SiO$_2$ = 60.1 g 1 mol = 60.1 g
60.1 g of SiO$_2$ = 0.8 mol of SiO$_2$ x -------
1 mol of SiO$_2$
= 48.1 g SiO$_2$
**Ex. How many mol of CO\(_2\) are present in 55.5 L?**

A: \(22.4 \text{ L} = 1\text{mol}\)

\[
\frac{1\text{mol}}{22.4 \text{ L}} = \frac{55.5 \text{ L}}{22.4 \text{ L}} = 2.48 \text{ mol of CO}_2.
\]

**Ex. Calculate number of molecules in 200 g of N\(_2\)O.**

Molar mass of N\(_2\)O = 44 g

i) to find number of moles:

\[
\frac{1\text{mol}}{44 \text{ g}} = \frac{200 \text{ g}}{44 \text{ g}} = 4.55 \text{ mol of N}_2\text{O}
\]

ii) to find number of molecules

\[
1\text{ mol} = 6.02 \times 10^{23} \text{ molecules}
\]

\[
\frac{6.02 \times 10^{23} \text{ molecules N}_2\text{O}}{4.55} = 2.74 \times 10^{24} \text{ molecules N}_2\text{O}
\]
Ex. Calculate the number of aluminium ions present in 0.051 g of aluminium oxide.

Ans : Molar mass of Al₂O₃ = 102 g

\[ Al₂O₃ \leftrightarrow 2 Al³⁺ + 3 O²⁻ \]

102 g of Al₂O₃ contains = \( 2 \times 6.02 \times 10^{23} \) Al³⁺ ions

\[ 2 \times 6.02 \times 10^{23} \text{ Al}³⁺ \text{ ions} \]

0.051 g of Al₂O₃ contains = \( \frac{102}{1} \times \frac{1}{2} \times 0.051 \)

= \( 2 \times 6.02 \times 10^{20} \) Al³⁺ ions

Q.1 Calculate the mass of one atom of sodium?

Q.2 The atomic mass of calcium is 40 u. What will be the number of calcium atoms in 0.4 u of calcium?

Q.3 How many atoms of oxygen are present in 120 g of nitric acid?

QUESTION BANK [ *HOTS ]

1 Mark Questions:

1. Who gave law of conservation of mass?

2. What term is used to represent the mass of 1 mole molecules of a substance?

3. What name is given to the number \( 6.023 \times 10^{23} \) ?

4. What is molecular mass?

5. Give Latin names for sodium & mercury.

6. *How many atoms are there in exactly 12 g of carbon?

7. Define mole.

8. Calculate formula unit mass of CaCl₂. [ At. Mass : Ca = 40 u, Cl = 35.5 u ]

9. Name a diatomic gas.

10. How many atoms are present in H₂SO₄.
2 Marks Questions:

1. Give the chemical symbols for the following elements: Gold, Copper, Potassium & Iron.

2. *What do the following symbols represent - i) H & ii) H₂


4. What elements do the following compounds contain?
   i) Water    ii) Lead nitrate

5. State the differences between an atom or a molecule.

6. Molar Mass of water is $18 \text{ g mol}^{-1}$, what is the mass of 1 mole of water?.

7. *The number of atoms in 1 mole of hydrogen is twice the number of atoms in one mole of helium. Why?

8. Write the chemical formula for the following:
   i) Silver oxide    ii) Iron (III) sulphate

9. Calculate molar mass of $\text{H}_2\text{O}_2$ & $\text{HNO}_3$.

10. What is the mass of 0.2 moles of oxygen molecules?

3 Marks Questions:

1. State the main postulates of John Dalton’s atomic theory.

2. What are polyatomic ions? Give two examples.

3. State the following
   i) Law of conservation of mass.   ii) Law of constant proportion

4. What is the mass of:
   i) 1 mol of N atoms.   ii) 4 mol of Al atoms.

5. What is meant by the term atomicity? State the atomicity of
   i) Phosphorous    ii) Sulphur

5 Marks Questions:

1. i) What is molecular formula? State with example what information can be derived from a molecular formula.

   ii) Write the names of the compounds represented by the following formulae:
       a) Mg(NO₃)₂   b) K₂SO₄   c) Ca₃N₂
2. i) What is gram molecular mass?
   ii) Write the formulae & names of the compounds formed between :
       a) Ferrous and sulphide ions    b) Aluminium and sulphate ions
       c) Potassium and chlorate ions d) Barium and chloride ions

3. i) Calculate the number of moles for the following:
       a) 52 g of He                    b) 17 g of H₂O

   ii) How many molecules are present in 34 g of ammonia ?

   iii) Calculate the mass of 0.5 mole of sugar (C₁₂H₂₂O₁₁).

You are expected to know............

- Laws of Chemical combination.
- John Dalton’s imagination about atom & the limitation of his theory.
- Difference between an atom & molecule.
- Types of ions
- Writing chemical formula of compounds.
- Relationship between Mole, Molar Mass & Avogadro Constant
CHAPTER -4 “STRUCTURE OF ATOM”

CONCEPT DETAILS

KEY CONCEPTS : [ *rating as per the significance of concept]

<table>
<thead>
<tr>
<th>#</th>
<th>Concept</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dalton’s Atomic theory</td>
<td>**</td>
</tr>
<tr>
<td>2.</td>
<td>J J Thomson Experiments</td>
<td>***</td>
</tr>
<tr>
<td>3.</td>
<td>Rutherford’s Scattering Experiments</td>
<td>********</td>
</tr>
<tr>
<td>4.</td>
<td>Sub atomic particles</td>
<td>*****</td>
</tr>
<tr>
<td>5.</td>
<td>Atomic number &amp; Mass number</td>
<td>*****</td>
</tr>
<tr>
<td>6.</td>
<td>Neil Bohr’s Atomic Model</td>
<td>***</td>
</tr>
<tr>
<td>7.</td>
<td>Electronic Configuration &amp; Valency</td>
<td>********</td>
</tr>
<tr>
<td>8.</td>
<td>Isotopes &amp; Isobars</td>
<td>****</td>
</tr>
</tbody>
</table>

Pre requisites:
- Difference between an atom & molecule.
- Gram atomic mass & Molar mass.
- Dalton’s Atomic theory.

SURVEY ANALYSIS

Conceptual levels of comprehension on the basis of feedback taken from the students
More than 2400 years ago, he named the smallest piece of matter “ATOMOS,” meaning “not to be cut.”

To Democritus,

- Atoms were small, hard particles that were all made of the same material but were different shapes and sizes.
- Atoms were infinite in number, always moving and capable of joining together

1. Dalton’s Atomic theory:

He proposed the Atomic theory of matter based on his experimental observations.
First recorded evidence that atoms existed.

Using his theory, Dalton rationalized the various laws of chemical combination

**Dalton's theory was based on the premise that the atoms of different elements could be distinguished by differences in their weights.**

- **Limitations**
  - The indivisibility of an atom was proved wrong, for, an atom can be further subdivided into protons, neutrons and electrons.
  - The atoms of same element are similar in all respects, but isotopes of same element have different mass.

**Dalton's theory was based on the premise that the atoms of different elements could be distinguished by differences in their weights.**

### 2. J J Thomson Experiments:

<table>
<thead>
<tr>
<th>SCIENTIST</th>
<th>PROPOSED ATOMIC MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joseph John Thomson</td>
<td>PLUM – PUDDING MODEL</td>
</tr>
<tr>
<td>British Physicist and Nobel laureate</td>
<td></td>
</tr>
</tbody>
</table>

- Discovered electrons in 1897.
- Showed us that the atom can be split into even smaller parts.

*His discovery was the first step towards a detailed model of the atom.*

- An atom is a uniform sphere of positive charges (due to presence of protons) as well as negative charges (due to presence of electrons).
- Atom as a whole is electrically neutral because the negative and positive charges are equal in magnitude.
An electron is a negatively charged component of an atom which exists outside the nucleus. Each electron carries one unit of negative charge and has a very small mass as compared with that of a neutron or proton.

JJ Thomson used cathode ray tubes to demonstrate that the cathode ray responds to both magnetic and electric fields.

Since the ray was attracted to a positive electric plate placed over the cathode ray tube (beam deflected toward the positive plate) he determined that the ray must be composed of negatively charged particles.

He called these negative particles "electrons."

Limitation: Model failed to explain how protons and electrons were arranged in atom so close to each other.

Eugene Goldstein:

<table>
<thead>
<tr>
<th>SCIENTIST</th>
<th>PROPOSED ATOMIC MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eugene Goldstein a German physicist</td>
<td><img src="image" alt="Eugene Goldstein's atomic model" /></td>
</tr>
</tbody>
</table>
- E. Goldstein in 1886 discovered the presence of new radiations in a gas discharge and called them canal rays. These rays were positively charged radiations which ultimately led to the discovery of another sub-atomic particle.

- Used a Cathode Ray Tube to study "canal rays" which had electrical and magnetic properties opposite of an electron.

- Canal Rays: The positively charged radiation produced in the discharge tube at low pressure and high voltage are called canal rays.

  **Protons:**
  *The canal rays have positively charged sub-atomic, particles known as protons (p).*

---

Q.1 What was the model of an atom proposed by Thomson?
Q.2 What is the nature of charge on electrons?
Q.3 What are canal rays?
Q.4 State the nature of the constituents of canal rays.

---

### 3. Rutherford’s Scattering Experiments:

<table>
<thead>
<tr>
<th>SCIENTIST</th>
<th>PROPOSED ATOMIC MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sir Earnest Rutherford</td>
<td><img src="image" alt="Rutherford Model" /></td>
</tr>
</tbody>
</table>

**Nobel Prize 1908**

**Experiment:** Rutherford took a thin gold foil and made alpha particles, \([ \text{He}^{2+} ]\) positively charged Helium fall on it.
<table>
<thead>
<tr>
<th>S.No</th>
<th>OBSERVATION</th>
<th>INFEERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Most of the a-particles passed through the gold foil without getting deflected.</td>
<td>Most of the space inside the atom is empty.</td>
</tr>
<tr>
<td>2.</td>
<td>Very few particles were deflected.</td>
<td>Positive charge of the atom occupies very little space.</td>
</tr>
<tr>
<td>3.</td>
<td>A very few alpha particles, 1 in 100000 completely rebound on hitting the gold foil.</td>
<td>Nucleus of an atom is very small as compared to the total size.</td>
</tr>
</tbody>
</table>

**Limitation:** In Rutherford’s atomic model, Nucleus & electrons are held together by electrostatic force of attraction which would lead to the fusion between them. This does not happen in the atom.

\[
\text{Atomic radius} \sim 100 \text{ pm} = 1 \times 10^{-10} \text{ m} \\
\text{Nuclear radius} \sim 5 \times 10^{-3} \text{ pm} = 5 \times 10^{-15} \text{ m}
\]
In 1932, James Chadwick proved that the atomic nucleus contained a neutral particle which had been proposed more than a decade earlier by Ernest Rutherford officially discovered the neutron in 1932, Chadwick received the Nobel Prize in 1935.

A neutron is a subatomic particle contained in the atomic nucleus. It has no net electric Charge, unlike the proton’s positive electric charge.

Q.1 Who discovered the nucleus of the atom?
Q.2 What is the charge on alpha particles?
Q.3 Which observation of Rutherford’s scattering experiment established the presence large empty space in atom?
Q.4 What is the nature of charge on nucleus of atom?
Q.5 Who discovered neutron?

4. Sub Atomic Particles:

<table>
<thead>
<tr>
<th>Name</th>
<th>Symbol</th>
<th>Location in the atom</th>
<th>Charge</th>
<th>Relative Mass</th>
<th>Actual Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electron</td>
<td>e^-</td>
<td>Around the nucleus</td>
<td>1-</td>
<td>1/1840</td>
<td>9.11 x 10^-28</td>
</tr>
<tr>
<td>Proton</td>
<td>P^+</td>
<td>In the nucleus</td>
<td>1+</td>
<td>1</td>
<td>1.67 x 10^-24</td>
</tr>
<tr>
<td>Neutron</td>
<td>n^0</td>
<td>In the nucleus</td>
<td>0</td>
<td>1</td>
<td>1.67 x 10^-24</td>
</tr>
</tbody>
</table>

Protons & Neutrons collectively are known as NUCLEONS.
Q.1 Why is the relative mass of an electron taken as negligible?
Q.2 Give the actual masses of electron & proton in kg?
Q.3 What are nucleons?

5. Atomic Number & Mass Number:

“Atomic number of an element is defined as the number of unit positive charges on the nucleus (nuclear charge) of the atom of that element or as the number of protons present in the nucleus.”

Atomic number, $Z = \text{Number of unit positive charge on the nucleus}$

$= \text{Total number of unit positive charges carried by all protons present in the nucleus.}$

$= \text{Number of protons in the nucleus (p)}$

$= \text{Number of electrons revolving in the orbits (e)}$

E.g.: - Hydrogen – Atomic number = 1 (1 proton)

Helium – Atomic number = 2 (2 protons)

Mass number $[A]$: It is defined as the sum of the number of protons & neutrons present in the nucleus of an atom.

Mass Number = Mass of protons + Mass of neutrons

E.g.: - Carbon – Mass number = 12 (6 protons + 6 neutrons) Mass = 12u

Aluminum – Mass number = 27 (13 protons + 14 neutrons) Mass = 27u
Q.1 The mass number of an element is 18. It contains 7 electrons. What is the number of protons and neutrons in it?

Q.2 An atom contains 3 protons, 3 electrons and 4 neutrons.
   i) What is its atomic number?
   ii) What is its mass number?

Q.3 An element is represented by $^{34}\text{P}$. Give the number of electrons and neutrons in it.

6. Niels Bohr Atomic Model:

<table>
<thead>
<tr>
<th>SCIENTIST</th>
<th>PROPOSED ATOMIC MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danish physicist</td>
<td></td>
</tr>
</tbody>
</table>

Main Postulates of the Bohr Model [refer NCERT Text Book article 4.3, page number-49]

Q.1 What happens when an electron jumps from lower to higher energy level? Q.2 Which energy shell is nearest to the nucleus of an atom? Q.3 Which energy shell has higher energy L or N?

7. Electronic configuration & Valency:

Bohr and Bury Scheme - Important Rules

<table>
<thead>
<tr>
<th>S.No</th>
<th>Electron Shell</th>
<th>$2n^2$ where $n = $ shell number</th>
<th>Maximum Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K Shell</td>
<td>$2 \times (1)^2$</td>
<td>2 electrons</td>
</tr>
<tr>
<td>2</td>
<td>L Shell</td>
<td>$2 \times (2)^2$</td>
<td>8 electrons</td>
</tr>
<tr>
<td>3</td>
<td>M Shell</td>
<td>$2 \times (3)^2$</td>
<td>18 electrons</td>
</tr>
<tr>
<td>4</td>
<td>N shell</td>
<td>$2 \times (4)^2$</td>
<td>32 electrons</td>
</tr>
</tbody>
</table>
The outermost shell of an atom cannot accommodate more than 8 electrons, even if it has a capacity to accommodate more electrons. This is a very important rule and is also called the OCTET RULE. The presence of 8 electrons in the outermost shell makes the atom very stable.

Q.1 An atom has atomic number 13. What would be its configuration? Q.2 What is octet rule? Q.3 How many electrons M shell can accommodate? Q.4 If an atom has complete K and L shell, what would be its atomic number?

8. Isotopes & Isobars:

<table>
<thead>
<tr>
<th>ISOTOPES</th>
<th>ISOBARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemically same, physically different</td>
<td>Chemically different, physically same</td>
</tr>
<tr>
<td>Number of electrons is same</td>
<td>Number of electrons is different</td>
</tr>
<tr>
<td>Cannot be separated by chemical means</td>
<td>Can be separated by chemical means</td>
</tr>
</tbody>
</table>

[for application of isotopes refer NCERT Text Book article 4.6, page number-53]

Q.1 Why atoms of isotopes are chemically same? Q.2 Give the representation of three isotopes of carbon which are C-12, C-13 and C-14.

1 Mark Questions:
1. Write the names of three elementary particles which constitute an atom.
2. Name the scientist & his experiment to prove that nucleus of an atom is positively charged.
3. Which is heavier, neutron or proton?
4. *How many times a proton is heavier than an electron?
5. What was the model of an atom proposed by Thomson?
6. How many electrons at the maximum can be present in the first shell?
7. What type of charge is present on the nucleus of an atom?
8. Give the number of protons in $^{35}\text{Cl}$
9. *What are isobars?
10. Name the particles which determine the mass of an atom.
11. Why did Rutherford select the gold foil in his α particle scattering experiment.
12. The atomic no of Argon and Calcium are 18 and 20 respectively. Mass no of both the element are 40. Write the term used for such a pair of element.

2 Marks Questions:
1. Define the following terms: a) Atomic number b) Mass number
2. Write the charges on sub atomic particles.
3. Identify the isotopes out of A, B, C & D ? $^{33}A_{17}, ^{40}B_{20}, ^{37}C_{17}, ^{38}D_{19}$

4. * Give one Achievement and one limitation of J.J Thomson’s model of atom?

5. What are valence electrons? Give example.

6. *Which kind of elements have tendency to lose electron? Give example.

7. How many electrons are present in the valence shell of nitrogen & argon?

8. State the maximum capacity of various shells to accommodate electrons.

9. Give the symbol, relative charge & mass of the three sub atomic particles.

10. From the symbol $^{32}S_{16}$ state:
   i) Atomic number of sulphur,
   ii) Mass number of sulphur
   iii) Electronic configuration of sulphur.

3. Marks Questions:
1. Why do Helium has Zero valency?

2. An atom contains 3 protons, 3 electrons and 4 neutrons. What is its atomic number, mass number & valency?

3. *How are the isotopes of hydrogen represented?

4. Write the complete symbol for the atom with the given atomic number [Z] & mass number[A].
   i) Z= 17 , A = 15;   ii) Z=4 , A = 9;   iii) Z= 92 ; A=233

5. *What would be the electronic configuration of Na$^+$, Al$^{3+}$, O$^{2-}$, Cl$^-$.?

6. Complete the following table:

<table>
<thead>
<tr>
<th>Element</th>
<th>Atomic No</th>
<th>Mass No</th>
<th>Proton</th>
<th>Neutron</th>
<th>Electron</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td>35</td>
<td>-</td>
<td>-</td>
<td>17</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
</tbody>
</table>

5 Marks Questions:

1.* a) Give the observations as well as inferences of Rutherford’s Scattering experiment for determining the structure of an atom.
   b) On the basis of above experiment write the main features of atomic model.

2. Write the main postulates of Bohr’s Model of Atom.

You are expected to know.........

➢ The scientists who discovered subatomic particles.
➢ Rutherford established the existence of nucleus.
➢ Difference between Atomic number and Mass number
➢ Electronic configuration & its relation with Valency.
➢ Difference between Isotope and Isobar.

************

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**“Fundamental particles in Atom”**

<table>
<thead>
<tr>
<th>Name of Elements</th>
<th>Symbol</th>
<th>Atomic Number</th>
<th>Number of Electrons</th>
<th>Number of Protons</th>
<th>No. of Neutrons</th>
<th>Atomic Mass</th>
<th>Electronic Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>H</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>K</td>
</tr>
<tr>
<td>Helium</td>
<td>He</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>L</td>
</tr>
<tr>
<td>Lithium</td>
<td>Li</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>M</td>
</tr>
<tr>
<td>Beryllium</td>
<td>Be</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>N</td>
</tr>
<tr>
<td>Boron</td>
<td>B</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>C</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>O</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Flourine</td>
<td>F</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Neon</td>
<td>Ne</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>Na</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>12</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mg</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>Al</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>14</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Silicon</td>
<td>Si</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td>P</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Sulphur</td>
<td>S</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>Cl</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>18</td>
<td>35.5</td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>Ar</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>K</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>20</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>Ca</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
MULTIPLE CHOICE QUESTIONS ON CHEMISTRY PRACTICALS

1. To prepare
   a) a true solution of common salt, sugar and alum
   b) a suspension of soil, chalk powder and fine sand in water
   c) a colloidal of starch in water and egg albumin in water and distinguish between these on the basis of i) transparency  ii) filtration criterion  iii) stability

1. Name the solute in common salt solution :
   a) H₂O   b) NH₄Cl
   c) NaOH   d) NaCl

2 Pick out a colloid from the following :
   Sugar solution  Salt solution  Muddy solution  Milk solution

3. Which of the following is property of true solution ?
   a) Homogeneous   b) Heterogeneous
   c) Translucent   d) None of these

4. The process of separation of insoluble solids from a liquid is called :
   a) Filtration   b) Decantation
   c) Sedimentation   d) Evaporation

5. Which of the following mixtures is stable?
   a) chalk in water   b) Sugar in water
   c) Sand in water   d) Wheat flour in cold water
6. Egg albumin in water forms:
   a) True solution    b) Colloidal solution
   c) Suspension      d) None of these

7. Which of the following represents a correct set of observations for a mixture of common salt and water?

<table>
<thead>
<tr>
<th>Transparency</th>
<th>Stability</th>
<th>Filtration</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Transparent</td>
<td>Unstable</td>
<td>No residue</td>
</tr>
<tr>
<td>b) Transparent</td>
<td>Stable</td>
<td>No residue</td>
</tr>
<tr>
<td>c) Translucent</td>
<td>Stable</td>
<td>No residue</td>
</tr>
<tr>
<td>d) Opaque</td>
<td>Unstable</td>
<td>Residue</td>
</tr>
</tbody>
</table>

2. To prepare a) a mixture   b) a compound
   using iron filings and sulphur powder and distinguish between these on the basis of:
   i. appearance i.e., homogeneity and heterogeneity
   ii. behaviour towards a magnet
   iii. behaviour towards carbon disulphide as a solvent.
   iv. effect of heat.

1. The colour of sulphur is:
   a) White    b) Colourless
   c) Green    d) Yellow

2. FeS is not attracted by magnet because:
   a) It has lost properties of its components.  b) It is not made up of iron.
   c) It is a mixture                           d) It is black in colour.

3. Sulphur is soluble in:
   a) Water    b) Carbon disulphide
   c) Both (a) and (b)                         d) Neither (a) not (b)
4. In FeS, the particles of iron and sulphur are:
   a) Visible  
   b) Not visible  
   c) Visible under microscope  
   d) None of these

5. Iron reacts with sulphur to form FeS at:
   a) High temperature  
   b) Low temperature  
   c) Moderate temperature  
   d) Below 0°C

6. When a mixture of iron fillings and sulphur is heated, the colour of the mixture changes from:
   a) Black to yellow  
   b) Yellow to black  
   c) Greyish yellow to black  
   d) Black to brown

7. Which of the following has lowest melting point:
   a) Iron  
   b) Sulphur  
   c) Iron sulphide  
   d) Carbon

3. To carry out the following reactions and classify them as physical or chemical changes.
   a. Iron with copper sulphate solution in water.
   b. Burning of magnesium in air.
   c. Zinc with dilute sulphuric acid d. Heating of copper sulphate e. Sodium sulphate with barium chloride in the form of their solutions in water.

1. The colour of hydrated copper sulphate is:
   a) Blue  
   b) Colourless  
   c) Brown  
   d) Yellow

2. What happens when Zn granules react with dilute sulphuric acid:
   a) Bubbles due to colourless, odourless gas are formed and colourless solution is obtained.
   b) No reaction takes place.
   c) Pungent smelling gas comes out.
   d) No gas evolved.
3. Fe + CuSO₄ → FeSO₄ + Cu is an example of:
   a) Displacement reaction            b) Decomposition reaction
   c) Redox reaction                  d) Double decomposition

4. What happens when iron nails are added to copper sulphate solution:
   a) The solution becomes pale green and reddish brown copper metal gets deposited.
   b) The solution becomes colourless
   c) There is no reaction
   d) Copper displaces iron

5. BaSO₄ is:
   a) White ppt
   b) Colourless
   c) Blue solution
   d) Blue ppt.

6. Magnesium oxide, when placed on moist red litmus paper:
   a) It remains red
   b) It turns blue
   c) It becomes white
   d) It becomes black

7. What is the nature of SO₂:
   a) Acidic
   b) Basic
   c) Neutral
   d) All of these

4. To separate the components of a mixture of sand, common salt and ammonium chloride (or camphor) by sublimation.

1. Sublimation is the process in which:
   a) Liquid changes into gaseous state
   b) Solid changes into liquid state
   c) Solid directly changes into gaseous form
   d) Solid first converts into liquid, then into vapour form.
2. Which of the following substances sublimes on heating:
   a) Iodine 
   b) Camphor 
   c) Naphthalene 
   d) All of these

3. In a mixture of sand, common salt and ammonium chloride, the substance that sublimes is:
   a) Ammonium chloride 
   b) Sand 
   c) Common salt 
   d) All of these

4. Recovery of salt from salt solution in water can be done by:
   a) Evaporation 
   b) Distillation 
   c) Filtration 
   d) None of these

5. What do you observe in the inner side of the funnel during sublimation of NH₄Cl
   a) Particles of white solid 
   b) Yellow fumes 
   c) Vapour of sodium chloride 
   d) No fumes are deposited

6. Which of the following mixtures cannot be separated by sublimation:
   a) Ammonium chloride & sodium chloride 
   b) Ammonium chloride & sand 
   c) Ammonium chloride & iodine 
   d) Ammonium chloride & copper sulphate

7. A mixture of common salt and ammonium chloride is heated in a china dish covered with an inverted funnel with stem closed with a cotton plug. After the experiment the china dish will contain:
   a) Common salt 
   b) Ammonium chloride 
   c) Both (a) and (b) 
   d) None of these.

5. To determine the melting point of ice and the boiling point of water.

1. Which of the following will help in determining the melting point of ice accurately?
   a) Ice made from tap water 
   b) Ice made from distilled water 
   c) Ice made mixed with salt 
   d) None of these
2. In determination of melting point of ice, the ice is contaminated with some non-volatile impurity, like common salt, melting point of ice will:
   a) Increase  b) Decrease
   c) May increase or decrease  d) Does not change

3. What is the melting point of ice?
   a) 0°C  b) 100°C
   c) 273 K  d) Both (a) and (c)

4. Which vessel is used to determine the melting point of ice?
   a) Beaker  b) R B Flask
   c) Conical Flask  d) Measuring Flask

5. At what temperature ice and water both exist together under normal atmospheric pressure?
   a) Below 273.16 K  b) Above 273.16 K
   c) At 273.16 K  d) None of these

6. In determining the boiling point of water, correct reading is obtained when:
   a) Temperature start rising  b) Water starts boiling
   c) Whole of water evaporates  d) Temperature becomes constant

7. Water evaporates faster:
   a) In still air  b) In humid air
   c) In dry air  d) In windy & dry air

6. To verify the law of conservation of mass in a chemical reaction.

1. What does the law of conservation of mass state?
   a) It states that mass is neither created nor destroyed.
   b) It states that mass can be created or destroyed.
   c) It states that mass cannot be created but can be destroyed.
   d) It states that mass can be created but cannot be destroyed.
2. If you melt 100 g of ice will you get the same mass of water?
   a) Yes   b) No
   c) May be   d) Sometimes

3. State the chemical reaction between Barium Chloride (aqueous) & Sodium Sulphate (aqueous).
   a) $\text{BaCl}_2 (aq) + \text{Na}_2\text{SO}_4 (aq) \rightarrow \text{BaSO}_4 \text{ (white ppt)} + 2\text{NaCl (aq)}$
   b) $\text{BaCl}_2 (aq) + \text{Na}_2\text{SO}_4 (aq) \rightarrow \text{BaSO}_3 \text{ (red ppt)} + 2\text{NaCl (aq)}$
   Both (a) & (b)  d) None of these

4. Which of the following reaction does not conform to law of conservation of mass?
   a) Burning of candle   b) Melting of ice
   c) Fusion reaction occurring in sun  d) Combustion of fuel

5. In the reaction $2\text{NaN}_2 \rightarrow 2\text{Na} + 3\text{N}_2$, if 850 g of $\text{NaN}_2$ is decomposed to give 265.20 g of $\text{Na}$, how much $\text{N}_2$ is produced?
   a) 584.80 g   b) 265.20 g
   c) 850 g   d) 484.20 g

6. In chemical reactions how does law of conservation of mass contribute in writing chemical equations?
   a) It does not help.   b) Equations can be balanced by writing their correct co-efficient
   c) Both (a) and (b)  d) None of these

7. In accordance with the law of conservation of mass give the co-efficient of $\text{O}_2$ in the equation:
   \[ \text{C}_5\text{H}_{12} + \text{O}_2 \rightarrow 5\text{CO}_2 + 6\text{H}_2\text{O} \]
   a) 4   b) 6
   c) 8   d) 2
References:
- NCERT text book for class IX
- Foundation science for class IX By- H C Verma
- Self-study in Science By-Evergreen Publications

- [http://www.shikshaservices.com/content/getPage/Matter%20in%20our%20surroundings/103](http://www.shikshaservices.com/content/getPage/Matter%20in%20our%20surroundings/103)
- [http://www.ehow.com/list_7447055_important-metal-alloys.html](http://www.ehow.com/list_7447055_important-metal-alloys.html)
- [www.mpinstance.in](http://www.mpinstance.in)
- [http://www.emc.maricopa.edu/faculty/farabee/biobk/biobookchem1.html](http://www.emc.maricopa.edu/faculty/farabee/biobk/biobookchem1.html)

VIDEO LINKS

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<td><a href="http://www.youtube.com/watch?v=s-KvoVzukHo">http://www.youtube.com/watch?v=s-KvoVzukHo</a></td>
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<td>States of Matter : SONG</td>
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<td>4.</td>
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<td>Compound &amp; Mixture</td>
<td><a href="http://www.youtube.com/watch?v=cL6l1O1YHH0">http://www.youtube.com/watch?v=cL6l1O1YHH0</a></td>
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<td><a href="http://www.youtube.com/watch?v=4ueTSxC4zr4">http://www.youtube.com/watch?v=4ueTSxC4zr4</a></td>
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<td>7.</td>
<td>Latent heat</td>
<td><a href="http://www.youtube.com/watch?v=Hg8Pw2Kd4og">http://www.youtube.com/watch?v=Hg8Pw2Kd4og</a></td>
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<td><a href="http://www.youtube.com/watch?v=sQUcKiwxtoE">http://www.youtube.com/watch?v=sQUcKiwxtoE</a></td>
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<td>9.</td>
<td>True solution , sol &amp; suspension [II]</td>
<td><a href="http://www.youtube.com/watch?v=q96ljVMHYLo">http://www.youtube.com/watch?v=q96ljVMHYLo</a></td>
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<td>10.</td>
<td>Earliest Models - ATOM</td>
<td><a href="http://www.youtube.com/watch?v=BhWqv0STLZs">http://www.youtube.com/watch?v=BhWqv0STLZs</a></td>
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Chapter 5: “The Fundamental Unit of Life”

KEY CONCEPTS: [*rating as per the significance of concept*]

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<th>CONCEPTS</th>
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<td>Study of historical perceptive related to cell</td>
<td>*****</td>
</tr>
<tr>
<td>Discovery</td>
<td></td>
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<tr>
<td>Study of Microscope</td>
<td>**</td>
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<tr>
<td>Study of Hypotonic/Isotonic/Hypertonic solutions relation to osmosis.</td>
<td>****</td>
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<tr>
<td>Cell wall</td>
<td>***</td>
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<tr>
<td>Nucleus</td>
<td>*****</td>
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<tr>
<td>Cytoplasm</td>
<td>***</td>
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<tr>
<td>Cell organelles</td>
<td>*****</td>
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</table>

1. All the living organisms are made up of fundamental unit of life called” cell”.
2. The cell is a Latin word for “a little room”.
3. The scientist Robert Hooke saw a little room in the cork (the bark of a tree) resembled the structure of a honeycomb. The use of the word “Cell” to describe these units is used till this day in Biology as” Cell Biology”.
4. The Compound Microscope consist eye piece, objective lens and condenser to observe a cell after putting a drop of Safranin (for plant cell) and methylene blue (for animal cell). (Please refer to Fig. 5.1: Compound Microscope NCERT Book Page-57)
5. The scientist Leeuwenhoek saw free living cells in the pond water for the first time. (father of microbiology)
6. The scientist Robert Brown discovered the nucleus in the cell.
7. The cell theory states that all the plants and animals are composed of cells, it was proposed by Schleiden and Schwann. Cell is structural and functional unit of all living beings.
8. The cell theory was further expanded by Virchow by suggesting that “all cells arise from the pre-existing cells”.
9. The cells differ in size, shape, structure (Please refer to Fig. 5.2/5.3: Onion peel/Various cells in Human body, NCERT Book Page-57/58): Types of cells: Onion cells, Smooth muscle cell, Blood cells, Bone cell, Fat cell, Nerve cell, Ovum, Sperm etc. Each kind of cell performs specific function.
   - The Largest Animal Cell → Egg of an ostrich
   - Longest cell → Nerve cell
   - Smallest cell → Mycoplasma (PPLO)
- A single cell may constitute a whole organism as in Amoeba, Chlamydomonas, Paramecium and Bacteria; these are called as unicellular organisms. Whereas in multi-cellular organisms (Human beings) division of labor is seen.
- The feature in almost every cell is same: Plasma membrane, nucleus and cytoplasm.
- Plasma membrane: It is the outermost covering of the cell.
  It is called as selectively permeable membrane (because it prevents movement of some materials).
  It helps in diffusion and osmosis
  Diffusion: movement of substance from high concentration to low concentration.
  Eg; exchange of carbon dioxide or oxygen with external environment.

osmosis: it is the passage of water from the region of high water concentration to a region of low water concentration through a selectively permeable membrane. [ SPM]

a) The cell gains water, if the medium surrounding the cell has a higher water concentration (Hypotonic solution) than the cell. (Cell will be swell)

b) The cell maintains the same water concentration as the cell (Isotonic solution), water crosses the cell membrane in both directions.
c) The cell loses water, if the medium has lower water concentration (Hypertonic solution) than the cell. (The cell will be Shrink)

Note - The cell drinking is endosmosis;
- omission (Coming out of water) of water is called ex-osmosis.

13. The cell engulfs food is called endocytosis and ejects solid is called exocytosis. Amoeba acquires food through endocytosis and excretion of solid is called exocytosis.

14. The cell wall is a rigid outer covering composed of cellulose. It provides structural strength to plant cells. When a living cell loses water, there is shrinkage of contents of a cell away from the cell wall. This phenomenon is called as plasmolysis. The cell walls permit the cells of plants, fungi and bacteria to withstand very dilute (Hypotonic) external media without bursting.

15. The Nucleus: It is a dark colored, spherical or oval, dot-like structure near the center of a cell called Nucleus. The nucleus plays a central role in cellular activities/reproduction. The chromatin material gets organized into chromosomes. The chromosomes contain information for inheritance of features from parents to next generations in the form of DNA (Deoxyribo Nucleic Acid) and protein molecules. The functional segments of DNA are called genes.

16. In some organisms like Bacteria nucleus is not covered by nuclear membrane. Hence it is called as prokaryote. (Pro = primitive; karyote = karyon = nucleus.) The organisms with cells having a nuclear membrane are called eukaryotes.

17. Differences between prokaryotes and eukaryotes (Please refer to Fig. 5.4: Prokaryotic cell NCERT Book Page-62)

<table>
<thead>
<tr>
<th></th>
<th>Prokaryotes</th>
<th>Eukaryotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size: generally small</td>
<td>(1-10 µm)</td>
<td>Size: generally large. (5-500 µm)</td>
</tr>
<tr>
<td>Nuclear region:</td>
<td>Not well defined and not surrounded by a nuclear</td>
<td>Well defined and surrounded by a nuclear membrane</td>
</tr>
<tr>
<td></td>
<td>membrane known as nucleoids.</td>
<td></td>
</tr>
<tr>
<td>Chromosome:</td>
<td>Single</td>
<td>More than one chromosome</td>
</tr>
<tr>
<td>Membrane-bound cell</td>
<td>Absent</td>
<td>Membrane-bound cell organelles present</td>
</tr>
<tr>
<td>organelles:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eg: bacteria, blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green algae</td>
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</table>
18. **Cell organelles**: Every cell has fluid matrix (other than nucleus) is called cytoplasm. The nucleus and cytoplasm is together called as protoplasm. The protoplasm term was coined by Purkinje. It has important cell organelles: Endoplasmic Reticulum (ER), Golgi apparatus, Lysosomes, Mitochondria, Plastids, and vacuoles.

19. **Endoplasmic Reticulum (ER)**: It is a large network of membrane-bound tubules and vesicles.
   - There are two types of Endoplasmic Reticulum (RER AND SER)
   - Rough Endoplasmic Reticulum (RER) (It looks rough because Ribosomes are attached to its surface. They are the sites of protein synthesis).
   - Smooth Endoplasmic Reticulum (SER) (It looks smooth because Ribosomes are not attached to its surface. They are the sites of fat molecules synthesis).
     1. SER; help in the functioning of enzymes and hormones to carryout biochemical activities.
     2. SER detoxifies many poisons and drugs from the cell.
     3. ER serves as channel for the transport of material between various regions of the cytoplasm and the nucleus.
     4. Proteins and fat molecules produced by ER helps in membrane biogenesis.

20. **Golgi apparatus**: It was first described by a scientist Camillo Golgi. It is a system of membrane-bound vesicles called cisterns. It functions include the storage, modification and package of cell products. The complex sugars are made from simple sugars in the Golgi apparatus. It is also involved in the formation of lysosomes.

21. **Lysosomes**: They contain membrane-bound sacs with powerful digestive enzymes (enzymes are made by RER) to digest the worn-out cell organelles. When the cell gets damaged, lysosomes may burst and the enzymes digest their own cell, hence called as “Suicidal bags of a cell”. It is a waste disposal system of the cell.

22. **Mitochondria**: It is covered by a double membrane. Outer membrane is very porous and the inner membrane is deeply folded. These folds create a large surface area for ATP (Adenosine Triphosphate) molecule synthesis. ATP is the energy currency of a cell; hence the Mitochondria are called as Power House of a Cell. Mitochondria have their own DNA and Ribosomes; therefore they can make their own proteins.

23. **Plastids**: They are present only in plant cells. They are two types.
   1. Chromoplasts (Colored Plastids: Chloroplasts – Green pigmented and useful in Photosynthesis and also contains various other pigments like yellow or orange)
   2. Leucoplasts (White or colorless plastids; stores materials such as oils, proteins, fats etc.) Plastids are also covered by a double membrane. The matrix is called Stroma, seat for enzymatic actions. Plastids have their own DNA and Ribosomes; therefore they can make their own proteins.
24. **Vacuoles**: Storage sacs for solid or liquid contents. They are small in size in animals while plants have large, may occupy 50-90% of the cell volume. Helps to provide turgidity and rigidity to the cell. Many substances like amino acids, sugars, organic acids and proteins are stored in vacuoles. In Amoeba food vacuole is specialized to play an important role. The membrane of vacuole which called tonoplast.

25. **Cell**: It is the fundamental structural unit of living organisms, helps in respiration, obtaining nutrition and clearing waste material or forming a new protein. Differences between Plant cell and Animal Cell

<table>
<thead>
<tr>
<th>(Please refer to Fig. 5.5 Animal cell &amp; 5.6: Plant cell NCERT Book Page-63&amp;64) ANIMAL CELL</th>
<th>PLANT CELL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell wall absent</td>
<td>Cell wall present</td>
</tr>
<tr>
<td>Plasma membrane is the outer layer which provides turgidity to the cell</td>
<td>Cell wall is the outer layer which gives rigidity and turgidity to the cell</td>
</tr>
<tr>
<td>Vacuoles are small in size</td>
<td>Vacuoles are big in size</td>
</tr>
<tr>
<td>Plastids are absent</td>
<td>Plastids are present</td>
</tr>
<tr>
<td>Nucleus lies in the centre</td>
<td>Nucleus lies on one side</td>
</tr>
</tbody>
</table>

**Question Bank**

1. All the living organisms are composed of fundamental unit called as............... (Cell)

2. Who discovered the nucleus in the cell...............................(Robert Brown)

3. Who saw the free living cells for the first time.................(Leeuwenhoek)

4. Name two unicellular organisms ..................... ...................(Amoeba, Chlamydomonas,)

5. Write two differences between prokaryotes and eukaryotes...............(Nuclear region/ Chromosome)

6. What are the two types of ERs ...... (RER/ SER)

7. What are the functions of Golgi Bodies? (It includes the storage, modification and package of cell products. The complex sugars are made from simple sugars in the Golgi apparatus).

8. What are the types of plastids (Chromoplasts & Leucoplasts)
9. Which are the substances stored in vacuoles? (Substances like amino acids, sugars, organic acids and proteins are stored in vacuoles)

10. Draw and label Animal cell & Plant cell (Ref NCERT Book Page-63&64)
11. Where is proteins synthesis inside the cell? (Ribosomes)
12. Why are lysosomes known as suicide bags?
QUESTION PAPER: FORMATIVE ASSESSMENT – I (For Practice)

Marks- 40  
Time: 90 minutes

* General Instructions

1. Questions 1-5 (1 Mark each)  
2. Questions 6-10 (2 Mark each)  
3. Questions 11-15 (3 Mark each)  
4. Questions 16-17 (5 Mark each)

Q.1 What is ATP, expand the term ...........................................

Q.2 Cellulose is a Fat (Mention, True/False) .............................

Q.3 Which cell organelle is synthesizing the enzymes for the Golgi Apparatus .................

Q.4 The flexibility of the cell membrane to engulf food and other material is called Endocytosis (Mention, True / False) .................................

Q.5 What is the main function of Leucoplasts?

Q.6 Draw the structure of Ovum.

Q.7 Why the Plasma membrane is called as Selective Permeable Membrane? Q.8 Describe what is an isotonic solution

Q.9 What is Plasmolysis?

Q.10 Write any two parts of a Compound microscope.

Q.11 Distinguish between Prokaryotic and Eukaryotic Cell.

Q.12 Write about the three properties of Cytoplasm.

Q.13 What is the significance of Vacuoles

Q.14 Write a short notes on Mitochondria.

Q.15 Explain the concept of diffusion.

Q.16 Draw the structure of a plant Cell and label it.

Q.17 Write the differences between a plant and animal cell.
Chapter 6: “Tissues”

**KEY CONCEPTS:** [*rating as per the significance of concept*]

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<tr>
<td>Permanent tissues in plants</td>
<td>****</td>
</tr>
<tr>
<td>Animal tissues</td>
<td>*****</td>
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1. **Tissue** is a group of cells having similar origin, structure & function. Study of tissues is called **Histology**
2. In unicellular organism (Amoeba) single cell performs all basic functions, whereas in **multi-cellular organisms** (Plants and Animals) shows **division of labor as Plant tissue & Animal tissues**.
3. Plant tissues are two types: Meristems & Permanent tissues.

4. **Meristems**: The Meristems are the tissues having the power of cell division. It is found on those region of the plant which grows.

5. Types of Meristems;
   1. **The Apical meristems – It is present** at the growing tip of the stem and root and increases the length.
   2. **The lateral meristems - present** at the lateral side of stem and root (cambium) and increases the girth.
   3. **The intercalary meristems - present** at internodes or base of the leaves and increases the length between the nodes.

   (Please refer to Fig. 6.2: location of meristems in plant body, NCERT Book Page- 69).

26. **Permanent tissues**: Two types such as Simple permanent tissues & Complex permanent tissues.
   a) **Simple permanent tissues**: subdivided as
      (i): **Parenchyma**: Tissues provide the support to plants. They are loosely packed and has large intracellular space.
- Parenchyma with chlorophyll which performs photosynthesis is called as chlorenchyma.

- The parenchyma with large air spaces to give buoyancy is called as aerenchyma. Parenchyma also stores food and water.

(ii) **Collenchyma**: Tissue provides mechanical support, thickened at the corners, have very little intercellular space. It allows easy bending of various parts of a plants without breaking.

(iii) **Sclerenchyma**: Tissue makes the plant hard and stiff, thickened due to lignin and no intercellular space. Cells of this tissue are dead and commonly seen in the husk of coconut.

**Guard cells & Epidermal tissue**: the tissue aids in protection and exchange of gases. Guard cells kidney shaped in dicots, dumb bell shaped in monocots to guard the stomata. The epidermal tissues of roots aid in absorption of water and minerals. The epidermal tissues in desert plants have a thick waxy coating of Cutin with waterproof quality. The epidermal tissues form the several layer thick Cork or the Bark of the tree.  
*(Please refer to Fig. 6.3-6.6, NCERT Book Page-70-73).*

b) **Complex permanent tissues**: The complex tissues are made of more than one type of cells. All these cells coordinate to perform a common function.

They are subdivided as:

**Xylem**: It consists of tracheids, vessels, xylem parenchyma and xylem fibers. The cells have thick walls,

**Function** - aids in conduction of water and minerals.

**Phloem**: It consists of sieve tubes, companion cells, phloem parenchyma, and phloem fibers.

**Function** - Phloem transports food material to other parts of the plants.  
*(Please refer to Fig. 6.7, NCERT Book Page-73).*

6. **Animal tissues**: Sub divided as **epithelial tissue, connective tissue, muscular tissue and nervous tissue**.

1. **Epithelial tissue**: It is a protective covering forming a continuous sheet. Simple epithelium is the one which is extremely thin in one layer, whereas stratified epithelium are arranged in pattern of layers. Depending on shape and function they are classified as:

   a) **Squamous epithelium** in the lining of mouth and esophagus.
b) **Cuboidal epithelium** in the lining of kidney tubules and salivary glands.

c) **Columnar epithelium** in the intestine & Columnar epithelium with cilia in the lining of respiratory tract.

d) **Glandular epithelium** in the Glands aids in a special function as gland cells, which can secrete at the epithelial surface.

(Please refer to Fig. 6.9, NCERT Book Page-75).

ii) **Connective Tissue: Five Types, such as;**

   a) **Blood:** The Blood is a fluid connective tissue. Blood plasma has RBCs (Red BloodCells) WBCs (White Blood Cells) and platelets. Blood plasma contains proteins, salts and hormones. Blood flows and transports gases, digested food, hormones and waste materials.

   b) **Bone:** The bone is a connective tissue with hard matrix, composed of calcium and phosphorus. A bone is connected by another bone with another connective tissue called ligaments. A bone is connected by muscle with another connective tissue called tendon.

   c) **Cartilage:** The cartilage is a connective tissue with solid matrix composed of proteins and sugars. It is commonly seen in nose, ear, trachea, and larynx.

   d) **Areolar Connective Tissue:** It is found between the skin and muscles, around the blood vessels. It supports internal organs and aids in repair of tissues.

   e) **Adipose Connective Tissue:** It is filled with fat globules for the storage of fat. It acts as insulator. (Please refer to Fig. 6.10, NCERT Book Page-76).

**Muscular tissues:** They have special contractile proteins responsible for movements. Three types, such as;

**Striated muscles/skeletal muscles/voluntary muscles:**
They are cylindrical, un-branched and multinucleated. They have dark bands and light bands.

**Unstriated muscles/smooth muscles/involuntary muscles:**
They are commonly called as Smooth muscles, having no striations (dark bands/ light bands are absent). Commonly found alimentary canal, ureters, Iris of an Eye. They are spindle shaped. Involuntary in nature

**Cardiac Muscles:** They are commonly called as Heart muscles, cylindrical, branched and uninucleate. Involuntary in nature. (Please refer to Fig. 6.11, NCERT Book Page-77).

**Nervous Tissue:** The tissue responds to stimuli. The brain, spinal cord and nerves are composed of nervous tissue or neurons. A neuron consists of Cell Body, cytoplasm, Nucleus, Dendrite, Axon, nerve ending. The neuron impulse allows us to move our muscles when we want to respond to stimuli. (Please refer to Fig. 6.12, NCERT Book Page-78).
Question Bank

1. Define the term tissue……………… ( A group of cells forms tissue)
2. What is Histology? ( Study of different tissues)
3. How many types of meristems are present in plants? (3 : Apical meristems, Lateralmeristem, Intercalary meristem )
4. Name the Parenchyma with chlorophyll which performs photosynthesis........................ (chlorenchyma)
5. Which plant tissue makes the plant hard and stiff and thickened due to lignin with no intercellular spaces .......................( Sclerenchyma)
6. Give the details of epidermal tissue in Plants. (For protection and exchange of gases. Guard cells kidney shaped in dicots, dumb bell shaped in monocots to guard the stomata. The epidermal tissues of roots aid in absorption of water and minerals.)
7. Which elements constitute the Phloem? (Sieve tubes, companion cells, phloem parenchyma, and phloem fibers.)
8. Distinguish between ligament and tendon (A bone to bone connective tissue called ligament. A bone to muscle connective tissue called tendon.)
9. Name the three muscular tissues in the animals........(Striated muscles ,Un- Striated muscles, Cardiac Muscles)
10. Draw the neuron and label it (Please refer to Fig. 6.12, NCERT Book Page-78).
QUESTION PAPER: FORMATIVE ASSESSMENT – I (For Practice)

Marks- 40

Time: 90 minutes

* General Instructions

1. Questions 1-5 (1 Mark each)
2. Questions 6-10 (2 Mark each)
3. Questions 11-15 (3 Mark each)
4. Questions 16-17 (5 Mark each)

Q.1 What is a group of cells that are similar in structure and work called?

Q.2 Which is the hardest connective tissue?

Q.3 What is the name of Blood matrix?

Q.4 By what process permanent tissues are formed?

Q.5 Two bones are connected with ligaments. Mention True/False.................

Q.6 What are the two main types of tissues found in plants? Q.7

Draw the structure of Stomata and label it.

Q.8 Write the main functions of parenchyma

Q.9 What are the fluid connective tissues?

Q.10 What is the difference between voluntary and involuntary muscles? Q.11

Write a short notes on Cardiac muscles.

Q.12 Draw a labeled diagram of areolar tissue.

Q.13 Mention the three elements of Xylem tissue. Q.14. Write a short notes on Glandular Epithelium. Q.15. Write three significant points about Sclerenchyma

Q.16 With the help of suitable diagram, describe the Phloem. Q.17

Draw and label the Nerve Cell. Explain in brief.
Chapter 7: “Diversity in Living Organisms”

KEY CONCEPTS: [*rating as per the significance of concept]

<table>
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<tr>
<th>CONCEPTS</th>
<th>RATING</th>
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</thead>
<tbody>
<tr>
<td>Basis of classification</td>
<td>***</td>
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<tr>
<td>Hierarchy of classification</td>
<td>****</td>
</tr>
<tr>
<td>Kingdom Plantae</td>
<td>*****</td>
</tr>
<tr>
<td>Kingdom Animalia</td>
<td>*****</td>
</tr>
</tbody>
</table>

1. Each **organism** is different from all other organisms.

2. In this activity, we decide which **characteristics** (we can run, but the Banyan tree can’t run is a characteristic) are important in forming the desired **category**.

3. **Greek thinker Aristotle classified animals according to whether they lived on land, in water or in air.** This classification is a landmark in ideology, but has limitations. For example, animals that live in the sea include Corals, Whales, Octopus, Starfish, and Shark. In fact they are different from each other.

4. **Classification and Evolution**: organisms are classified based on body design, hierarchy in developing, relation to evolution. **Charles Darwin** first described the idea of evolution in 1859 in his book “ *The Origin of Species*”

5. The Biologists, such as Haeckel, Whittaker & Carl Woese tried to classify all living organisms into broad Kingdoms. **The Whittaker proposed five kingdoms: Monera, Protista, Fungi, Plantae and Animalia.** Carl Woese introduced by dividing Monera into Archaebacteria and Eubacteria.
6. Hierarchy of Classification:

**Linnaeus's System of Classification**

- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species

7. **Monera**: They have **unicellular, Prokaryotic organisms** (do not have defined nucleus or organelles). The cell wall may or may not be present. The mode of nutrition is **autotrophic** (synthesizing food on their own) **or** **heterotrophic** (getting food from environment). Ex. **Bacteria, Anabaena.** (Please refer to Fig. 7.1 Monera NCERT Book Page-83)

8. **Protista**: They have **unicellular eukaryotic organisms** (do have well defined nucleus or organelles). The body is covered by **cilia, flagella for locomotion**. The mode of nutrition is **autotrophic or heterotrophic**. Ex. Diatoms, protozoans. (Please refer to Fig. 7.2 NCERT Book Page-84)
9. **Fungi**: These are multi-cellular eukaryotic organisms with cell wall, made up of Chitin. They do not perform Photosynthesis (heterotrophic), Saprophytic (derived nutrition from decaying material). Ex. Aspergillus, Penicillium, Mushroom, Rhizopus. The fungi living with algae forms Lichen (Symbiotic Association). (Please refer to Fig. 7.3 NCERT Book Page-84).

10. **Plantae**: These are multi-cellular eukaryotic organisms with cell wall, made up of Cellulose. Able to perform photosynthesis (autotrophic). Ex. Rice, wheat.

11. **Animalia**: These are multi-cellular eukaryotic organisms without cell wall. They are not able to perform photosynthesis (heterotrophic). Ex Human beings, Peacock.

(Please refer to Fig. 7.4 NCERT Book Page-85).

### DETAILS OF KINGDOM PLANTAE

1. The kingdom Plantae is further classified as Thallophyta, Bryophyta, Pteridophyta, Gymnosperms, Angiosperms.

2. **Thallophyta**: The plants do not have well defined body design, commonly called as” Algae”, mostly aquatic. Ex. Spirogyra, Ulothrix. (Please refer to Fig. 7.5 NCERT Book Page-86).

3. **Bryophyta**: These are commonly called as the “Amphibians of Kingdom”. The plant body is differentiated into roots like (Rhizoids), stem like and leaf like structures. No specialized tissues for the conduction of water and food. Ex. Marchantia, Funaria. (Please refer to Fig. 7.6 NCERT Book Page-86).

4. **Pteridophyta**: These are commonly called as the “First vascular land plants ”. The plant body is differentiated into root, stem and leaf. Specialized tissues for the conduction of water and food are developed in these plants. The reproductive organs are inconspicuous. Ex. Marsilea, Fern. (Please refer to Fig. 7.7 NCERT Book Page-87).

**Special Note**: The reproductive organs are inconspicuous in Thallophyta, Bryophyta, Pteridophyta are can’t develop seeds. They are together called as” Cryptogamae (Non-Flowering Plants)” The plants with well differentiated reproductive organs and that
ultimately make seeds are called” **Phanerogams (Flowering Plants)**”. This group is further classified **Gymnosperms** (Bear naked Seeds) & **Angiosperms** (Bears seeds inside Fruit).

5. **Gymnosperms**: These are commonly called as “**Naked seed bearing plants**”. They are usually perennial, evergreen and woody. Ex. Pinus, Cycas (Please refer to Fig. 7.8 NCERT Book Page-87).

6. **Angiosperms**: These are commonly called as “**Enclosed seed bearing plants**”. Plants with seeds having a single cotyledon are called as” **Monocotyledons or Monocots**”. Plants with seeds having two cotyledons are called as “**Dicots**”. Ex. Ipomoea, Paphiopedium. *(Please refer to Fig 7.9 &. 7.10 NCERT Book Page-87 ;Fig. 7.11 Page-88).*

**DETAILS OF KINGDOM ANIMALIA**

These are Eukaryote, multicultural and hetero-tropic.

They are further classified as **Non- Chordates**(Porifera, Coelenterata, Platyhelminthes , Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata) and **Chordates** { Protochordata, Vertebrata ( Pisces, Amphibians, Reptilia, Aves, Mammalia)} .

I. **Non- Chordates**

1. **Porifera**: The word Porifera” **means organisms with holes**”. The canal system helps in circulating water, food, oxygen. They are non-motile with cellular level of organization and mainly **marine** organisms with hard outer coat called as **Skeleton**. They are commonly called as **Sponges**. Ex. *Spongilla, Sycon* ( Please refer Fig. 7.12, NCERT Text Book Page- 89)

2. **Coelenterata**: The word Coelenterata” **means organisms with body cavity called** Coelenteron”’. They are radially symmetrical, **Diploblastic** ( two layers of cells), commonly called as **Cnidarians** ( Stinging cells for protection are present in the body). Ex. Hydra, Sea Anemone *(Please refer Fig. 7.13, NCERT Text Book Page- 89).*

3. **Platyhelminthes**: The word Platyhelminthes **means organisms with flatworms ( dorsocentrally flattened)”**. They are bilaterally symmetrical **Triploblastic** ( three layers of
cells), either free-living or parasitic. No true Coelom is present - Acoelomates. Ex. Planaria (Free living), Tape worm (Parasitic)(Please refer Fig. 7.14, NCERT Text Book Page-90).

4. **Nematoda:** The word *Nematoda* “means organisms with roundworms”. They are bilaterally symmetrical **Triploblastic** (three layers of cells), familiar with parasitic worms. The false Coelom is called as Pseudocoelome. Ex. Ascaris, Wuchereria (Filarial worm causes elephantiasis). (Please refer Fig. 7.15, NCERT Text Book Page-90).

5. **Annelida:** The word Annelida “means organisms with metameric-segmented”. They are bilaterally symmetrical Triploblastic (three layers of cells) with closed circulatory system, familiar with earth worms. The Coelom is called as true Coelom. Ex. Neries, Earth worm, Leech (Please refer Fig. 7.16, NCERT Text Book Page-90).

6. **Arthropoda:** The word *Arthropoda* “means organisms with jointed legs” They are bilaterally symmetrical Triploblastic (three layers of cells), familiar with cockroaches. The Coelom is blood filled called as Haemo Coelom. Ex. Prawn, Scorpion, Housefly (Please refer Fig. 7.17, NCERT Text Book Page-91).

7. **Mollusca:** The word *Mollusca* “means organisms with soft body” They are bilaterally symmetrical, Triploblastic (three layers of cells), familiar with Octopus, Pila. Foot is for moving, kidney like organ for excretion, with open circulatory system. Ex. Unio, chiton (Please refer Fig. 7.18, NCERT Text Book Page-91).

8. **Echinodermata:** The word *Echinodermata* “means organisms with spiny skinned”. Exoskeleton is with calcium carbonate. They are radially symmetrical **Triploblastic** (three layers of cells) with coelomic cavity, familiar with Star fish. They are exclusively free-living marine animals. Ex. Sea Cucumber, Feather Star (Please refer Fig. 7.19, NCERT Text Book Page-91).

**II. Chordates:** They are further classified as two major groups such as **Protochordata & Vertebrata**

(A). **Protochordata:** Notochord present in at least larval forms, but very rudimentary. It is a rod like supporting structure, runs along with nervous tissue from the gut of animal. They are bilaterally symmetrical, triploblastic (three layers of cells) with a Coelom, familiar with Amphioxus. Ex. Balanoglossus (Please refer Fig. 7.20, NCERT Text Book Page-92).
Vertebrata: Notochord is replaced by vertebral column and internal skeleton. They are bilaterally symmetrical, triploblastic, coelomic and segmented having paired gill pouches. Vertebrates are grouped into five classes.

1. Pisces: These are commonly called as “fishes”, exclusively aquatic. Body is streamlined and a tail for locomotion. Gills for respiration, heart is two chambered, cold blooded, skin is covered with scales, plates. They are cold-blooded animals. Skeleton of bone (Rohu) / cartilage (Shark). They lay eggs. Ex. Lion Fish, Dog Fish (Please refer Fig. 7.21, NCERT Text Book Page- 92).

2. Amphibians: These are commonly called as “Amphibians” because they can live on land and in water”. Body is streamlined and a webbed foot/ foot for locomotion. Gills or lungs or skin for respiration, heart is three chambered, cold blooded, skin is lack of scales, plates. They are cold-blooded animals. They lay eggs. Ex. Rana tigrana (Frog), Hyla (Tree Frog) (Please refer Fig. 7.22, NCERT Text Book Page- 93).

3. Reptilia: These are commonly called as “Reptilians”. A lung for respiration, heart is three chambered (Crocodile heart is four chambered), skin have scales. They are cold-blooded animals. They lay eggs. Ex. Snakes, Turtles (Please refer Fig. 7.23, NCERT Text Book Page- 93).

4. Aves: These are commonly called as “Birds”. A lung for respiration, heart is four chambered, fore limbs are modified for flight, skin has feathers. They are warm-blooded animals. They lay eggs. Ex. Ostrich (Flightless Bird), Pigeon, Sparrow (Please refer Fig. 7.24, NCERT Text Book Page- 94). A presence of pneumatic bones.

5. Mammalia: These are commonly called as “animals with mammary glands for producing milk to nourish their young ones”. A lung for respiration, heart is four chambered, skin has hairs, sweat or oil glands. They are warm-blooded animals. They lay eggs (Platypus, Echidna), give birth to young ones poorly developed (Kangaroo) & give birth to developed young ones (Human beings). Ex. Lion, Whale, Bat (Please refer Fig. 7.25, NCERT Text Book Page- 94 & Fig.7.26, classification of Animals, Page- 95).
DETAILS OF NOMENCLATURE

NOMENCLATURE: The system of scientific naming or nomenclature was introduced by Carolus Linnaeus. It is unique to identify in the world. We limit ourselves to writing the names of the Genus and Species of that particular organism. The world over, it has been agreed that both these names will be used in Latin forms. When printed is given in italics and when written by hand, the Genus and Species name have to be underlined separately. Ex. Ostrich (Common name): Struthiocamelus (scientific name with two parts namely the Genus and Species).

QUESTION BANK

1. What is the book written by Charles Darwin?...................... (The Origin of Species)
2. Who proposed the five kingdoms such as, Monera, Protista, Fungi, Plantae and Animalia? (Whittaker)
3. Monera members are unicellular, Prokaryotic organisms, mention TRUE/ FALSE ..... (TRUE)
4. The Diatoms belongs to the kingdom....................... (Protista)
5. The Anabaena belongs to the kingdom ...................... (Monera)
6. ......................... are commonly called as the “Amphibians of Plant Kingdom”. (Bryophyta)
7. The warm-blooded animals with fore limbs modified for flight, skin has feathers are called as........................ (Aves/Birds)
8. Write the four salient features of Reptiles.
9. Compare the Pisces and Amphibians.
10. Write the five salient features of Mammalia, give two examples.

QUESTION PAPER: FORMATIVE ASSESSMENT – I (For Practice)

Marks- 40 Time: 90 minutes

* General Instructions

1. Questions 1-5 (1 Mark each) 2. Questions 6-10 (2 Mark each)
3. Questions 11-15 (3 Mark each) 4. . Questions 16-17 (5 Mark each)

Q.1 Anabaena is member of the Phylum........................................
Q.2 Aspergillus is a member of the Phylum.................................
Q.3 Define the term Autotrophic mode of nutrition........................ Q.4
The fungus living with algae is called as ......................................
Q.5 Name the scientist who has divided the Monera into two sub-groups...........
Q.6 Draw and label Paramecium.
Q.7 Distinguish the meaning of terms Gymnosperms and Angiosperms.
Q.8 What is Pseudocoelome? Give one example of it.
Q.9 What is Haemocoelome? Give one example of it.
Q.10 Write two salient features of mammalian group.

Q.11 What is the basis of nomenclature of organisms, give the scientific name of Ostrich.

Q.12 Give three salient features of Amphibia.

Q.13 Mention three features of Chordates.


Q.15 Give two salient features of Aves and mention one example of a flightless bird.

Q.16 Write about the Hierarchy of Classification- Groups and mention basic unit of classification.

Q.17 Give the salient features of Bryophytes and draw the diagram of Funaria.
Chapter 13: “Why do we fall ill?”

KEY CONCEPTS: [rating as per the significance of concept]

<table>
<thead>
<tr>
<th>CONCEPTS</th>
<th>RATING</th>
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<tbody>
<tr>
<td>Significance of Health</td>
<td>**</td>
</tr>
<tr>
<td>Disease and Its causes</td>
<td>***</td>
</tr>
<tr>
<td>Infectious diseases</td>
<td>******</td>
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<tr>
<td>Principles of prevention of diseases</td>
<td>****</td>
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</tbody>
</table>

1. **Health** is a state of being well enough to function well physically, mentally, and socially.

2. **Disease** (disturbed ease) means being uncomfortable. One or more systems of the body will change, give rise to “Symptoms” (Cough, loose motions, pus formation, headache, fever, breathlessness, vomiting, fits, unconsciousness, inflammation, swelling, and general effects - a Doctor look for the basis of symptoms). Diseases are basically two types- Acute Disease & Chronic Disease

3. **Acute Disease**: The disease which lasts for only a short period of time is called Acute Disease. Ex. Common Cold.

4. **Chronic Disease**: The disease which lasts for long period of time is called Chronic Disease. Ex. Tuberculosis.

<table>
<thead>
<tr>
<th>Acute Disease</th>
<th>Chronic Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>They are short duration disease</td>
<td>They are long lasting disease</td>
</tr>
<tr>
<td>Patient recovers completely after the cure</td>
<td>Patient does not recover completely</td>
</tr>
<tr>
<td>There is no loss of weight or feeling of tiredness afterward</td>
<td>There is often loss of weight or feeling of tiredness</td>
</tr>
<tr>
<td>There is short duration loss of work and efficiency</td>
<td>There is a prolonged loss of work and efficiency</td>
</tr>
</tbody>
</table>

5. **Causes of Diseases**: Most of the diseases have many causes, rather than one single cause, like unclean water, nourishment, genetic differences, genetic abnormalities e.g. Based on the causes diseases are of two types: Non-Infectious Diseases and Infectious Diseases.

6. **Non-Infectious Diseases**: Not caused by infectious agents, mostly internal and non-infectious cause. Ex. Cancer
7. **Infectious Diseases**: Caused by infectious agents.

<table>
<thead>
<tr>
<th>SN</th>
<th>Type Of Disease</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Bacterial diseases</strong></td>
<td>Typhoid, Cholera, Tuberculosis, Acne, Anthrax,</td>
</tr>
<tr>
<td>2</td>
<td><strong>Viral diseases</strong></td>
<td>Common Cold, Influenza, Dengue fever, AIDS, Japanese encephalitis or brain fever</td>
</tr>
<tr>
<td>3</td>
<td><strong>Fungal diseases</strong></td>
<td>Skin diseases, Athletes foot, Mycoses</td>
</tr>
<tr>
<td>4</td>
<td><strong>Protozoan diseases</strong></td>
<td>Malaria (Plasmodium), Kala-azar (Leishmania), Sleeping sickness (Trypanosomes)</td>
</tr>
<tr>
<td>5</td>
<td><strong>Worm diseases</strong></td>
<td>Ascariosis (Round worm), Elephantiasis (Wuchereria)</td>
</tr>
</tbody>
</table>

*(Please refer Fig. 13.1 (a-e), NCERT Text Book Page- 181).*

a) The infectious diseases spread by agents are called as **Communicable Diseases**.

<table>
<thead>
<tr>
<th>SN</th>
<th>Type of Disease</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Air born Diseases</strong></td>
<td>Pneumonia, common cold, Tuberculosis;</td>
</tr>
<tr>
<td>2</td>
<td><strong>Water born diseases</strong></td>
<td>Cholera, hepatitis</td>
</tr>
<tr>
<td>3</td>
<td><strong>Sexual Diseases</strong></td>
<td>HIV, Syphilis.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Animal born Disease</strong></td>
<td>Rabies. <em>(Vector- the animal carrying infectious agent from a sick person to another potential host without getting affected Ex. Mosquito carrying Malaria Parasite).</em></td>
</tr>
</tbody>
</table>

*(Please refer Fig. 13.2 & 13.3, NCERT Text Book Page- 183).*

9. **Principles of Treatment**:

1. **Antibiotics**- many bacteria make a cell wall to protect themselves, the antibiotic (Penicillin) blocks the bacterial process that builds cell wall and blocks the biochemical pathways. Antibiotics do not work against viral infections. Antiviral medicine is harder than making Antibacterial medicine because Virus has only few biochemical mechanisms of their own. Other medicines bring down fever, reduce pain or loose motions. We can take bed rest to conserve energy.
10 Principles of Prevention: Following three limitation are normally confronted while treating an infectious disease:

- Once someone has disease, their body functions are damaged and may never recover completely.
- Treatment will take time, which means that someone suffering from a disease is likely to be bedridden for some time even if we can give proper treatment.
- The person suffering from an infectious disease can serve as the source from where the infection may spread to other people.

General ways of preventing infectious disease:

- Air-borne – We can prevent exposure by providing living condition that are not overcrowded.
- Water-borne – prevent by providing safe drinking water. This is done by treating the water to kill any microbial contamination.
- Vector-borne – We can provide clean environment, which would not allow mosquito breeding.

11. Immunity: Even in cells there is repair mechanism called” Immunity”. Immune cells manage to kill off the infectious agents. Smallpox disease is eliminated by developing memory cells for particular infection by mimics the microbes, called” Vaccine”. The basis of Immunization- if you had smallpox once, there was no chance of suffering from it again. Proper nutrition is essential to maintain body immunity. There are vaccines against tetanus, diphtheria, whooping cough, measles, polio and many other diseases.

12. Prevention of disease is better than cure. Hygiene is the basic key to maintain good health.

QUESTION BANK:

1. Define Health....... (It is a state of being well enough to function well physically, mentally, and socially)
2. Name any two Symptoms of diseases.......................... (Cough& loose motions)
3. The disease which last for only a short period of time is called..................(Acute Disease)
4. State whether Tuberculosis is a Chronic Disease or Acute Disease...... (Chronic Disease)
5. Mention the causal organism for Sleeping sickness ............ (Trypanosoma)
6. Cholera is a waterborne disease, mention TRUE/ FALSE ............ (TRUE)
7. Antibiotics do not work against viral infections, mention TRUE/ FALSE ............ (TRUE)
8. Write short notes on Immunity
(Even in cells there is repair mechanism called” Immunity”. Immune cells manage to kill off the infectious agents.)

9. Explain with an example the term Vaccine. (Smallpox disease is eliminated by developing memory cells for particular infection by mimics the microbes, called“ Vaccine”).

10. State reasons to support “Prevention of disease is better than cure”.

**QUESTION PAPER: FORMATIVE ASSESSMENT – I (For Practice)**

**Marks- 40**

**Time: 90 minutes**

* General Instructions

1. Questions 1-5 (1 Mark each)
2. Questions 6-10 (2 Mark each)
3. Questions 11-15 (3 Mark each)
4. Questions 16-17 (5 Mark each)

Q.1 Define Health

Q.2 Mention any two symptoms of diseases.

Q.3 Typhoid is a bacterial disease. Mention True/False.............

Q.4 Sleeping sickness is caused by..............................................

Q.5 Elephantiasis is caused by..................................................... Q.6.

Mention two Air born diseases1........................................2........

Q.7 Mention two Sexually Transmitted Diseases1................2........

Q.8 Mention two Viral Diseases1.................................2...........

Q.9 What is called vector. Give one example.

Q.10 Give two examples of Chronic diseases.

Q.11 Distinguish between Infectious and Non-infectious diseases.

Q.12 Write a short notes on Small Pox.

Q.13 What is immunity? Write short notes on it.

Q.14 What is Vaccination? Give the details, how it works in human body.

Q.15 Write three reasons for Cancers.

Q.16 What are the basic five principles of treatment for diseases.

Q.17 How Hygiene could help you to maintain good health and mention five situations to take care about health.
Chapter 14: “Natural resources”

KEY CONCEPTS: [ *rating as per the significance of concept]

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Breath of air</td>
<td>**</td>
</tr>
<tr>
<td>A wonder liquid</td>
<td>***</td>
</tr>
<tr>
<td>Biogeochemical cycles</td>
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</tbody>
</table>

1. The ”Biosphere” is the life supporting zone of the earth with three sub-zones called as lithosphere (rock part), atmosphere (air part) and hydrosphere (water part).

Breath of air
2. Composition of Air

![Composition of Air](image)

3. The interactions between different components of the Biosphere to maintain the balance between the biotic and a biotic component makes “Biogeochemical cycle”. Ex. Water Cycle, Nitrogen Cycle, Carbon cycle, Oxygen Cycle,

4. Role of atmosphere in climate control: atmosphere act as protective blanket for the earth. Since atmosphere is a bad conductor of heat, it keeps the average temperature of the earth constant. At night, it slows down the escape of heat into outer space.

5. The movement of air: the atmosphere gets heated from the radiation that is reflected back by the land or water bodies. As a result of heating, convection currents are set up in the air. Since land gets heated faster than water, the air over land gets heated faster than air above water bodies.
6. In coastal regions, during the day, the air above the land gets heated faster and starts rising. So a region of low pressure is created and air over sea moves into this area of low pressure. The movement of air from one region to the other region causes **Wind**.

7. During the day, the direction of wind would be from the sea to the land and at night, both land and sea starts to cool. Since water cools down slower than the land, the air above water would be warmer than air above land, thus the direction of wind would be from the land to the sea.

8. **Air pollution**: it is an undesirable change in the physical, chemical or biological characteristics. It is caused due to an increase in the content of harmful substances (pollutant) such as oxides of nitrogen and sulphur, etc.

9. **Harmful effect of air pollution**:
   - It affects the respiratory system causing breathing difficulties eg; bronchitis, asthma, lung cancer, tuberculosis, etc.
   - Burning of fossil fuels like coal and petroleum releases oxides of nitrogen and sulphur. Inhalation of these gases is dangerous.
   - Combustion of fossil fuel also increases the amount of suspended particles in air. The presence of high levels of all these pollutants, reduce visibility in cold weather where water also condenses out of air forming **smog**.
   - **Acid rain** formed from the gases like sulphur dioxide and nitrogen oxides present in polluted air. It causes damage to living and non-living thing.

3. **The Water Cycle**:

   a) The process in which water evaporates and falls on the land as rain and later flows back into the sea via rivers is known as the **“Water Cycle”**. Water flows through rocks containing soluble minerals, some of them get dissolved in the water. Thus the rivers carry many nutrients from the land to sea and these are used by the marine organisms.
   
   b) When the water vapors condense as water droplets and grow big and heavy, they fall down in the form of **“rain”**. It ranges from 5 cm to 200 cm of rain fall in a year in our country. In large parts of India, rains are mostly brought by the south-west or north-east monsoons. Depressions in the Bay of Bengal may also cause rains in some areas.
c) **Water is a wonder liquid** because all cellular processes take place in a water medium; substances are transported in a dissolved form; terrestrial forms require fresh water to maintain the equilibrium of salts; major resource to determine the life on the earth.

d) The dissolved fertilizers (NPK fertilizers), pesticides (DDT), sewage (Disease causing Organisms), waste from factories (Mercury) and water released from the dams can affect the life forms on the earth. The dissolved Oxygen is being used by the animals and plants that live in water, would adversely affect the aquatic organisms. The change in temperature would be dangerous for the eggs and larvae of the various animals particularly susceptible to temperature changes. It leads to “water pollution”.

*Please refer Fig. 14.5, NCERT Text Book Page- 197.*

4. **Nitrogen Cycle:**

a) The nitrogen gas makes up 78% of our atmosphere. It is essential for the synthesis of proteins, DNA, RNA, urea, alkaloids and Vitamins.

b) The simple molecular nitrogen from the atmosphere is converted into more complex molecules in the living beings and back again to atmosphere is called “**Nitrogen Cycle**”.

i) **Nitrogen fixation by Lightening:** During lightning, the molecular nitrogen is converted into oxides of nitrogen and dissolves in water to give nitric and nitrous acids and fall on lands along with rains. These are then utilized by various life forms.

ii) **Nitrogen fixation by Bacteria:** The molecular nitrogen is converted into nitrates and nitrites, by free living bacteria or the bacteria present in the root nodules of legumes.

iii) The conversion of molecular nitrogen into nitrates and nitrites is called as” **Nitrification**”. Plants generally covert them into amino acids. The conversion of nitrates and nitrates into Ammonia is called as” **Ammonification**”. The conversion of Ammonia into molecular Nitrogen is called as” **Denitrification**”. Thereby nitrates and nitrites are converted into molecular or elemental nitrogen in the nature. (Please refer Fig. 14.6, NCERT Text Book Page- 198).
5. The Carbon cycle:

i) The Carbon dioxide gas makes up 0.039 % of our atmosphere. Carbon occurs in the elemental form as diamonds and graphite in earth. Carbon is essential for the synthesis of proteins, carbohydrates, fats, nucleic acids and Vitamins in living organisms.

ii) The Carbon dioxide Fixation: Green plants convert Carbon dioxide into glucose in the presence of sunlight through Photosynthesis. The glucose molecules are converted into other biologically important molecules. And many marine animals use carbonates dissolved in sea water to make shells, exoskeletons.

iii) The combustion: The Carbon dioxide in the atmosphere is added by the process of combustion, where fuels are burnt to provide energy for various needs like heating, cooking, transportation, and industrial process.

iv) The Greenhouse Effect: The percentage of Carbon dioxide in the atmosphere is said to have doubled since the industrial revolution when human beings stated burning fossil fuels on a very large scale. The Carbon dioxide is a greenhouse gas. The increase in the Carbon dioxide content would cause more heat to be retained by the atmosphere and lead to Global Warming. It is called” Greenhouse Effect”

v) The carbon cycle is repeated through different physical and biological activities. (Please refer Fig. 14.7, NCERT Text Book Page- 199).

6. Oxygen Cycle:

i) The Oxygen gas makes up 21 % of our atmosphere. Oxygen is essential component of proteins, carbohydrates, fats, nucleic acids in living organisms.

ii) Oxygen from our atmosphere is used up in three processes, namely combustion, respiration and in the formation of oxides of nitrogen. Oxygen is returned to the atmosphere in only one major process, that is, Photosynthesis, it is called as Oxygen Cycle.
iii) The air is heated faster than water; the air over land would also be heated faster than the air over water bodies. The movement of air from one region to the other creates winds, during the day the direction of the wind would be from the sea to land. At night, both land and sea start to cool.

iv) The oxides of nitrogen and sulphur gases dissolve in rain to gives rise to “Acid rains”. The smog is a visible indication of Air Pollution. The pollutants bring respiratory, cardiac problems and allergies. The organisms called Lichens are found on the bark of trees, they are indicators of pollution free environment. Three atoms of Oxygen (O₃) is called as Ozone.

The Ozone is poisonous but absorbs harmful radiations from the Sun. The Ozone layer around the earth, if, dwindles further may cause Health hazards including Cancers. Recently discovered the Ozone hole; in the region of Antarctica. (Please refer Fig. 14.8 & 14.9, NCERT Text Book Page- 200).

**QUESTION BANK**

1. What are the three sub-zones in the Biosphere? {Lithosphere (rock part), atmosphere (air part) and hydrosphere (water part)}.

2. The process in which water evaporates and falls on the land as rain and later flows back into the sea via rivers is known .................(Water Cycle).

3. In large parts of India, rains are mostly brought by..................... monsoons. (the south-west or north-east monsoons).

4. Why water is a wonder liquid? Justify (A major resource to determine life on the earth)

5. What are the four major water Pollutants? {NPK fertilizers, pesticides (DDT), sewage (Disease causing Organisms), waste from factories (Mercury)}

6. Write a short notes on Nitrogen fixation by Bacteria.{The molecular nitrogen is converted into nitrates and nitrites, by free living bacteria or the bacteria present in the root nodules of legumes}.

7. What is Greenhouse Effect? {The Carbon dioxide is a greenhouse gas. The increase in the Carbon dioxide content would cause more heat to be retained by the atmosphere and lead to Global Warming. It is called” Greenhouse Effect”}

8. What is the percentage of Oxygen gas in our atmosphere? (21 %)
9. Which organisms are found on the bark of trees as indicators of pollution free environment? {Lichens}

10. Write about the Ozone hole in the Antarctica. {The Ozone layer around the earth is dwindling further to damage and cause Health hazards including Cancers. Recently discovered Ozone hole in the Antarctica.}

**QUESTION PAPER: FORMATIVE ASSESSMENT – I (For Practice)**

Marks- 40  
Time: 90 minutes

* General Instructions

1. Questions 1-5 (1 Mark each)
2. Questions 6-10 (2 Mark each)
3. Questions 11-15 (3 Mark each)
4. Questions 16-17 (5 Mark each)

Q.1 What is called Lithosphere, define it.

Q.2 Water covers 75% of the Earth’s surface. Mention True/ false.

Q.3 What is the percentage of Carbon dioxide on Venus.

Q.4 What is the range of temperature on the Moon.

Q.5 Define the term Pollutant.

Q.6 What are the two ways to fix Carbon dioxide on earth. Q.7 Mention any two important features of Water.

Q.8 How the Depressions effect our environment?

Q.9 Define the term Soil Pollution. Give one reason for it.

Q.10 How changes of temperature effect living organisms in water?

Q.11 What is Humus? Mention its importance in two points.

Q.12 What is deforestation? Give two reasons for it.

Q.13 Define Global Warming, mention two causes for it.

Q.14 What is Ozone Depletion? Give two reasons for it.

Q.15 Draw the schematic diagram of Water Cycle in the nature.

Q.16 Write any five salient features of Nitrogen Cycle with a suitable diagram.

Q.17 Write about Industrial Pollution and mention five effects in the environment.
Chapter 15: “Improvement in food resources”

KEY CONCEPTS: [*rating as per the significance of concept]*

<table>
<thead>
<tr>
<th>CONCEPTS</th>
<th>RATING</th>
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</thead>
<tbody>
<tr>
<td>Improvement in crop yield</td>
<td>***</td>
</tr>
<tr>
<td>Crop variety improvement</td>
<td>****</td>
</tr>
<tr>
<td>Crop production management</td>
<td>*****</td>
</tr>
<tr>
<td>Crop protection management</td>
<td>***</td>
</tr>
<tr>
<td>Animal Husbandry</td>
<td>****</td>
</tr>
</tbody>
</table>

1. **Food Resources**: Cereals (Wheat, rice, maize, millets and sorghum) provide us carbohydrates; Pulses (Grams, pea and lentil) provide us proteins; Oil seeds (Soya bean, ground nut, sesame, and castor) provide us fats; Vegetables, spices and fruits provide us a range of minerals, nucleic acids and vitamins. In addition to these food crops, fodder crops like berseem, oats or sudan grass are raised as food for the livestock are called as fodder crops.

2. **The Kharif crops**: The crops grown in rainy season are called as *Kharif crops* (*Paddy, Soya bean, pigeon pea and maize*). They are grown from June to October.

3. The **Rabi crops**: The crops grown in winter season are called *Rabi crops* (*Wheat, gram, peas, and mustard*). They are grown November to April.

Compare *Kharif crops and Rabi crops*:

<table>
<thead>
<tr>
<th>SN</th>
<th>Crop</th>
<th>Season</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Kharif crops</em></td>
<td>June to October (Rainy Season)</td>
<td><em>Paddy, Soya bean, and maize</em></td>
</tr>
<tr>
<td>2</td>
<td><em>Rabi crops</em></td>
<td>November to April (winter season)</td>
<td>Wheat, gram, peas, and Mustard</td>
</tr>
</tbody>
</table>

4. **The Green Revolution**: Food supplies are generally as proteins, carbohydrates, fats, minerals, nucleic acids and vitamins in all living organisms. Indian population is growing enormously. Green Revolution is the need of the hour to increase food-grain production.
5. **Sustainable Practices**: For sustained livelihood, one should undertake mixed farming, intercropping, and integrated farming practices, for example, combining agriculture with livestock/ poultry/ fisheries/bee-keeping. The major group of activities for improving crop yield can be classified as: **Crop varietal improvement, Crop production improvement, Crop protection improvement**

6. **The Crop varietal improvement:**

   a) **Hybridization**: It refers to crossing between genetically dissimilar plants; It is all to get higher yield, improved quality, biotic and abiotic resistance, change in maturity duration, wider adaptability and desirable agronomic characteristics.

   
<table>
<thead>
<tr>
<th>SN</th>
<th>Type</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intervarietal Hybridization</td>
<td>between different varieties</td>
</tr>
<tr>
<td>2</td>
<td>Interspecific Hybridization</td>
<td>between different species</td>
</tr>
<tr>
<td>3</td>
<td>Intergeneric Hybridization</td>
<td>between different genera</td>
</tr>
<tr>
<td>4</td>
<td>Genetically Modified Crops (GMC)</td>
<td>Another way of improving the crop is by introducing a gene that would provide the desired characteristic.</td>
</tr>
</tbody>
</table>

7. **The Crop production improvement**: They include” **no cost production**, ” **low cost production**” or “**high cost production**” practices.

   a) **Nutrients** (Sixteen elements are required for growth are called as essential elements Carbon, oxygen, hydrogen+ Macronutrients & Micronutrients. They increase the yield):

<table>
<thead>
<tr>
<th>SN</th>
<th>Macronutrient</th>
<th>Micronutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Six elements are required in larger quantity</td>
<td>Other seven elements are required in small quantity</td>
</tr>
<tr>
<td>2</td>
<td>Ex. Nitrogen, phosphorus, calcium, Postassium, magnesium, sulphur</td>
<td>Ex. Iron, manganese, boron, zinc, copper, molybdenum, chlorine</td>
</tr>
</tbody>
</table>
b) **Manure & Fertilizers:**

<table>
<thead>
<tr>
<th>SN</th>
<th>Manure</th>
<th>Fertilizers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manure is prepared by the decomposition of animal excreta and decides the texture of the soil. Compost: Farm waste, cow dung etc. Vermi compost: Compost prepared by using earthworms.</td>
<td>Fertilizers are commercially produced plant nutrients. Excess fertilizers destroy the soil fertility. Organic farming: No use of chemicals fertilizers, herbicides, pesticides etc. (Culturing blue green algae, neem leaves, healthy cropping systems.</td>
</tr>
<tr>
<td>2</td>
<td>It is cheap and prepared in rural homes and fields</td>
<td>It is costly and is prepared in factories</td>
</tr>
<tr>
<td>3</td>
<td>It is voluminous and bulky</td>
<td>It is compact and concentrated</td>
</tr>
<tr>
<td>4</td>
<td>It is inconvenient to store, transport, handle.</td>
<td>It is easy to store, transport, handle.</td>
</tr>
<tr>
<td>5</td>
<td>It is not nutrient specific.</td>
<td>It is nutrient specific and can provide specifically nitrogen, phosphorus etc.</td>
</tr>
</tbody>
</table>

|            | Add great humus to the soil                                         | Does not add humus to the soil.                                            |

3. **Irrigation:** India has variety of water resources: Wells, canals, river lift system, tanks, rainwater harvesting, water shedding management to increase in ground water levels and to check the water flowing away to the sea. Planning to reduce soil erosion.

**Methods of irrigation:**

A) Traditional : a) well b) canal c) river d) lift irrigation e) tanks f) moat system g) pulley

B) Modern : a) Sprinkler b) drip irrigation

4. **Cropping patterns:**
<table>
<thead>
<tr>
<th>SN</th>
<th>Mixed cropping</th>
<th>Inter-cropping</th>
<th>Crop rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Two or more crops grown simultaneously on the same piece of land</td>
<td>Two or more crops grown simultaneously on the same piece of land in a definite pattern</td>
<td>Growing different crops on a piece of land in a pre-planned succession</td>
</tr>
<tr>
<td>2</td>
<td>Ex. Wheat+ Gram; Wheat+ Mustard; Wheat+ gram; Groundnut+ sunflower.</td>
<td>Soyabean + maize/bajra+Cowpea (Please refer Fig. 15.2, NCERT Text Book Page- 208).</td>
<td>Two or three crops can be grown in a year depending upon the duration.</td>
</tr>
</tbody>
</table>

A type of insurance against failure of one of the crops.

A few rows of one crop alternate with a few rows of a second crop. Crops are selected such that their nutrient requirements are different. This ensures the maximum utilization of the nutrients supplied and prevents pests and diseases spreading in the crop field.

The availability of moisture and irrigation facilities decides the choice of the crop to be cultivated.

### 8. Crop protection improvement/management: Field crops are infested by large number of weeds, insects pests, diseases & storage of grains

<table>
<thead>
<tr>
<th>SN</th>
<th>Weeds</th>
<th>Insect pests</th>
<th>Diseases</th>
<th>Storage of grains</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Weeds are unwanted plants in the crop field</td>
<td>Insect pest is nuisance in the crop field</td>
<td>Disease is caused by pathogens in the field</td>
<td>Different factors are responsible.</td>
</tr>
<tr>
<td>2</td>
<td>Weeds take up nutrients and reduce the growth</td>
<td>Insect pest affect the health of crop and reduce the yield.</td>
<td>Diseases alter the physiology of crops and reduce the yield</td>
<td>Different factors reduce the quality of stored grains</td>
</tr>
<tr>
<td>4</td>
<td>Removal of weeds at an early stage is recommended. Spray weedicides</td>
<td>Spread of chemicals such as pesticides</td>
<td>Spread of chemicals to kill pathogens</td>
<td>Systematic management of warehouse.</td>
</tr>
</tbody>
</table>
9. **Animal Husbandry**: It is a scientific management of animal livestock, includes feeding, breeding and diseases control. Animal-based farming includes cattle farming, Poultry farming, fish farming, and bee keeping.

<table>
<thead>
<tr>
<th>SN</th>
<th>Content</th>
<th>Cattle farming</th>
<th>Poultry farming</th>
<th>Fish farming</th>
<th>Bee Keeping</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Purpose</td>
<td>Milk (milch animals) and draught labor (draught animals) in agriculture.</td>
<td>Meat, chicken, egg production</td>
<td>Cheap source of animal protein. Fish production is aquaculture. Growing of marine fishes is called mariculture.</td>
<td>Honey, wax, Medicinal preparations. Additional income to the farmer.</td>
</tr>
<tr>
<td>2</td>
<td>Cross breeding: To get desired qualities</td>
<td>Exotic-quality of lactation Indigenous breeds-quality of disease resistance</td>
<td>Exotic &amp; Indigenous Breeds</td>
<td>Both Exotic &amp; Indigenous fishes are used</td>
<td>Exotic- high honey collection Capacity &amp;stingless. Indigenous bees- are used</td>
</tr>
<tr>
<td>3</td>
<td>Desirable maintenance</td>
<td>Good ventilation in sheds Roughage/concentrates Protection from parasites &amp; skin diseases Vaccination</td>
<td>Good ventilation in sheds Roughage/concentrates Protection from parasites &amp; skin diseases Vaccination</td>
<td>Fish farming/locating large schools of fish/use of satellites and echo-sounds In Composite fish culture seed is wild, mixed with other species. Hormonal stimulation to bring desired quality in fish production.</td>
<td>Value or quality depends upon the pasturage or the flowers available for the taste of honey.</td>
</tr>
<tr>
<td></td>
<td>Example</td>
<td>Apiculture - Culture of honeybee</td>
<td>Sylviculture – Cultivation of forest plants</td>
<td>Aqua culture – Culture of fish and other aquatic animals</td>
<td>Horticulture – to culture fruits and vegetables</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>--------------------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Exotic or foreign breeds (Jersey, brown Swiss) Local breeds (Red sindhi, Sahiwal)</td>
<td>Exotic-Leghorn Indigenous breeds- Aseel</td>
<td>Fresh water (Macrobrachium) &amp; Marine (Peneaus) prawns Fresh water fishes Marine fishes (Bombay duck, sardines) Common</td>
<td>Apisceranaindica dorsata, A.florae</td>
<td></td>
</tr>
</tbody>
</table>
1. Give two examples of Cereals (Wheat, rice)

2. Define the Kharif crop and give two examples (The crops grown in rainy season are called as Kharif crops Ex. Paddy, Soya bean).

3. Write about the importance of Green Revolution (Indian population is growing enormously. Green Revolution is the need of the hour to increase food-grain production.

4. Define the term Hybridization (Crossing between genetically dissimilar plants)

5. What is the importance of Genetically Modified Crops? (It is another way of improving the crop is by introducing a gene that would provide the desired characteristic.)

6. Define the term mixed cropping and give two examples. (Two or more crops grown simultaneously on the same piece of land Ex. Wheat+ Gram; Wheat+ Mustard)

7. Distinguish between weeds, insects pests (Weeds are unwanted plants in the crop field Insect pest is nuisance in the crop field)

8. What is Animal Husbandry? It is a scientific management of animal livestock, includes feeding, breeding and diseases control. Animal-based farming includes cattle farming, Poultry farming, fish farming, and bee keeping.

9. Distinguish between aquaculture and mariculture. (Fish production is aquaculture. Growing of marine fishes is called mariculture.)

10. What is the importance of Bee Culture? (It is useful for honey, wax, medicinal preparations. And also for additional income to the farmer.)
QUESTION PAPER: FORMATIVE ASSESSMENT – I (For Practice)

Marks- 40  Time: 90 minutes

* General Instructions

1. Questions 1-5 (1 Mark each)  2. Questions 6-10 (2 Mark each)
3. Questions 11-15 (3 Mark each)  4. Questions 16-17 (5 Mark each)

Q.1 Maize and Millets are Pulses. Mention True/False...............................
Q.2 What is the Scientific name of Honey Bee...............................................
Q.2 What led us to improve food grain production?
Q.3 Which revolution led to the availability of milk for efficient use?
Q.4 What is the process of injecting semen of desired bull into the vagina of cows is called?
Q.5 Name any one exotic breed usually used for variety of improvement programmes.
Q.6 What is the significance of GMC
Q.7 Mention the significance of Irrigation in developing agriculture.
Q.8. What is Pest and give one example.
Q.9 What is Weed and give one example.
Q.10 Give two examples for Inter-cropping.
Q.11 Distinguish between Kharif and Rabi Crops
Q.12 What is called Sustainable Practice in improvement in food resources.
Q.13. Mention three techniques of Hybridization used to achieve desirable agronomic characteristics.
Q.14.Distinguish between Macro Nutrients and Micro Nutrients
Q.15 Distinguish between Compost and Vermi Compost.
Q.16 Distinguish between Cattle farming and Poultry farming.
Q.17 Distinguish between Fish farming and Bee keeping.
SECTION: PHYSICS
Chapter 8: “Motion”

KEY CONCEPTS [*rating as per the significance of concept ]

<table>
<thead>
<tr>
<th></th>
<th>Motion</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Graphical Representation of Motion &amp; Graphs</td>
<td>***</td>
</tr>
<tr>
<td>3</td>
<td>Equation of motion</td>
<td>****</td>
</tr>
<tr>
<td>4</td>
<td>Uniform Circular Motion</td>
<td>**</td>
</tr>
</tbody>
</table>

**Motion** (Uniform Motion and Non Uniform Motion, Acceleration and Velocity)

A particle is a point-like object, has mass but infinitesimal size.

The object’s position is its location with respect to a chosen reference point.

Motion occurs when an object changes its position.

Relative motion: when two objects are moving in a plane (either in same direction or opposite) each has relative motion with respect to second. e.g. a person sitting in a moving train and watching a tree, in this case tree is stable but is assumed to be moving but with respect to train.

**Distance vs. Displacement**

**Distance:** How far an object has moved. It has only magnitude without direction.

**Displacement:** How far and in what direction an object has moved from its start position. I.e. the minimum distance between two points.

**Speed**

Speed=the distance an object travel in unit time.

Speed=distance/time.

SI unit of speed is m/s.

**Types of Speed**

**Constant (uniform) speed:** speed doesn’t change (set your car on cruise control).

**Changing (variable) speed:** Riding a bike for 5 km. Take off and increase speed, slow down up hill, speed up downhill, stop for stop sign.

**Average speed:** (total distance)/(total time).

**Instantaneous speed:** speed at any given time.
Velocity

Velocity: includes speed with direction.
Two types of velocity—Constant velocity & variable velocity.
Constant velocity includes constant speed in same direction.
Variable velocity- either speed change or direction change.
Suppose two trains are going with the same speed in opposite direction so they are having different velocities.

Race car going around an oval track might have constant speed, but different velocities at each point due to change in direction.

Acceleration
Any change in velocity over a period of time is called acceleration.
Acceleration is rate of change in velocity.
\[ a = \frac{(v-u)}{t} \]
Acceleration may be positive or negative

+ve sign shows the acceleration or increasing velocity.
-ve sign shows de-acceleration or retardation or decreasing velocity.

Images of car are equally spaced.

The car is moving with constant positive velocity (shown by arrows maintaining the same size above the car).

The acceleration equals to zero

(Different position of a car) Velocity & acceleration are in same direction.

Images of car become farther apart as time increases

Velocity and acceleration are in the same direction

Acceleration is uniform (Arrows below the car maintain the same length)

Velocity is increasing (Arrows above the car are getting longer)

This shows positive acceleration and positive velocity
Acceleration in opposite direction of velocity shows retardation.

The instant speed at points of equal elevations is the same.

The velocities are different because they are in opposite direction.

Free Fall
Galileo Galilei Italian physicist and astronomer

Formulated laws of motion for objects in free fall

A freely falling object is any object moving freely under the influence of gravity alone.

It does not depend upon the initial motion of the object

Dropped – released from rest

The acceleration of an object in free fall is directed downward, regardless of the initial motion

The magnitude of free fall acceleration (gravitational acceleration) is \( g = 9.80 \text{ m/s}^2 \)

‘g’ decreases with increasing altitude

‘g’ varies with latitude, height and depth from earth surface.

9.80 m/s\(^2\) is the average at the Earth’s surface
The italicized $g$ will be used for the acceleration due to gravity

Not to be confused with $g$ for grams

With negligible air resistance, falling objects can be considered freely falling. Objects of different shapes accelerate differently due to air resistance. E.g., stone vs. feather.

The path is symmetrical.

Acceleration is constant & in downward direction.

The magnitude of the velocities is the same at equal heights.

Acceleration and velocity are in opposite directions when ball goes upward.

Acceleration is uniform (arrows maintain the same length)

Velocity is decreasing in upward motion.

Positive velocity and negative acceleration

Velocity becomes zero at maximum height.

Time duration of flight in going upward and coming back is always same.

**Test Yourself:**
1. What is SI Unit of displacement?

2. Name the quantity which represents rate of change of velocity?

3. A particle describes a semicircle of radius 14m. What are its distance and displacement covered?

Graphical Representation of Motion & Graphs *(Refer to article 8.4 of NCERT textbook.)*

**Test Yourself:**

1. What does slope of Position – Time graph represent?

2. If velocity –time graph is parallel to time axis, what type of motion does it represent?

3. Is it possible to have a graph parallel to velocity axis in a v-t graph. Justify your answer with explanation.

4. How can you calculate the distance covered by an object by seeing v-t graph?

**Equation of motion**

When object is moving in straight line-

\[ v = u + at \]

\[ s = ut + \frac{1}{2} at^2 \]

\[ v^2 = u^2 + 2as \]

Average acceleration describes how fast the velocity is changing with respect to time.: 

when object is coming vertically downward(g is +ve)-

\[ v = u + gt \]

\[ h = ut + \frac{1}{2} gt^2 \]

\[ v^2 = u^2 + 2ah \]

(3) when object is coming vertically upward(g is -ve)-

\[ v = u + (-g)t \]

\[ h = ut + \frac{1}{2}(-g)t^2 \]

\[ v^2 = u^2 + 2(-g)h \]

Average acceleration is + or – depending on direction.

Instantaneous acceleration is zero where slope is constant

Instantaneous acceleration is positive where curve is concave up

Instantaneous acceleration is negative where curve is concave down
Test Yourself:

1. Give the equation for uniform motion.

2. When a car stops after applying brakes, what is the final velocity?

Uniform Circular Motion

In this kind of motion the object moves on circle with fix speed but the direction is changed by the time so the velocity change so its called accelerated motion. This acceleration is called centripetal acceleration. It is directed toward the centre.

Test Yourself:

1. What remains constant in uniform circular motion?

2. What changes continuously in uniform circular motion?

QUESTION BANK

One Mark questions

1. Can displacement be zero even when distance is not zero?

2. Can the distance travelled by an object be smaller than magnitude of its displacement?

3. A particle is moving with uniform velocity. What is its acceleration?

4. How can you get speed of an object from its distance – time graph?

5. How can you get distance of an object from its speed – time graph?

6. A brick & an elephant are in free fall. What is common in their motion?

7. When an object is thrown vertically upwards. What is its velocity at the highest point?

8. Can velocity & acceleration point in opposite directions?


10. What is non uniform motion?

Two Marks questions

1. Differentiate scalar & vector quantity?

2. What is retardation? How does it affect the speed?


4. Why is circular motion with constant speed called accelerated motion?

5. State the difference between distance & displacement.
6. What is the difference between speed & velocity?

7. What does a speedometer & odometer indicate?

**Three Marks questions**

1. If an object is thrown vertically upwards with speed $49 \text{ ms}^{-1}$. How long does it take to complete upward journey? What maximum height does it achieve?

2. An object starting from rest covers 20 metres in first 2 seconds & 160 metres in next 4 seconds. What is its velocity after 7 seconds from the start?

**Five Marks questions**

1. Derive all the three equations of motion for uniform acceleration using graphical method.

2. A car a moving at rate of $72\text{km/h}$ and applies brakes which provide a retardation of $5 \text{ ms}^{-2}$.

3. How much time does the car takes to stop.

4. How much distance does the car cover before coming to rest?

5. What would be the stopping distance needed if speed of the car is doubled?
CHAPTER -9 “Force & Laws Of Motion”

KEY CONCEPTS [*rating as per the significance of concept]

<table>
<thead>
<tr>
<th></th>
<th>Balanced and Unbalanced Forces</th>
<th>***</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Laws of Motion</td>
<td>*****</td>
</tr>
<tr>
<td>3</td>
<td>Inertia and Mass</td>
<td>*****</td>
</tr>
<tr>
<td>4</td>
<td>Conservation of Momentum</td>
<td>****</td>
</tr>
</tbody>
</table>

1 Balanced and Unbalanced Forces

Net Force: The net force is when two or more forces are applied on the same object and at the same time and the body does not change its position. The resultant force of all forces applied on an object is net force. The resultant force is zero.

Balanced Force:- When the resultant force of all forces applied on an object is zero then it is called balanced force.

   Example of balanced force:

   ![Diagram of balanced forces]

   - The forces on the book are balanced.
   - The table pushes upward on the book (N)
   - Gravity pulls downward on the book (W)

   **N = W**

   **Unbalanced Forces**: When unequal forces are applied in opposite direction the net resultant force is called unbalanced force. Net force ≠ 0

   **Example of Unbalanced Forces**: If I have a chair and I push on one side of it with a force and if the chair move it means there is unbalanced force acts on the chair.
**Test Yourself**

1. An object of 5 kg is acted upon by two forces, 70 N each in opposite directions. What is its acceleration?

2. Why does an object accelerate during free fall?

---

**Laws of Motion**

**Newton's First Law**

“An object at rest will stay at rest, and an object in motion will stay in motion at constant velocity, unless acted upon by an unbalanced force.”

**Newton's Second Law**

“The rate of change of momentum is proportional to applied force.”

\[ F \propto \frac{mv - mu}{t} \]

\[ F \propto \frac{m(v - u)}{t} \]

\[ F \propto ma \]

\[ F = kma \]

\[ F = ma \quad \text{as } k = 1 \]

*Hence acceleration depends on mass and net applied force on the body.*

**Newton's Third Law**

For every action there is an equal and opposite reaction and these action and reaction acts on two different bodies.

---

**Test Yourself**

1. Can action reaction balance each other?

2. What does a force do?

---

**Inertia and Mass**

Inertia is the tendency of an object to resist any change in its motion. An object will continue to move at the same speed and in the same direction unless acted upon by an unbalanced force. A bowling ball rolled down the road would eventually come to a stop due to unbalanced force (Friction) that causes the ball to stop or
slow down. Without friction, the ball would keep on rolling.

Mass is the amount of matter in an object. A bowling ball has more mass than a tennis ball. The greater the mass of an object the greater its inertia. Mass is the measurement of inertia.

Types of Inertia –
(a) Inertia of rest
(b) Inertia of Motion
(c) Inertia of direction

**Test Yourself**
1. Why do we fall forward if we alight from a moving bus?
2. Why does an athlete run for some distance before long jump?

**Conservation of Momentum:** According to law of conservation of momentum, if no external force is applied on the body the total momentum of the system of the body will remain conserve.

For example in case of collision of two bodies the total momentum before collision will be equal to total momentum after collision

\[
\text{TOTAL MOMENTUM BEFORE COLLISION} = \text{TOTAL MOMENTUM AFTER COLLISION}
\]

\[
m_A u_A + m_B u_B = m_A v_A + m_B v_B
\]
QUESTION BANK

One Mark questions
1. Define momentum.
2. State first law of motion.
3. What is inertia?
4. Can action and reaction balance each other?
5. How does one climb up a rope?
6. Why cannot we walk in space?
7. What does rate of change of momentum represent?
8. Why do we continuously paddle to keep the cycle moving?
9. Why does a scooter tend to skid while executing a sharp turn?
10. Which one would have more inertia: 10 kg mass & 5 kg mass?

Two Marks questions
1. Explain the functioning of shockers in cars.
2. How much force is needed to pull an object of mass 40 kg in vertically upward direction with acceleration of 2.2 m / $s^2$.
3. Why does a fan keep moving for sometime when switched off?
4. What do you mean by conservation of momentum?
5. Inflated balloon lying on the surface of a floor moves forward when pricked with a pin. Why?

Three Marks questions
1. An iron sphere of mass 10 kg is dropped from a height of 80 cm, if ‘$g$’ = 10 m / $s^2$. Calculate the momentum transferred to the ground by the body.
2. What would be the force required to stop a car of mass 1000 kg and a loaded truck of mass 10,000 kg in 2 seconds each moving with velocity 5 m / s.
3. Deduce law of conservation of momentum using third law of motion.

Five Mark questions
1. Name and define three different types of inertia & give an example of each.
Gravity is one of the most basic forces in the universe. It plays a fundamental role not only in the structure of our solar system but also in the way objects behave on Earth. In this section, we will talk about gravity on a small scale. We will discuss topics such as weight, free fall, and ballistics. We will learn the physics of phenomena we experience daily and take for granted.

1. UTILITY OF GRAVITATIONAL FORCE

Gravitation is the force of attraction between two objects in the Universe. Gravitation may be the attraction of objects by the earth. This force is proportional to the product of masses of the objects and inversely proportional to the square of the distance between them. It is independent of medium.

\[ F \propto \frac{m_1 m_2}{r^2} \]
Where ‘r’ is the distance between the two bodies.

Eg :- If a body is dropped from a certain height, it falls downwards due to earth’s gravity. If a body is thrown upwards, it reaches a certain height and then falls downwards due to the earth’s gravity.

- Gravitation is the attraction between objects in outer space.
  E.g. :- Attraction between the earth and moon. Attraction between the sun and planets.

**UTILITY OF GRAVITATIONAL FORCE**

- A natural force that pulls all objects toward the center of the earth
- keeps the moon orbiting
- It holds stars together.
- And binds galaxies together for billions of years. Prevents Planets from losing their atmospheres.

**Test Yourself:**

1. *When we move from the poles to the equator. Hence, the value of g decreases. Why?*
2. *What is the difference between gravity and gravitation?*

**2. Universal law of gravitation**

- The universal law of gravitation states that, ‘Every object in the universe attracts every other object with a force which is directly proportional to product of the masses and inversely proportional to the square of the distance between them.’

- The SI unit of $G$ is $\text{N m}^2\text{kg}^{-2}$ and its value is $6.673 \times 10^{-11} \text{ N m}^2\text{kg}^{-2}$
- The strength of the gravitational attraction between two objects depends on two factors:
• How heavy the objects are (how much mass they have) and
• How far apart they are.

Test Yourself

1. What is the difference between gravity and gravitation?

2. What does it mean to say that the Force of gravity is proportional to the masses of the bodies, and inversely proportional to the distance between them?

3. Free Fall

• With negligible air resistance, falling objects can be considered freely falling. objects of different shapes accelerate differently due to resistance of air.
• In absence of air (vacuum) every object falls with same acceleration.

Test Yourself

1. A coin and a feather are dropped from the roof of a building. Which one will fall to the ground first?

4. To calculate the value of “g” (acceleration due to gravity)

• The acceleration due to gravity is denoted by g.
• The unit of g is same as the unit of acceleration ms^-2
• From the second law of motion, force is the product of mass and acceleration.

\[ F = ma \]

• For free fall, force is the product of mass and acceleration due to gravity.

\[ F = mg \quad (1) \]

\[ F = G \frac{Mm}{r^2} \quad (2) \]

From equation (1) and (2)

\[ mg = G \frac{Mm}{r^2} \]

\[ g = G \frac{M}{r^2} \]

where M is the mass of the Earth and r is the distance between the object and the earth.
Test Yourself

1. Calculate the value of g on the surface of earth.
2. What is the difference between "weight" and "mass"?

5. Mass and Weight:

- Mass is a fundamental, universal property. Mass of a body is constant all over the universe.
- Weight is not fundamental its value depends on circumstances in the Universe. Weight is a force. It is the resultant gravitational force exerted on a body with mass m by all the other bodies on the Universe.

\[
\text{Weight} = F_g = G \frac{m M_e}{R^2} = mg \quad (\because g = \frac{gM_e}{R^2})
\]

where \(M_e\) is the mass of the Earth and \(R\) is the radius of the Earth.

Test Yourself

1. An astronaut has 80 kg mass on earth (a) what is his weight on earth? (b) What will be his mass and weight on Mars where \(g = 3.7 \text{ m/s}^2\).
2. When you put an object on a spring balance, do you get the mass of an object or its weight?

6. Weight of the Object on Moon

- The mass of the moon is less than the mass of the earth. So the moon exerts lesser force on the objects than the earth.
- The weight of an object on the moon is one sixth (\(1/6^{th}\)) of its weight on the earth.
- The weight of an object on the earth is the force with which the earth attracts the object and the weight of an object on the moon is the force with which the moon attracts the object.

<table>
<thead>
<tr>
<th>Celestial body</th>
<th>Mass (kg)</th>
<th>Radius (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth</td>
<td>5.98 x 10^{24}</td>
<td>6.37 x 10^6</td>
</tr>
<tr>
<td>Moon</td>
<td>7.36 x 10^{22}</td>
<td>1.74 x 10^6</td>
</tr>
</tbody>
</table>

Test Yourself

1. What will be the weight of the body on the moon whose mass is 12 kg?
7. **Thrust & Pressure**

- **Thrust** is the force acting on an object perpendicular to the surface.

- **Pressure** is the force acting on unit area of a surface.

  \[
  \text{Thrust} \quad \text{Pressure} = \frac{\text{---------}}{\text{Area}}
  \]

- The SI unit of thrust is N/m\(^2\) or N m\(^{-2}\). It is called Pascal (Pa).

8. **Pressure In Fluids**

- Fluids exert pressure in all directions.

- Pressure exerted on fluids is transmitted equally in all directions.

9. **Buoyancy**

When an object is immersed in a fluid it experiences an upward force called buoyant force. This property is called buoyancy or upthrust.

10. **Why objects float or sink when placed on the surface of water?**

- Take some water in a beaker. Take a piece of cork and an iron nail of the same mass. Place them on the water. The cork floats and the nail sinks.

- If the density of an object is less than the density of a liquid, it will float on the liquid and if the density of an object is more than the density of a liquid, it will sink in the liquid.

11. **Archeimedes Principle**

- Archimedes’ principle states that, When a body is partially or fully immersed in a fluid it experiences an upward force that is equal to the weight of the fluid displaced by it.”
12. Relative Density

- The relative density of a substance is the ratio of the density of a substance to the density of water. It is a ratio of similar quantities and has no unit.

**QUESTION BANK**

One Mark questions

1. Explain what Centrifugal force is.
2. What do you mean by the weight of the body on moon.
3. Give the value of G with proper units.
4. Give the value of g with proper units.
5. What is measured by physical balance?

Two Marks questions

1. At what height above the earth’s surface would the value of acceleration due to gravity be half of what it is on the surface? Take radius of earth to be R.
2. A body of 90 kg f on the surface of earth. How much will it weigh on the surface of moon whose mass is 1/9 and radius is ⅓ of that of earth?
3. A piece of paper takes much longer to fall than a stone through the same distance. Explain the reason.
4. Consider a heavenly body which has a mass twice that of the earth and radius thrice that of the earth. What will be the weight of the book on this heavenly body, if its weight on earth is 900 N?

Three Marks questions

1. Why gravitational force is usually unnoticeable?
2. Prove that acceleration due to gravity is independent of mass of the body.
3. How can the average density of the earth can be determined?
4. What is buoyancy and buoyant force? Upon what factors do they depend?
5. Why does an iron boat float on the surface of water where as iron nail sinks in it?

Five Marks questions

1. Find the percentage change in the weight of a body when it is taken from equator to poles. The polar radius is 6,357 Km and equatorial radius is 6,378 Km.
2. The density of ice is 918kgm-3 and that of sea water is 1,030kgm-3. An iceberg floats with a portion 224 liters outside water. Find the volume of iceberg.
3. What are the laws of flotation? Give some illustrations.
CHAPTER 11 “Work & Energy”

KEY CONCEPTS [*rating as per the significance of concept]*

|   | **Work Done By A Constant Force** | ***
|---|----------------------------------|---
| 2 | **Energy And Its Forms(Kinetic Energy & Potential Energy)** Are Various Energy Forms Inter convertible? | ****
| 3 | **Potential Energy Of An Object At A Height** | ****
| 4 | **Law Of Conservation Of Energy** | ****
| 5 | **Rate Of Doing Work & Commercial Unit Of Energy** | ****

2. **Work Done By A Constant Force**

- *Work is a scalar quantity equal to the product of the displacement x and the component of the force F in the direction of the displacement.*
- Work is defined as a force acting upon an object to cause a displacement.
- Mathematically, work can be expressed by the following equation.
  \[ W = F \times d \cos \theta \]
- where \( F \) = force, \( d \) = displacement, and the angle \( \theta \) is defined as the angle between the force and the displacement vector.
- Three things are necessary for the performance of work:
  - There must be an applied force \( F \).
  - There must be a displacement \( x \).
  - The force must have a component along the displacement.

**Diagram A**

A 100 N force is applied to move a 15 kg object a horizontal distance of 5 meters at constant speed.

**Diagram B**

A 100 N force is applied at an angle of 30° to the horizontal to move a 15 kg object at a constant speed for a horizontal distance of 5 m.

**Diagram C**

An upward force is applied to lift a 15 kg object to a height of 5 meters at constant speed.

**Negative Work** – displacement is opposite to the applied force \( \theta=180^\circ \)
The friction force f opposes the displacement

Force F contributes to displacement x.

Test Yourself:
1. Calculate Work when F = 40 N and x = 4 m.
2. Calculate Work when F = -10 N and x = 4 m.
3. A lawn mower is pushed a horizontal distance of 20 m by a force of 200 N directed at an angle of 30° with the ground. What is the work of this force?
4. A student lifts a 50 pound (lb) ball 4 feet (ft) in 5 seconds (s). How many joules of work has the student completed?

2. Energy And Its Forms

James Joule

The metric system unit of energy is the joule (J), after James Joule.

- Mechanical energy is the energy which is possessed by an object due to its motion or its stored energy of position

Forms of Energy

- Kinetic energy: is the energy of motion

Energy which a body possesses because of its motion, which occurs anywhere from an atomic level to that of a whole organism
Examples of Kinetic Energy: This is not an all-inclusive list.

\[ \text{K.E.} = \frac{1}{2} mv^2 \]

- Electrical – The movement of atoms
- Electromagnetic or Radiant – The movement of waves
- Thermal or Heat – The movement of molecules
- Motion – The movement of objects
- Sound – The movement through waves

Engineers generally refer to thermal/heat energy as “internal energy” and use “kinetic energy” strictly in reference to motion.

**Potential Energy** (Stored energy or gravitational energy)

\[ \text{P.E.} = mgh \]

- The capacity to do work by virtue of position or configuration
- an object can store energy as the result of its position or elastic source
- Potential Energy is maximum at the maximum HEIGHT

**Energy transformation** involves the conversion of one form of energy into another form.
Examples of energy transformation include:

- **Chemical** – Food is consumed and converted into motion for playing sports or taking a test.

- **Radiant** – Sunlight is consumed by plants and converted into energy for growth.

- **Electrical** – Energy transferred to an oven is converted to thermal energy for heating our food.

Now you know the basic forms of energy. The next question is “What are the energy sources?”

There are renewable and nonrenewable sources of energy. A renewable energy source is a form of energy that is constantly and rapidly replenished by natural processes. Examples of **renewable energy sources** include:

- **Biomass** – The use of a living or once living organism as fuel
- **Hydropower** – The energy produced from the movement of water
- **Geothermal** – The use of heat from within the Earth or from the atmosphere near oceans to warm houses or other buildings
- **Wind** – The use of wind to generate electricity
- **Solar** – The use of the sun as a source of heat; for instance, to heat a room within a house, etc.

**Energy Conversion Examples**

- **Fossil fuels** Chemical → Heat → Mechanical → Electrical
- **Solar cells** Sunlight → Electrical
- **Wind turbines** Kinetic → Mechanical → Electrical
- **Hydroelectric** Gravitational potential → Mechanical → Electrical
- **Nuclear** Nuclear → Heat → Mechanical → Electrical
Test Yourself

1. How much potential energy is lost by a 5Kg object to kinetic energy due a decrease in height of 4.5m.

3. Potential energy of an object at a height

An object increases its energy when raised through a height.

The potential energy of an object at a height depends on the ground level or the zero level.

4. Law Of Conservation Of Energy

The principle of Conservation of Mechanical Energy

The total mechanical energy (E=KE+PE) of an object remains constant as the object moves, provided that the net work done by external non-conservative forces is zero, $W_{nc}=0$J Total mechanical energy: the sum of kinetic energy and gravitational potential energy

$$E = KE + PE$$

$$W_{nc} = (KE_f - KE_0) + (PE_f - PE_0)$$

$$W_{nc} = (KE_f + PE_f) - (KE_0 + PE_0)$$

$$W_{nc} = E_f - E_0$$

$$E_f = KE_f + PE_f$$

Test yourself

1. How much potential energy is lost by a 5Kg object to kinetic energy due to a decrease in height of 4.5 m.
5. Rate of Doing Work & Commercial Unit Of Energy

POWER

Rate at which work is performed or energy is expended

\[ P = \frac{W}{t} \]

Watt is the base unit of Power

One watt is equal to 1 joule of work per second

Types of Power

- **Electrical Power**
  Uses electrical energy to do work

- **Mechanical Power**
  Uses mechanical energy to do work (linear, rotary)

- **Fluid Power**
  Uses energy transferred by liquids (hydraulic) and gases (pneumatic)

- Power is the rate that we use energy.
- Power = Work or Energy / Time
- \[ P = \frac{W}{t} = F \times \frac{d}{t} = F \times v \]

- The unit joule is too small. The bigger unit of energy called kilowatt hour (kWh) 1 kWh is the energy used in one hour at the rate of 1000 J s^{-1} (or 1 kW)

\[
1 \text{ kW h} = 1 \text{ kW} \times 1 \text{ h} \\
= 1000 \text{ W} \times 3600 \text{ s} \\
= 3600000 \text{ J} \\
1 \text{ kW h} = 3.6 \times 10^6 \text{ J}.
\]

**Test Yourself**

1. A 5 Kg Cart is pushed by a 30 N force against friction for a distance of 10m in 5 seconds. Determine the Power needed to move the cart.

2. A student lifts a 50.0 pound (lb) ball 4.00 feet (ft) in 5.00 seconds (s). How many watts of power are used to lift the ball?

**Important Points for Work Problems:**

- Always draw a free-body diagram, choosing the positive x-axis in the same direction as the displacement.

- Work is negative if a component of the force is opposite to
displacement direction

• Work done by any force that is at right angles with displacement will be zero (0).

• For resultant work, you can add the works of each force, or multiply the resultant force times the net displacement.

• Energy is the ability to move
• Potential is stored energy (Statics)
• Dependant on height
• Kinetic is moving energy (Dynamics)
• Dependant on velocity
• Springs store energy dependant on distance and constant

**QUESTION BANK**

One mark questions

1. Does work have a direction?
2. Does the kinetic energy of an object depend on its direction of motion?
3. Can matter be converted into energy?
4. Give an example of conversion of chemical energy into heat energy.

Two marks questions

1. Two persons do the same amount of work. The first person does it in 10 s and the second, in 20 s. Find the ratio of the power used by the person to that by the second person.
2. A body of mass 25 g has a momentum of 0.40 kgm/s. Find its kinetic energy.
3. Define work and write its units.
4. By what factor does the kinetic energy of an object depend on its direction of motion?

Three marks questions

1. How much time will it take to perform 440 j of work at a rate of 11 W.
2. A body of mass 3.0 kg and a body B of mass 10 kg are dropped simultaneously from a height of 14.9 m. Calculate their Momenta, their Potential energies and kinetic energies when they are 10 m above the ground.
3. A man does 200 j of work in 10 seconds and a boy does 100 j of work in 4 seconds. Who is delivering more power? Find the Ratio of power delivered by the man to that by the boy.
Five marks questions

1. Show that the work done by a force is given by the product of the force and the projection of the displacement along the force.

2. Find the expression for gravitational potential energy of a body of mass \( m \) at height \( h \).

3. Why does a person standing for a long time get tired when he does not appear to do any work?

4. How can you justify that a body kept at a greater height has larger energy?
CHAPTER 12 – “Sound”

KEY CONCEPTS [*rating as per the significance of concept]*

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1. **Production of Sound**

Sound is produced due to the vibration of objects. Vibration is the rapid to and fro motion of an object.

Vibrating objects are the source of all sounds. Irregular, chaotic vibrations produce noise. Regular, controlled vibration can produce music. All sound is a combination of pure frequencies.

A stretched rubber band when plucked vibrates and produces sound.

2. **Propagation of Sound**

When an object vibrates, the particles around the medium vibrate. The particle in contact with the vibrating object is first displaced from its equilibrium position.

The disturbance produced by the vibrating body travels through the medium but the particles do not move forward themselves.

A wave is a disturbance which moves through a medium by the vibration of the particles of the medium. So sound is considered as a wave. Sound waves require medium for transmission. **Sound waves are called mechanical waves.** When a vibrating object moves forward, it pushes and compresses the air in front of it forming a region of high pressure called compression (C). When the vibrating object moves backward, it forms a region of low pressure called rarefaction (R).
A vibrating object producing a series of compressions (C) and rarefaction (R)

In these waves the particles move back and forth parallel to the direction of propagation of the disturbance. **Such waves are called longitudinal waves.**

**There is another kind of waves called transverse waves.** In these waves the particles oscillate up and down perpendicular to the propagation of the direction of disturbance.

Sound propagates in a medium as a series of compressions (C) and rarefactions (R).

Compressions are the regions of high pressure and density where the particles are crowded and are represented by the upper portion of the curve called crest.

Rarefactions are the regions of low pressure and density where the particles are spread out and are represented by the lower portion of the curve called trough

**Characteristics of a sound wave**

![Sound Wave Diagram]

**Figure 1**

Frequency of sound wave

The number of oscillations per unit time is called the frequency of the sound wave.

It is represented by the symbol \( \nu \) (Greek letter nu). Its SI unit is hertz (Hz)
Time period of sound wave

Frequency and time are represented as follows:-

$\mu$ for one oscillation

$T = \frac{1}{\nu}$ or $\nu = \frac{1}{T}$

Amplitude of sound wave

The amplitude of sound wave is the height of the crest or trough.

It is represented by the letter A.

The SI unit is the same as that of length.

The wavelength is the distance between the "crests" of two waves that are next to each other. The amplitude is how high the crests are.

Pitch and loudness of sound

The pitch of sound (shrillness or flatness) depends on the frequency of vibration.

If the frequency is high, the sound has high pitch and if the frequency is low, the sound has low pitch

Speed of sound

The speed of sound is more in solids, less in liquids and least in gases.

The speed of sound also depends on the temperature of the medium. If the temperature of the medium is more, the speed of sound is more

3. Reflection of Sound

Sound gets reflected at the surface of a solid or liquid and follows the laws of reflection.

i) The angle of incidence is equal to the angle of reflection.
ii) The incident ray, the reflected ray and normal at the point of incidence all lie in the same plane.

4. Echo

If we shout or clap near a reflecting surface like tall building or a mountain, we hear the same sound again. This sound which we hear is called echo. It is caused due to the reflection of sound.

To hear an echo clearly, the time interval between the original sound and the echo must be at least 0.1 s.

Since the speed of sound in air is 344 m/s, the distance travelled by sound in 0.1 s = 344 m/s x 0.1 s = 34.4 m

So to hear an echo clearly, the minimum distance of the reflecting surface should be half this distance that is 17.2 m.

Reverberation

Echoes may be heard more than once due to repeated or multiple reflections of sound from several reflecting surfaces. This causes persistence of sound called reverberation.

In big halls or auditoriums to reduce reverberation, the roofs and walls are covered by sound absorbing materials like compressed fibre boards, rough plaster or draperies.

5. Uses Of Multiple Reflection Of Sound

Megaphones, horns, musical instruments like trumpets, etc. are deigned to send sound by multiple reflection in a particular direction without spreading in all directions.

ii) Doctors listen to sounds from the human body through a stethoscope. The sound of heartbeat reaches the doctor’s ears by multiple reflections.

iii) Generally the ceilings of cinema halls and auditoriums are curved so that sound after multiple reflections reaches all parts of the hall.

Sometimes a curved sound board is placed behind the stage so that sound after multiple reflections spreads evenly across the hall.
6. Range of Hearing

Human beings can hear sound frequencies between 20 Hz and 2000 Hz.

Sound whose frequency is less than 20 Hz is called infrasonic sound
Sound whose frequency is more than 2000 Hz is called ultrasonic sound

7. Uses of ultrasonic sound

Ultrasonic sound is used to clean objects like electronic Components, used to detect cracks in metal blocks, used in ultra sound scanners for getting images of internal organs of the human body used to break small stones formed in the kidneys into fine grains.

8. Sonar

It is a device which uses ultrasonic waves to measure distance, direction and speed of underwater objects. The distance of the object can be calculated by knowing the speed of sound in water and the time taken between the transmission and reception of ultrasound

9. Structure of the human ear

The sound waves passes through the ear canal to a thin membrane called eardrum. The eardrum vibrates. The vibrations are amplified by the three bones of the middle ear called hammer, anvil and stirrup. Middle ear then transmits the sound waves to the inner ear. The brain then interprets the signals as sound.
QUESTION BANK

One mark questions

1. What do you understand by sound waves?
2. Give an example to show that sound travels at a finite speed.
3. Is sound wave longitudinal or transverse?
4. Name two quantities that vary periodically at a place in air as a sound wave travels through it.
5. An airplane produces a sound wave with frequency of 5 KHz and wavelength 30 m. In how much time would the sound wave cover the distance of 4 Km?
6. With the help of a diagram show how longitudinal waves like sound waves travel in air.
7. Can we hear the ringing of a mobile phone placed in a vacuum chamber?
8. Can two astronauts talk on moon as they do on the surface of the earth?

Two marks questions

1. Explain how echoes are used by bats to judge the distance of an obstacle?
2. State the special properties of ultrasound that make it useful to us. In general, how these properties are utilized.
3. Why is soft furnishing avoided in concert halls?
4. Draw a diagram depicting low pitched sound and high pitched sound and write main difference between the two?
5. Distinguish between longitudinal and transverse waves. Give one example each.
6. An explosion takes place at the moon. After what time would it be heard at the earth?

Three marks questions

1. Two sources A and B vibrate with the same amplitude. They produce sounds of frequencies 1 kHz and 30 kHz respectively. Which of the two waves will have greater power?
2. Find the time period of the source of a sound wave whose frequency is 400Hz.
3. A sound wave travels at a speed of 340m/s. If its wavelength is 2 cm, what is
the frequency of the wave? Will it be in the audible range?

4. The grandparents and parents of a two year girl are playing with her in a room. A sound source produces a 28—kHz sound. Who in the room is most likely to hear the sound?

**Five marks questions**

1. Sound cannot travel in vacuum. Describe an experiment to demonstrate this.

2. With the help of a diagram describe how compression and rarefaction pulses are produced in air near a source of sound.

3. Explain briefly how a flaw in a mental component can be detected using ultrasound?

4. Explain the working and application of SONAR.

5. A monkey drops a coconut from the top of a tree. He hears the sound of the coconut hitting the ground 2.057 seconds after dropping it. If the monkey was 19.6 metres above the ground, what is the speed of sound in air? (take \( g = 9.8 \text{m/s}^2 \)).

6. Draw a neat diagram of human ear. Explain the function of various parts.

**What have you learnt?**

**Longitudinal waves**: Those in which the direction of vibration is the same as their direction of propagation. So the movement of the particles of the medium is either in the same or in the opposite direction to the motion of the wave. Exemple: sound waves, what changes in this case is the pressure of the medium (air, water or whatever it be).

**Transverse waves**: The oscillations occur perpendicularly to the direction of energy transfer. Exemple: a wave in a tense string. Here the varying magnitude is the distance from the equilibrium horizontal position.

A general property of waves is that their speed relative to medium depends on the properties of medium but is independent of the motion of the source of waves. If the observer is in motion with respect to the medium, the velocity of wave propagation relative to the observer will be different. A remarkable exception is encountered in the case of light.

**PROPERTIES**

Frequency

- Wavelength
- Period
- Amplitude
- Intensity
- Speed
- Direction

Perception of Sound

For humans, hearing is limited to frequencies between about 20 Hz and 20000 Hz, with the upper limit generally decreasing with age.

**KEY LEARNING:**

Vibration - repetitive back and forth motion Periodic motion - a motion that repeats itself Mechanical waves require medium for propagation

Waves move through medium but medium remains in place

Longitudinal waves - Vibration direction parallel to wave propagation direction Particles in medium move closer together/farther apart. Example: sound waves

Gases and liquids - support only longitudinal waves

Transverse waves -

Vibration direction perpendicular to wave propagation direction. Example: plucked string

Solids - support both longitudinal and transverse waves

Sound waves Require medium for transmission

1. Sound is a wave motion, produced by a vibrating source.
2. A medium is necessary for the propagation of sound waves.
3. Sound is a longitudinal wave in which the particles of medium move along the direction of motion of wave.
4. The part or region of a longitudinal wave in which the density of the particles of the medium is higher than the normal density is known as compression.
5. The part or region of a longitudinal wave in which the density of the particles of the medium is lesser than the normal density is called a rarefaction.
6. The point of maximum positive displacement on a transverse wave is known as crest.
7. The point of maximum negative displacement on a transverse wave is known as through.
8. A wave or short duration which is confined to a small portion of a medium at any
given time is known as a pulse.

9. The maximum displacement of particles of the medium from their mean positions during the propagation of a wave is known as amplitude of the wave.

10. The distance traveled by a wave in one second is called wave velocity. It depends upon the nature of the medium through which it passes.

11. The speed of sound depends primarily on the nature and the temperature of the transmitting medium.

12. Sound travels faster in solids than in air. The speed of sound in solids is much more than the speed of sound in liquids or gases.

13. The distance between two consecutive compressions or two consecutive rarefactions is called the wavelength.

14. Frequency is defined as the number of oscillations per second.

15. The time taken by the wave for one complete oscillation of the density or pressure of the medium is called the time period, T.

16. How the brain interprets the frequency of an emitted sound is called the pitch of sound.

17. Loudness is the degree of sensation of sound produced.

18. Sound properties such as pitch, loudness and quality are determined by the corresponding wave properties.

19. Sound gets reflected and follows the same law as the reflection of light.

20. The persistence of sound due to repeated reflection and its gradual fading away is called reverberation of sound.

21. Echo is a repetition of sound due to the reflection of original sound by a large and hard obstacle.

22. The audible range of hearing for average human beings is in the frequency range of 20 Hz – 20 kHz.

23. The amount of sound energy passing each second through unit area is called the intensity of sound.

24. Sound of frequency less than 20 Hz is known as infrasound and greater than 20 kHz is known as ultrasound.

25. Ultrasound has many medical and industrial applications.

26. SONAR stands for Sound Navigation and Ranging and it works on the principle of reflection of sound waves.

27. The SONAR technique is used to determine the depth of the sea and to locate under
VALUE BASED QUESTIONS
MATTER IN OUR SURROUNDINGS

1. Radha wears colourful and synthetic clothes even in summer. His father asked him to wear white or light-coloured cotton clothes instead of colourful synthetic clothes. But, Radha did not take his father’s advice seriously.
   a) Why did Radha’s father advise him to wear white or light-coloured cotton clothes
   b) What values does Radha not possess?

Ans.: a) Cotton beings a good absorber of water helps in absorbing the sweat and exposing it to the atmosphere for easy evaporation. Also white or light-coloured clothes are poor absorbers of heat from atmosphere whereas coloured and synthetic clothes absorb much heat from the atmosphere, and do not absorb sweat; so they are not good for skin.

   b) Radha does not possess values like awareness and obedience.

2. Even if Radha has a refrigerator in her home, she uses earthen pot (Matka) to store drinking water in summer.
   a) How does the water kept in an earthen pot become cool during summer?
   b) Which values does Radha possess?

Ans.: a) The pores of an earthen pot provide more surface area to water for faster evaporation. As the water seeps out of the pores, its evaporation keeps the water inside the pot cool.

   b) Simplicity and awareness.

IS MATTER AROUND US PURE?

1. Cough syrup is common medicine used in cold and cough. It contains alcohol (ethanol) as one of its constituents. Some of the people use it as an alternative of wine.
   a) What should government do to prevent the misuse of such medicines?
   b) If 400 g of cough syrup contains 40 g glucose and 20 g alcohol, what is the concentration in the solution?

Ans.: a) Government should regulate production and supply of such medicines. There should be a proper law for sale and purchase of such medicines.

   b) Mass of glucose (solute) = 40g

   Mass of water and alcohol (solvent) = 400 – 40 = 360 g

   Concentration = \( \frac{40}{360} \times 100 = 11.11\% \)

2. After winter, Astha packed off her woolen clothes with naphthalene balls. With passage of time, these naphthalene balls become smaller in size.
What type of change is involved during this process?

b) Why did Astha pack off her woolen clothes with naphthalene balls?

c) What values does Astha possess?

Ans.: a) This is a physical change since balls are converted from solid to vapour i.e., they undergo sublimation process at room temperature.

b) To prevent woolen clothes from getting damaged by moths.

c) Awareness, care of her clothes.

**Motion**

1. A bus moves from Stop A to Stop B with a speed of 50 km/h travelling a distance 10 km. Then the driver increases the speed upto 60 km/h. One of the passengers asks the driver to decrease the speed of the bus because as per motor vehicle rule maximum speed limit for heavy vehicle is 40 km/h. After 6 minutes moving with the speed of 60 km/h, it reaches stop C. Then driver decreases the speed of the bus and reaches Stop D, which is 12 km from Stop C.

   a) Calculate the distance covered by the bus from Stop B to Stop C.

   b) If the average speed of the bus is 40 km/h, what is the speed of the bus between Stop C and Stop D?

   c) What value is shown by the passenger who asks the driver to decrease the speed of the bus?

Ans.: a) From Stop B to C:

   Speed of the bus = 60 km/h

   Time = 6 minutes = 6/60 = 0.1 h

   Therefore, Distance = Speed x Time

   = 60 x 0.1 = 6 km.

   From Stop A to Stop B:

   Distance = 10 km

   Speed = 50 km/h

   Time = 10/50 = 1/5 hours

   From Stop B to Stop C:

   Distance = 6 km

   From Stop C to Stop D:

   Distance = 12 km

   Speed = x km/h

   Time = 6 minutes = 6/60 = 0.1 h

   Therefore, Distance = Speed x Time

   = x x 0.1 = 12 km

   Speed = 40 km/h

   Therefore, Distance = Speed x Time

   = 40 x 0.1 = 4 km

   x km/h

   50 km/h
Time = 6 minutes = 1/10 hours

From Stop C to Stop D:

Distance = 12 km
Let Speed = x km/h
Therefore, Time = 12/x

Average Speed = Total distance / Total time

Or, 40 = \frac{10 + 6 + 12}{\frac{10}{5} + \frac{12}{x}}

Or, 40 = \frac{28 \times 10x}{3x + 120}
Therefore, x = 30 km/h

Speed of the bus between stops C and D = 30 km/h

d) The passenger shows concern for the safety of himself and others, and adherence to the rule of law.

**FORCE AND LAWS OF MOTION**

1. It is mandatory to fasten seat belt while driving the vehicles. But some of the people do not obey this rule.
   a) What will happen if a car driver not fastening the seat belt, suddenly applies the brake to stop the car?
   b) Which law of motion describes this phenomenon?
   c) Which values are possessed by those people who fasten their seat belt while driving the vehicle.

Ans.: a) When a car driver applies the brake he/she tends to fall forward. If the driver, not fastening his/her seat belt, suddenly applies the brake to stop the car, his/her head may strike to the steering and he/she may get injury.

b) Newton’s first law of motion
c) Concerns for one’s safety and adherence to the rule of law.

**GRAVITATION**

1. Abhishek buy few grams of gold at poles as per the instruction of his friend Alok. He hands over the same when he meets him at equator. But, when Alok weighs the gold, he finds it less in weight.
   a)
   b) Why does Alok finds the weight of gold less?
   c) Does Abhishek steal some gold?
   d) What value is possessed/violated by Abhishek?

Ans.: a) Acceleration due to gravity at poles is greater than at equator. Due to this, the weight of gold is less at equator.
b) No, Abhishek does not steal the gold.

c) He possesses honesty and trustworthy.

TISSUES

1. a) Which type of tissue is blood?
   b) Name two substances transported by blood.
   c) What values are shown by those who donate blood?

Ans.: a) Connective tissue
   b) oxygen and absorbed food
   c) concerns for other’s lives, social responsibility

IMPROVEMENT IN FOOD RESOURCES

1. Farmers use pesticides to control weeds, insects and diseases. The chemicals which
   are use to eliminate weeds and insects have harmful effects on environment.
   a) What are harmful effects of pesticides on environment?
   b) Should farmers use pesticides to protect their crops from weeds, insects and
diseases? Give your suggestions.

Ans.: a) Pesticides are non-biodegradable so, they remain in soil, water as well as in
plants. They enter in the food chain, and harm the human beings and other animals.

b) Farmers should use biological method to control pests as they do not cause any
environmental pollution. As far as possible farmers should avoid the use of
pesticides. It is our responsibility to keep our environment pollution free.
Explorations

- NCERT text book for class IX
- Foundation science for class IX By- H C Verma
- Self study in Science By-Evergreen Publications
- http://webphysics.davidson.edu/physlet_resources/bu_semester1/c2_twocars_grahs.html
- http://video.google.com/videoplay?docid=-2960800254662978674&q=%2B%22terminal+velocity%22&total=96&start=0&num=10&so=0&type=search&plindex=0
## ZIET CHANDIGARH

**KENDRIYA VIDYALAYA SANGATHAN**

**BLUE PRINT**

**SUBJECT – SCIENCE**

**CLASS - IX**

**Summative Assessment – I (SA 1 – Term I)**

**Time: 3 hours**

**M.M.: 90**

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<td></td>
<td>a) Improvement in food resources</td>
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General Instructions:

a. The question paper comprises of two sections A and B, you are to attempt both the sections.

b. All questions are compulsory.

c. There is no overall choice. However internal choice has been provided in all the three questions of five marks category. Only one option in each question is to be attempted.

d. Questions from 1 to 3 in section A are one mark questions these are to be answered in one word or a sentence.

e. Questions from 4 to 7 in section A are Two marks questions. These are to be answered in about 30 word each.

f. Questions from 8 to 19 in section A are Three marks questions. These are to be answered in about 50 words each.

g. Questions from 20 to 24 in section A carry five marks questions. These are to be answered in 70 words each.

h. Questions from 25 to 42 in section B are multiple choice questions based on practical skills. Each question is one mark question. You are to select one most appropriate response out of the four provided to you.
### SECTION – A

1. A substance has a definite volume but no definite shape. State whether this substance is a solid, liquid or a gas.  

2. What is the resultant force of a number of balanced forces acting on body?  

3. Name the plastids which have chlorophyll.  

4. State the difference between homogeneous & heterogeneous mixture. Give one example of each.  

5. What is the relation between the mass and the weight of the body? What are the differences between the two?  

6. State two differences between a mitochondria and plastid.  

7. Mention the significance of meristems in plants.  

8. Give reasons:  
   a) A sponge can be pressed easily; still it is called a solid.  
   b) Water vapours have more energy than water at same temperature.  
   c) Naphthalene balls disappear with time without leaving any solid.  

9. What is meant by concentration of a solution? Calculate the concentration of a solution which contains 12 g of urea in 160 g of solution.  

10. Consider the following graphs. Can you interpret the type of motion shown by car A and car B? Show calculations.  

11. Which of the following has more inertia & Why?  
   a) A rubber ball and a stone of the same size.  
   b) A bicycle and a train.
12. Two similar trucks are moving with a same velocity on a road. One of them is loaded while the other is empty. Which of the two will require a larger force to stop it?

13. Consider two bodies A and B. The body B is heavier than A. Which of the bodies is attracted with a greater force by earth? Which of the two will fall with greater acceleration? Explain.

14. Show that if a body is taken to a height H above the earth’s surface acceleration due to gravity is decreased by the factor \( \frac{R^2}{(R+H)^2} \), where R is the radius of the earth.

15. State the ways in which phloem is functionally different from xylem.

16. Draw a neat diagram of a section of phloem and label four parts.

17. Give one important functional difference amongst the muscle tissues and draw a labeled diagram of the muscle tissue which never shows fatigue.

18. Which cell organelle would you associate with elimination of old and worn out cells & why?

19. Which two factors bring about loss of food grains during storage? Give one example each. State any two control measures to be taken before grains are stored.

20. a) Account for the following:
   i) Hydrogen is considered an element.
   ii) Water is regarded as compound.

   b) What is the physical state of water at i) 250°C ii) 100°C?

   OR

   a) What is meant by evaporation? What are the factors on which the rate of evaporation depend upon?

   b) How does evaporation cause cooling?

21. a) Name the process you would use to:
   i) recover sugar from an aqueous sugar solution.
   ii) separate mixture of salt solution and sand.

   b) Which of the following will show “Tyndal Effect” & why?
   i) Salt Solution  ii) Milk
   iii) Copper Sulphate Solution  iv) Starch Solution

   OR

   a) How are sol, solution and suspension different from each other?

   b) Which of the following is chemical change? Justify.
i) Rusting of iron  ii) Mixing of iron fillings and sand
iii) Cooking of food  iv) Freezing of water

22. The graph below represents the distance-time graph of two cars A and B. Which car is moving with a greater speed when both are moving and why?

![Distance-time graph of cars A and B](image)

Define uniform acceleration. Derive the following equations considering uniform acceleration:

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

OR

23. Identify whether it is balanced or unbalanced force that causes the following different types of movement.
   (i) A person resting in an armchair.
   (ii) A cyclist braking.
   (iii) A lorry travelling at a constant speed on a straight road.
   (iv) A car that has a deceleration of 10 m/s\(^2\).

OR

Explain how Newton’s second law can be used to define the unit of force. Define the SI unit of force.

24. How crop variety improvement methods come to the rescue of farmers facing repeated crop failure? Describe three factors for which they could do crop improvement.

Which is the most common method of obtaining improved variety of crops? Explain briefly.

OR

A poultry farmer wants to increase his broiler production. Explain three management practices followed to enhance the yield

In what way is the daily food requirement of broiler different from those of egg layers.
## SECTION- B

25. Pick out a colloid from the following:

<p>| | | | |</p>
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<tbody>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
</tr>
<tr>
<td>Sugar</td>
<td>Salt</td>
<td>Muddy</td>
<td>Milk</td>
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<tr>
<td>solution</td>
<td>solution</td>
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</tbody>
</table>

26. Egg albumin in water forms:

a) True solution  
b) Colloid  
c) Suspension  
d) None of these

27. Which of the following represents a correct set of observations for a mixture of common salt and water?

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<th>Stability</th>
<th>Filtration</th>
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</thead>
<tbody>
<tr>
<td>a) Transparent</td>
<td>Unstable</td>
<td>No residue</td>
</tr>
<tr>
<td>b) Transparent</td>
<td>Stable</td>
<td>No residue</td>
</tr>
<tr>
<td>c) Translucent</td>
<td>Stable</td>
<td>No residue</td>
</tr>
<tr>
<td>d) Opaque</td>
<td>Unstable</td>
<td>Residue</td>
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</tbody>
</table>

28. When a mixture of iron fillings and sulphur is heated, the colour of the mixture changes from:

a) Black to yellow  
b) Yellow to black  
c) Greyish yellow to black  
d) Black to brown

29. The colour of hydrated copper sulphate is:

a) Blue  
b) Colourless  
c) Brown  
d) Yellow
30. What happens when Zn granules react with dilute sulphuric acid:
   a) Bubbles due to colourless, odourless gas are formed and colourless solution is obtained.
   b) No reaction takes place.
   c) Pungent smelling gas comes out.
   d) No gas evolved.

31. What happens when iron nails are added to copper sulphate solution:
   a) The solution becomes pale green and reddish brown copper metal gets deposited.
   b) The solution becomes colourless.
   c) There is no reaction.
   d) Copper displaces iron.

32. Which of the following substances sublimes on heating:
   a) Iodine
   b) Camphor
   c) Naphthalene
   d) All of these

33. At what temperature ice and water both exist together under normal atmospheric pressure?
   a) Below 273.16 K
   b) Above 273.16 K
   c) At 273.16 K
   d) None of these

34. Recovery of salt from salt solution in water can be done by:
   a) Evaporation
   b) Distillation
   c) Filtration
   d) None of these

35. If a particle moves with a constant speed, the distance time graph is a
   a) straight line
   b) circle
   c) straight vertical line
   d) polygon

36. In circular motion the
   a) direction of motion is fixed
   b) direction of motion changes continuously
   c) acceleration is zero
   d) velocity is constant

37. If no force acts on a body, it will
   a) get de-shaped
   b) Move with increasing speed
   c) Either remain at rest or move in a straight line
   d) Break
38. The steps for conducting the starch test on the given sample of rice grains are
   i) Crush the rice grains
   ii) Add water to the test tube
   iii) Add few drops of iodine
   iv) Boil the contents and filter
   The most appropriate order in which the steps should be followed are
   a) ii, iii, i, iv  
   b) ii, i, iii, iv 
   c) iii, iv, i, ii  
   d) i, ii, iv, iii

39. While preparing a temporary mount of the Cheek cells, the reason behind staining the cells is
   a) To prevent the cells from dying quickly  
   b) To preserve them  
   c) To distinct them  
   d) To make them the organelles clearly visible

40. Girt is formed in some fruits due to
   a) Sclereids  
   b) Parenchyma  
   c) Fibres  
   d) Collenchyma

41. A pulse is a/an:
   a) An isolated wave a very short duration  
   b) Group of 1-3 waves  
   c) Group of large number of waves  
   d) Electrical in nature having many waves

42. Which of the following has the largest inertia?
   a) A pin  
   b) An ink pot  
   c) Your physics text book  
   d) Your body
**ZIET CHANDIGARH**  
**KENDRIYA VIDYALAYA SANGATHAN**  
**BLUE PRINT**  
**SUBJECT – SCIENCE**  
**CLASS - IX**  
**Summative Assessment –II (SA 2 - Term II)**

**Time: 3 hours**  
**M.M.: 90**

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<td>Motion , Force &amp; work</td>
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<td>b) Ch.11 Work</td>
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<td>c) Ch.12 Sound</td>
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<td>18(18)</td>
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ZIET CHANDIGARH
KENDRIYA VIDYALAYA SANGATHAN
SUBJECT – SCIENCE
CLASS - IX

Summative Assessment –II (SA 2 - Term II)

MAX. Marks: 90
TIMES: 3 Hrs.

General Instructions:

a. The question paper comprises of two sections A and B, you are to attempt both the sections.

b. All questions are compulsory.

c. There is no overall choice. However internal choice has been provided in all the three questions of five marks category. Only one option in each question is to be attempted.

d. Questions from 1 to 3 in section A are one mark questions these are to be answered in one word or a sentence.

e. Questions from 4 to 7 in section A are Two marks questions. These are to be answered in about 30 word each.

f. Questions from 8 to 19 in section A are Three marks questions. These are to be answered in about 50 word each.

g. Questions from 20 to 24 in section A carry five marks questions. These are to be answered in 70 words each.

h. Questions from 25 to 42 in section B are multiple choice questions based on practical skills. Each question is one mark question. You are to select one most appropriate response out of the four provided to you.
## SECTION – A

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Give an example of tri atomic gas.</td>
</tr>
<tr>
<td>2.</td>
<td>The growth in plants is limited to certain regions. What is the reason?</td>
</tr>
<tr>
<td>3.</td>
<td>How the frequency of wave is related to its time period?</td>
</tr>
<tr>
<td>4.</td>
<td>State the factors on which work done depends.</td>
</tr>
<tr>
<td>5.</td>
<td>What are the main points of the Cell Theory proposed by Schleiden and Schwan?</td>
</tr>
<tr>
<td>6.</td>
<td>A car with a speed of 25m/s weighing 900 Kg stops at a distance of 40 metres. Calculate the force exerted and the work done by the brakes.</td>
</tr>
<tr>
<td>7.</td>
<td>What is Relative Density? If an object is immersed wholly in a liquid causing upthrust equal to the weight of the body, then what will be the relation between the Relative densities of liquid and the object.</td>
</tr>
<tr>
<td>8.</td>
<td>What is Symbiosis? Name a symbiotic life form. Mention the specific organisms which display the symbiotic relationship in this life form.</td>
</tr>
<tr>
<td>9.</td>
<td>Write the formulas &amp; names of the compounds formed between: a) Sodium and carbonate ions b) Aluminium and sulphate ions c) Barium and chloride ions</td>
</tr>
<tr>
<td>10.</td>
<td>a) Calculate molar mass of $S_8$. b) Convert into mole: i) 12 gram of oxygen gas ii) 32 gram of oxygen molecule</td>
</tr>
<tr>
<td>11.</td>
<td>Write three significant features of Bohr’s Model of atom.</td>
</tr>
<tr>
<td>12.</td>
<td>Suppose a man is trying to push a wall. But the wall doesn't move. What is the amount of work done? Calculate the amount of work done in lifting a body of mass 3 Kg through a distance of 11 metres.</td>
</tr>
<tr>
<td>13.</td>
<td>Explain the salient features of Phylum Mollusca.</td>
</tr>
<tr>
<td>14.</td>
<td>a) What are Concentrates in animal feed? b) Name two Internal Parasites that cause diseases in animals.</td>
</tr>
<tr>
<td>15.</td>
<td>a) Describe an activity to demonstrate the process of Osmosis.</td>
</tr>
</tbody>
</table>

17. Calculate the wavelength of a sound wave whose frequency is 220 Hz and speed is 440 m/s in a given medium.  

18. Explain the principle behind the wind up toys.  
A cat and a mouse are running with the same speed. If the weight of the cat is 20 times that of mouse, what is the ratio of their kinetic energy?  

19. State Archimedes Principle. Why does an object float or sink in water?  

20. a) State the Law of conservation of mass & Law of definite proportion with the help of one example each.  
b) What are polyatomic ions? Give two examples.  

OR  
a) State any two differences between an atom and molecule.  
b) How $^{22}Z$ and $^{20}Z$ related to each other and why? If abundance of $^{22}Z$ and $^{20}Z$ is 90% & 10% respectively then calculate the average atomic mass of Z?  

21. Which part of the ear contains the actual hearing organ? Draw the structure of the ear and label it.  

OR  
Show that the reflector must be situated at a least distance from the observer for formation of distinct echo. What is the value of this distance at room temperature?  
Why ceilings of concert halls and conference halls are made curved?  

22. a) What is transformation of energy? Explain with any two suitable examples.  
b) What must be the velocity of a moving body of mass 2 kg so that its K.E. is 25 J?  
c) Represent graphically constant force acting on a body producing a displacement along the direction of motion on a force-displacement graph. What is the significance of force-displacement graph?
OR

a) Define potential energy. Give two examples.
b) Two bodies of different masses \( m_1 \) and \( m_2 \) (\( m_1 > m_2 \)) have same kinetic energy. They are stopped by applying same retarding force. Which body will stop first?

23. a) Why do we classify organisms? Write it’s any four advantages.

b) Why is there a need for systematic naming of living organisms? Write four conventions that are followed while writing scientific names of the species.

OR

a) What are the basis of putting plants and animals in two different categories ? Write one main difference between fungi and plantae.

b) Classify the following in their respective phylum / class; Jellyfish, Earthworm, Cockroach, Rat.

24. With the help of a labeled diagram, show

a) Nitrogen cycle in nature.

b) Describe briefly any two processes involved in the cycling of \( N_2 \) in the atmosphere.

OR

With the help of a labeled diagram show the cycling of carbon in nature. What are the two ways in which carbon-di-oxide is fixed in the environment.

SECTION – B

25. State the chemical reaction between Barium Chloride (aqueous) & Sodium Sulphate (aqueous).

\[
\text{a) } \text{BaCl}_2 (aq) + \text{Na}_2\text{SO}_4 (aq) \rightarrow \text{BaSO}_4 \text{ (white ppt)} + 2\text{NaCl (aq)}
\]

\[
\text{b) } \text{BaCl}_2 (aq) + \text{Na}_2\text{SO}_4 (aq) \rightarrow \text{BaSO}_3 \text{ (red ppt)} + 2\text{NaCl (aq)}
\]

c) Both (a) & (b)

d) None of these

26. In accordance with the law of conservation of mass give the co-efficient of \( O_2 \) in the equation:

\[
\text{C}_5\text{H}_{12} + \text{O}_2 \rightarrow 5\text{CO}_2 + 6\text{H}_2\text{O}
\]
<table>
<thead>
<tr>
<th>Q.</th>
<th>Question</th>
<th>Options</th>
<th>Answer</th>
</tr>
</thead>
</table>
| 27. | Which of the following is not an aerial adaptation of a bird? | a) Presence of strong flight muscles.  
   b) Presence of vertebral column  
   c) Streamlined body  
   d) Forelimbs modified into wings. |  | 1 |
| 28. | The time period of a sound wave travelling in a medium is $T$. At a given instance $(t=0)$ a particular region in the medium has minimum density. The density of this region will be minimum again at | a) $t=T$  
   b) $t=T/2$  
   c) $t=T/3$  
   d) $t=T/4$ |  | 1 |
| 29. | Which of the following is not an aquatic adaptation: | a) Streamlined body  
   b) Hollow bones  
   c) Presence of Gills  
   d) Presence of fins |  | 1 |
| 30. | The frequency, wavelength and speed of a sound wave are related as: | a) $v=\lambda x V$  
   b) $\lambda=V x$  
   c) $v = \lambda / V$  
   d) $V = \lambda x v$ |  | 1 |
| 31. | If a flower has 6 petals which type of a plant would it be? | a) Dicot  
   b) Monocot  
   c) Both (a) and (b)  
   d) None of these |  | 1 |
| 32. | If the density of air in the lab, at a point through which a sound wave is passing is maximum at an instant, the pressure at that point will be: | a) Minimum  
   b) Same as the density of air  
   c) Equal to the atmospheric pressure  
   d) Maximum |  | 1 |
| 33. | Amphibians of the plant kingdom are: | a) Thallophyta  
   b) Pteridophyta  
   c) Bryophyta  
   d) None of these |  | 1 |
| 34. | Choose the option which includes the feature that helps the fish to change its | |  | 1 |
### 35. You are shown two slides of plant tissues; Parenchyma and Sclerenchyma. You can identify the Sclerenchyma by the:
- a) location of nucleus
- b) thickness of the cell wall
- c) size of the cell
- d) position of vacuoles

### 36. A sound wave consists of:
- a) A number of compression pulses one after the other
- b) A number of rarefaction pulses one after the other.
- c) Compression and rarefaction pulses one after the other.
- d) A compression and rarefaction pulse separated by a distance equal to one wavelength.

### 37. Wave produced along a compressed spring are:
- a) Longitudinal wave
- b) Transverse wave
- c) Seismic wave
- d) Electromagnetic wave

### 38. Water meniscus in a graduated cylinder is of concave shape. While finding the volume, the correct reading will correspond to:
- a) upper end of meniscus
- b) lower end of meniscus
- c) the midpoint of meniscus
- d) anywhere on the meniscus

### 39. The buoyant force on a body acts in a:
- a) vertically downward direction
- b) vertically upward direction
- c) direction between the horizontal and vertical
- d) direction between the horizontal and vertical

### 40. While taking readings on the spring balance what are the things you should take into account?
<table>
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<tr>
<th>Options</th>
<th>41. A body floats in a liquid if the buoyant force is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Zero error</td>
<td>b) Greater than its weight</td>
</tr>
<tr>
<td>c) Both (a) and (b)</td>
<td>d) Equal to its weight</td>
</tr>
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<td>42. Two bodies of unequal masses are dropped from the table. At any instant, they have equal:</td>
<td></td>
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<tr>
<td>a) Momentum</td>
<td>b) Acceleration</td>
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<tr>
<td>c) Potential energy</td>
<td>d) Kinetic energy</td>
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## PROFORMA-1 FOR ERROR ANALYSIS AT STUDENT AND VIDYALAYA LEVEL

### [SAMPLE]

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**TOTAL**

- **SL. No. of Questions**: 11
- **Marks Alloted**: 3
- **Name of the Student**: [VARIES]
- **UNIT-I**: 2
- **UNIT-II**: 7
- **UNIT-III**: 15
- **UNIT-IV**: 18
- **UNIT-V**: 23
- **UNIT-VI**: 26

### Analysis

- **Average Score**: 2.23
- **Percentage**: 74.36

### Learning Gap

- **>70**: 0
- **70-40**: 0
- **<40**: 0

### Teaching Gap

- **>70**: 0
- **70-40**: 0
- **<40**: 0
PRACTICALS – TERM I

Practical should be conducted alongside the concepts taught in theory classes.

List of Experiments

1. To test (a) the presence of starch in the given food sample (b) the presence of the adulterant metanil yellow in dal

2. To prepare
   a) a true solution of common salt, sugar and alum
   b) a suspension of soil, chalk powder and fine sand in water
   c) a colloidal of starch in water and egg albumin in water and distinguish between these on the basis of
      - transparency
      - filtration criterion
      - stability

3. To prepare
   a) a mixture
   b) a compound
      using iron filings and sulphur powder and distinguish between these on the basis of:
      i. appearance i.e., homogeneity and heterogeneity
      ii. behaviour towards a magnet
      iii. behaviour towards carbon disulphide as a solvent.
      iv. effect of heat.

4. To carry out the following reactions and classify them as physical or chemical changes.
   a. Iron with copper sulphate solution in water
   b. Burning of magnesium in air.
   c. Zinc with dilute sulphuric acid
   d. Heating of copper sulphate
   e. Sodium sulphate with barium chloride in the form of their solutions in water.

5. To prepare stained temporary mounts of (a) onion peel and (b) human cheek cells and to record observations and draw their labeled diagrams.

6. To identify parenchyma and sclerenchyma tissues in plants, striped muscle fibers and nerve cells in animals, from prepared slides and to draw their labeled diagrams.
7. To separate the components of a mixture of sand, common salt and ammonium chloride (or camphor) by sublimation.

8. To determine the melting point of ice and the boiling point of water.

9. To establish relationship between weight of a rectangular wooden block lying on a horizontal table and the minimum force required to just move it using a spring balance.

10. To determine the mass percentage of water imbibed by raisins.

**PRACTICALS-TERM-II**

*Practical should be conducted alongside the concepts taught in theory classes.*

**List of Experiments**

1. To verify laws of reflection of sound.

2. To determine the density of solid (denser than water) by using a spring balance and a measuring cylinder.

3. To establish the relation between the loss in weight of a solid when fully immersed in
   a. tap water
   b. strongly salty water, with the weight of water displaced by it by taking at least two different solids.

4. To observe and compare the pressure exerted by a solid iron cuboid on fine sand/ wheat flour while resting on its three different faces and to calculate the pressure exerted in the three different cases.

5. To determine the velocity of a pulse propagated through a stretched string/slinky.

6. To study the characteristic of spirogyra/Agaricus, Moss/Fern, Pinus (either with male or female cone) and an Angiospermic plant. Draw and give two identifying features of groups they belong to.

7. To observe and draw the given specimens-earthworm, cockroach, bony fish and bird. For each specimen record
   a. one specific feature of its phylum.
   b. one adaptive feature with reference to its habitat.

8. To verify the law of conservation of mass in a chemical reaction.

9. To study the external features of root, stem, leaf and flower of monocot and dicot plants.

10. To study the life cycle of mosquito.