Chapter 2:

Matter

Short Questions (Exercise)

(i) Can you write the formula of the carbon dioxide gas that we exhale?
The formula of carbon dioxide is **CO_2**.

(ii) Define the element, compound, and mixture.

- **Element**: A pure substance made of only one type of atom (e.g., oxygen).
- **Compound**: A substance formed by the chemical combination of two or more elements in a fixed ratio (e.g., water, H_2O).
- **Mixture**: A combination of two or more substances physically combined (e.g., air).

(iii) Differentiate between compound and mixture.

- **Compound**: Chemically combined, has a fixed composition (e.g., H_2O).
- **Mixture**: Physically combined, variable composition (e.g., saltwater).

(iv) Differentiate between concentrated and dilute solutions.

- **Concentrated Solution**: Contains a large amount of solute relative to solvent.
- **Dilute Solution**: Contains a small amount of solute relative to solvent.

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3. Define the term allotropes and explain the allotropes of carbon.

- **Allotropes**: Different structural forms of the same element.
- **Allotropes of Carbon**: Diamond (hard, 3D structure), graphite (soft, layered structure), and fullerenes (spherical molecules).

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4. What is the difference between homogeneous and heterogeneous solutions?

- **Homogeneous Solution**: Uniform composition throughout (e.g., saltwater).

- **Heterogeneous Solution**: Non-uniform composition, with visibly different parts (e.g., oil and water).

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5. Differentiate between colloids and suspensions.
   - **Colloids**: Particles are small and evenly dispersed, do not settle (e.g., milk).
   - **Suspensions**: Particles are large, can settle over time (e.g., muddy water).

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6. How can you identify solvent and solute?
   - **Solvent**: The substance in which the solute dissolves (e.g., water in saltwater).
   - **Solute**: The substance dissolved in the solvent (e.g., salt in saltwater).

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7. If there are 18 protons in the Argon atom, then what is the atomic number of Argon?
The atomic number of Argon is **18**, as it equals the number of protons.

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8. Describe the state of matter with an example.
   - **Solid**: Fixed shape and volume (e.g., ice).
   - **Liquid**: Fixed volume but no fixed shape (e.g., water).
   - **Gas**: Neither fixed shape nor volume (e.g., oxygen).

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9. Differentiate between the following:

a) Colloids and Suspensions

- **Colloids**: Small particles, do not settle (e.g., fog).
- **Suspensions**: Large particles, settle over time (e.g., sand in water).

b) Elements and Compounds

- **Elements**: Pure substances made of one type of atom (e.g., iron).
- **Compounds**: Substances formed by chemical combinations of elements (e.g., CO_2).

c) Concentrated and Dilute Solutions

- **Concentrated**: More solute relative to solvent (e.g., strong sugar syrup).
- **Dilute**: Less solute relative to solvent (e.g., weak sugar syrup).

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10. Examine the concept of solubility.
Solubility is the ability of a substance (solute) to dissolve in a solvent at a specific temperature and pressure (e.g., sugar dissolving in water).

Think Tank

11. Why is a solution considered a mixture?

A solution is considered a mixture because it is a physical combination of solute and solvent, retaining their individual properties.

12. How will you test whether a given solution is a colloid or a solution?

Shine a beam of light through the mixture:

- **Colloid**: The light scatters (Tyndall effect).
- **Solution**: The light passes through without scattering.

Projects (Exercise)

Project: Poster on Various Forms of Matter in Everyday Environment

Objective:

To create a poster illustrating the different forms of matter (solid, liquid, gas, and plasma) in a student's everyday environment.

Steps to Create the Poster

1. Title for the Poster:
"Forms of Matter in Our Everyday Life"

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2. Include the following sections on the poster:

A. Solids

- **Definition**: Solids have a definite shape and volume.
- **Examples**:
  - Furniture (e.g., chairs, tables)
  - Stationery (e.g., books, pens)
  - Building materials (e.g., bricks, wood)

B. Liquids

- **Definition**: Liquids have a definite volume but take the shape of the container.
- **Examples**:
  - Water (e.g., drinking water)
  - Beverages (e.g., milk, juice)
  - Cooking liquids (e.g., oil, vinegar)

C. Gases

- **Definition**: Gases have no definite shape or volume and fill the container they are in.
- **Examples**:
  - Air (e.g., oxygen, nitrogen)
  - Cooking gas (e.g., LPG, natural gas)

- Carbon dioxide (exhaled during breathing)

D. Plasma

- **Definition**: Plasma is an ionized state of matter with charged particles.
- **Examples**:
  - Lightning
  - Neon signs
  - Plasma in televisions

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3. Design Ideas for the Poster

- **Visuals**:
  - Use illustrations or images of solid items (like books and furniture), liquid containers (like water bottles), gas balloons, and plasma examples (like lightning).
  - Include colorful labels for each form of matter.
- **Layout**:
  - Divide the poster into four quadrants for each state of matter.
  - Use arrows or diagrams to connect real-life objects to their respective states of matter.
- **Captions**:
  - Add brief, descriptive captions for each example.

Materials Needed for Physical Poster:

- Poster board or chart paper
- Markers, colored pencils, or crayons
- Printouts or drawings of examples
- Glue and scissors

Digital Poster Alternative:

- Use digital tools like Canva, PowerPoint, or Google Slides to create the poster.

Extera Short Questions (Topic Wise)

2.1: States of Matter

1. **What are the three primary states of matter?**
   The three primary states of matter are solid, liquid, and gas. Solids have a definite shape and volume (e.g., ice), liquids have a definite volume but take the shape of their container (e.g., water), and gases have neither a fixed shape nor volume (e.g., oxygen).

2. **How does matter change from solid to liquid?**
   Matter changes from solid to liquid through a process called melting, which occurs when heat is absorbed. For example, ice absorbs heat and melts into water as its particles gain energy and move more freely.

3. **What is the key difference between gases and liquids?**
   Gases expand to fill any container and have no fixed shape or volume, while liquids have a definite volume but take the shape of their container. For example, steam from boiling water spreads to fill a room, while liquid water stays confined to a glass.

4. **What is plasma, and where can it be found?**
   Plasma is a state of matter where gases are ionized, meaning their particles are charged with free electrons and ions. It is found in extreme conditions such as stars (like the Sun) and lightning during thunderstorms.

2.2: Elements, Compounds, and Mixtures

1. **What is an element?**
   An element is a pure substance made of only one type of atom and cannot be broken down into simpler substances. Examples include hydrogen (H), oxygen (O), and gold (Au).

2. **How does a compound differ from a mixture?**
   A compound is a substance formed when two or more elements chemically combine in fixed proportions, such as water (H_2O). A mixture, on the other hand, consists of two or more substances physically combined, such as a mixture of sand and salt, where no chemical bonding occurs.

3. **Can elements be broken down into simpler substances?**
   No, elements cannot be broken down into simpler substances by chemical means. For instance, oxygen (O) remains oxygen, no matter the process applied.

4. **Give an example of a mixture.**
   Air is a mixture of gases like nitrogen, oxygen, and carbon dioxide. The proportions of these gases can vary, but they remain physically combined.

2.3: Allotropes

1. **What are allotropes?**
   Allotropes are different structural forms of the same element, which have distinct physical

and chemical properties due to variations in their atomic arrangements. For example, carbon exists as diamond, graphite, and graphene.

2. **Name two allotropes of carbon.**
   Two common allotropes of carbon are:
   - **Diamond**, which has a three-dimensional tetrahedral structure making it extremely hard.
   - **Graphite**, which has a layered structure, making it soft and slippery, often used in pencils.
3. **How do diamond and graphite differ structurally?**
   Diamond has a tetrahedral structure where each carbon atom is bonded to four others, making it extremely strong. Graphite, on the other hand, has layers of hexagonal carbon arrangements held together by weak forces, allowing layers to slide over each other.
4. **Why do allotropes have different properties?**
   Allotropes have different properties because of the way their atoms are bonded and arranged. For instance, diamond's rigid structure gives it unmatched hardness, while graphite's layered structure makes it a good lubricant and conductor of electricity.

2.4: Solutions

1. **What is a solution?**
   A solution is a homogeneous mixture where one substance (solute) is evenly distributed within another (solvent). For example, salt dissolved in water forms a saline solution.
2. **What is the solute in a sugar-water solution?**
   In a sugar-water solution, sugar is the solute because it is the substance being dissolved, and water is the solvent.
3. **What is a saturated solution?**
   A saturated solution is one in which no more solute can dissolve in the solvent at a given temperature. For example, if you keep adding sugar to water, there comes a point where the sugar stops dissolving, forming a saturated solution.
4. **Give an example of a solid dissolved in a liquid.**
   Salt dissolved in water is an example of a solid (salt) dissolved in a liquid (water), commonly used in cooking and preservation.

2.5: Colloids and Suspensions

1. **What is the main difference between a colloid and a suspension?**
   In a colloid, the particles are small enough to remain evenly dispersed without settling (e.g., milk), while in a suspension, the particles are larger and settle out over time if left undisturbed (e.g., muddy water).
2. **Give an example of a colloid found in daily life.**
   Milk is an example of a colloid where tiny fat globules are evenly distributed in water. Another example is mayonnaise.

3. **Why do particles settle in a suspension but not in a colloid?**
   In suspensions, the particles are larger and heavier, so gravity causes them to settle at the bottom over time. In colloids, the particles are smaller and remain suspended due to interactions with the dispersing medium.

4. **What is the Tyndall effect?**
   The Tyndall effect is the scattering of light by particles in a colloid, making the light beam visible. For example, the beam of a car's headlights is visible in fog because of this effect.

Extera Long Questions (Topic Wise)

1. How do the states of matter differ, and how do these differences affect their behavior and applications?

Key Differences Between States of Matter

The three primary states of matter—solid, liquid, and gas—differ in terms of particle arrangement, movement, and energy:

- **Solids:** Particles are tightly packed in a fixed structure, giving solids a definite shape and volume. For example, metals like iron are solid and used in construction due to their strength.
- **Liquids:** Particles are loosely arranged and can move past each other, allowing liquids to flow and take the shape of their container. For instance, water is used in cooling systems due to its ability to flow and absorb heat.
- **Gases:** Particles are far apart and move freely, giving gases no fixed shape or volume. Oxygen, a gas, is vital for respiration and is stored under pressure for medical purposes.

Behavior and Changes in States of Matter

- Solids melt into liquids when heated, as particles gain energy and overcome rigid bonds.
- Liquids evaporate into gases as heat energy increases, causing particles to break free.
- These changes are utilized in everyday life, such as ice melting in drinks or water boiling into steam for power generation.

Applications of States of Matter

Understanding states of matter allows for advancements in science and technology:

- **Solids:** Used in building materials and manufacturing tools.
- **Liquids:** Essential in transportation (fuels), cooling, and chemical reactions.
- **Gases:** Widely used in industry (natural gas for energy) and healthcare (oxygen cylinders).

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2. How do elements, compounds, and mixtures differ, and what are their roles in real-world applications?

Definition and Characteristics

- **Elements:** Pure substances made of one type of atom. They cannot be broken down further (e.g., gold, oxygen).
- **Compounds:** Substances formed by the chemical combination of two or more elements in fixed proportions (e.g., water, H_2O).
- **Mixtures:** Physical combinations of two or more substances that retain their individual properties (e.g., air, saltwater).

Key Differences

1. **Composition:** Elements are single substances; compounds are chemically bonded; mixtures are physically combined.
2. **Separation:** Compounds require chemical methods to separate, whereas mixtures can be separated physically.

Real-World Applications

- **Elements:** Oxygen supports life, and metals like aluminum are used in construction and packaging.
- **Compounds:** Water is vital for hydration and agriculture, and table salt (NaCl) is essential in cooking.
- **Mixtures:** Air provides the gases necessary for respiration and photosynthesis, while alloys like steel (a mixture of iron and carbon) are critical in construction.

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3. What are colloids and suspensions, and how do their properties impact their practical uses?

Definition and Differences

- **Colloids:** Mixtures with particles small enough to remain dispersed without settling, such as milk.
- **Suspensions:** Mixtures with larger particles that settle out over time, such as muddy water.

Properties

1. **Particle Size:** Colloids have intermediate particle sizes, while suspensions have larger particles.
2. **Settling:** Particles in colloids do not settle, while those in suspensions settle when left undisturbed.
3. **Light Scattering:** Colloids exhibit the Tyndall effect (light scattering), while suspensions often block light.

Practical Uses

- **Colloids:**
    - Milk and cream in the food industry.
    - Paints and inks for coating and printing.
    - Fog and mist systems for cooling and agriculture.
- **Suspensions:**
    - Medicinal suspensions like antacids require shaking before use.
    - Sewage treatment systems separate particles from water to purify it.

Understanding these differences allows industries to design products and processes optimized for specific needs.

MCQS

1. **Which state of matter has a definite shape and volume?**
   a) Liquid
   b) Solid ☑
   c) Gas
   d) Plasma
2. **What happens when a liquid changes to a gas?**
   a) Freezing
   b) Evaporation ☑
   c) Melting
   d) Condensation
3. **Which state of matter has particles that are far apart and move freely?**
   a) Solid
   b) Liquid
   c) Gas ☑
   d) Plasma
4. **What is plasma?**
   a) A state of matter with a definite shape
   b) A liquid with high energy
   c) Ionized gas with free electrons and ions ☑
   d) Solid with charged particles
5. **What is an element?**
   a) A mixture of substances
   b) A compound
   c) A pure substance made of one type of atom ☑
   d) A substance that can be broken down
6. **Which is an example of a compound?**
   a) Gold
   b) Water (H_2O) ☑
   c) Oxygen
   d) Helium
7. **What is a mixture?**
   a) Chemically bonded substances
   b) A physical combination of substances ☑
   c) A pure substance
   d) An element
8. **What distinguishes a compound from a mixture?**
   a) A compound is physically combined
   b) A compound has no fixed ratio
   c) A compound is chemically bonded ☑
   d) Compounds are mixtures
9. **What is an allotrope?**
   a) A mixture of two substances

b) A compound of elements

c) Different structural forms of the same element ☑

d) A reaction by-product

10. **Which of these is an allotrope of carbon?**

a) Water

b) Salt

c) Diamond ☑

d) Sand

11. **How does graphite differ from diamond?**

a) Both have different atoms

b) Graphite is chemically different

c) They have different atomic arrangements ☑

d) Both are compounds

12. **Which property of allotropes changes due to structural differences?**

a) Atomic mass

b) Chemical formula

c) Physical properties ☑

d) Atomic number

13. **What is a solution?**

a) A suspension

b) A heterogeneous mixture

c) A homogeneous mixture ☑

d) A solid-liquid mixture

14. **In a saltwater solution, what is the solute?**

a) Salt ☑

b) Water

c) Both salt and water

d) Air

15. **What happens when a solution becomes saturated?**

a) All solute dissolves

b) No more solute dissolves ☑

c) Solvent evaporates

d) Solute vanishes

16. **Which of these is a colloid?**

a) Saltwater

b) Milk ☑

c) Sandwater

d) Air

17. **What is the Tyndall effect?**

a) Light bending through solutions

b) Particle dissolution

c) Light scattering by colloidal particles ☑

d) Light absorption in suspensions

18. **What is the key difference between a colloid and a suspension?**

a) Colloids settle over time

b) Suspensions don't scatter light

c) Colloids don't settle; suspensions do ☑
d) Suspensions are smaller particles

19. **Which is an example of a suspension?**
a) Milk
b) Saltwater
c) Muddy water ☑
d) Air

20. **What keeps particles dispersed in a colloid?**
a) Large particle size
b) Gravity
c) Interactions with the dispersing medium ☑
d) No external force

21. **What are the states of matter in plasma TVs?**
a) Solid
b) Plasma ☑
c) Liquid
d) Gas

22. **Which process converts a solid directly into gas?**
a) Melting
b) Freezing
c) Sublimation ☑
d) Evaporation

23. **What is a homogeneous mixture?**
a) A mixture with uniform composition ☑
b) A mixture of solids
c) A mixture with varying phases
d) A heterogeneous compound

24. **What is an example of a homogeneous mixture?**
a) Sand and water
b) Air ☑
c) Oil and water
d) Muddy water

25. **Which process separates a solid from a liquid in a suspension?**
a) Evaporation
b) Melting
c) Filtration ☑
d) Freezing

26. **Why does a suspension settle?**
a) Particles are small
b) Particles are large and heavy ☑
c) Particles dissolve
d) Particles repel

27. **What is the smallest unit of an element?**
a) Atom ☑
b) Molecule
c) Ion
d) Compound

28. **What is the solvent in soda?**
    a) Carbon dioxide
    b) Sugar
    c) Water ☑
    d) Caffeine
29. **What type of mixture is fog?**
    a) Solution
    b) Suspension
    c) Colloid ☑
    d) Compound
30. **What is the property of colloids that suspensions lack?**
    a) Particle visibility
    b) Uniform particle distribution ☑
    c) Settling ability
    d) Chemical bonding