Chapter - 1 Matter in Our Surroundings

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- **Which of the following are matter?**

Matter is anything that has mass and occupies space.

- **Matter:** Chair, air, almonds, lemon water.
- **Not matter:** Love, smell, hate, thought, cold, smell of perfume (these are feelings, sensations, or perceptions and do not have mass).

- **Why does the smell of hot sizzling food reach you several meters away, but cold food requires you to be close?**

- This happens due to the process of **diffusion**.
- The particles in hot food have more kinetic energy and move faster, allowing the smell to spread over a larger distance.
- In cold food, the particles move slower, so the diffusion of the smell is limited, requiring you to be closer to detect it.

- **A diver is able to cut through water in a swimming pool. Which property of matter does this show?**

- This demonstrates the property that **particles of matter have space between them**.
- Water, being a liquid, has loosely packed particles with gaps, allowing the diver to move through it.

- **What are the characteristics of the particles of matter?**

- **Particles of matter have space between them.**
- **Particles of matter are constantly moving.**
- **Particles of matter attract each other.**
- **Particles of matter are very small.**

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1. Arrange the following in order of increasing density

Density is mass per unit volume. Arranging in increasing order of density:

Air < Exhaust from chimneys < Cotton < Water < Honey < Chalk < Iron

2. (a) Differences in the Characteristics of States of Matter

Property	Solid	Liquid	Gas
Shape	Fixed	No fixed shape, takes the shape of the container	No fixed shape
Volume	Fixed	Fixed	Not fixed, expands to fill the container
Compressibility	Negligible	Very little	High
Rigidity	High	Low	Very low
Fluidity	Cannot flow	Can flow	Can flow easily
Density	High	Lower than solids	Lowest

(b) Explanation of Terms

- **Rigidity** – The ability of a substance to retain its shape when an external force is applied. Solids are rigid.
- **Compressibility** – The ability of a substance to decrease in volume under pressure. Gases are highly compressible.
- **Fluidity** – The ability of a substance to flow. Liquids and gases are fluids.
- **Filling a gas container** – Gases do not have a fixed volume and expand to fill the entire container.
- **Shape** – Solids have a fixed shape, while liquids take the shape of the container, and gases have no definite shape.
- **Kinetic energy** – Energy of motion. Gas particles have the highest kinetic energy, followed by liquids, and solids have the least.
- **Density** – Mass per unit volume. Solids generally have the highest density, followed by liquids, and gases have the lowest.

3. Give reasons

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

- Gas particles move randomly in all directions and do not have a fixed shape or volume.
- Due to weak intermolecular forces, gases spread to occupy the entire container.

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

- Gas particles are in constant random motion and collide with the walls of the container.
- These collisions exert force per unit area, creating pressure.

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

- It has a fixed shape and volume.
- It is rigid and does not flow like liquids or gases.

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

- Air has widely spaced particles with weak intermolecular forces, allowing free movement.
- In solids, particles are tightly packed with strong forces, making movement difficult without applying significant force.

4. Why does ice float on water, even though solids are usually denser than liquids?

- Ice has a lower density than liquid water due to its unique structure.
- In ice, water molecules form a crystalline structure with spaces, making it less dense than liquid water.
- As a result, ice floats on water, unlike most other solids that sink in their liquid form.

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1. Convert the following temperature to Celsius scale:

The relationship between Kelvin (K) and Celsius (°C) is:

°C=K−273°C = K - 273°C=K−273

(a) 300 K

300−273=27°C300 - 273 = 27°C300−273=27°C

(b) 573 K

573−273=300°C573 - 273 = 300°C573−273=300°C

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2. Physical state of water at:

(a) 250°C – Water is in the **gaseous state** (steam) because it is above the boiling point (100°C).

(b) 100°C – Water exists in **both liquid and gaseous states** (boiling point). At this temperature, water is transitioning from liquid to gas.

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3. Why does the temperature remain constant during a change of state?

- When a substance changes state (solid to liquid or liquid to gas), heat energy is absorbed or released **without increasing temperature**.
- This energy is called **latent heat** and is used to break intermolecular bonds rather than raising the temperature.
- Example: When ice melts at 0°C or water boils at 100°C, the temperature does not rise until the entire transition is complete.

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4. Method to liquefy atmospheric gases

- **By compression and cooling**:
  - Gases are compressed under high pressure.
  - Then, they are cooled down, reducing their kinetic energy.
  - This forces gas particles to come closer and convert into a liquid state.
  - Example: **Liquefaction of oxygen and nitrogen** from the air using this method.

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1. Why does a desert cooler cool better on a hot dry day?

- A desert cooler works on the principle of **evaporative cooling**.
- On a **hot, dry day**, the air has **low humidity**, allowing water to evaporate quickly.
- Faster evaporation absorbs more heat from the surroundings, making the air cooler.
- On a humid day, evaporation is slower, reducing the cooling effect.

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2. How does the water kept in an earthen pot (matka) become cool during summer?

- An **earthen pot** has tiny pores that allow water to seep through and evaporate.
- **Evaporation requires heat**, which is taken from the water inside the pot.
- As a result, the remaining water loses heat and becomes cooler.

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3. Why does our palm feel cold when we put some acetone, petrol, or perfume on it?

- Acetone, petrol, and perfume are **volatile substances**, meaning they evaporate quickly.
- During evaporation, they absorb heat from the skin, causing a **cooling effect**.
- This is the same principle as sweating—evaporation cools the body.

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4. Why are we able to sip hot tea or milk faster from a saucer rather than a cup?

- A **saucer has a larger surface area** than a cup.
- More surface area allows **faster evaporation**, which cools the tea or milk quickly.
- This is why the tea in a saucer is cooler and easier to sip.

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5. What type of clothes should we wear in summer?

- We should wear **light-colored, loose, and cotton clothes** in summer.
- **Light colors** reflect heat instead of absorbing it, keeping us cooler.
- **Cotton clothes** absorb sweat and allow it to evaporate, helping the body cool down.

NCERT TEXT BOOK Solution:

1. Convert the following temperatures to the Celsius scale:

The formula is:

°C=K−273°C = K - 273°C=K−273

(a) 293 K

293−273=20°C293 - 273 = 20°C293−273=20°C

(b) 470 K

470−273=197°C470 - 273 = 197°C470−273=197°C

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2. Convert the following temperatures to the Kelvin scale:

The formula is:

K=°C+273K = °C + 273K=°C+273

(a) 25°C

25+273=298K25 + 273 = 298\ K25+273=298 K

(b) 373°C

373+273=646K373 + 273 = 646 K373+273=646K

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3. Give reasons for the following observations:

(a) Naphthalene balls disappear with time without leaving any solid.

- Naphthalene undergoes **sublimation**, meaning it directly changes from solid to gas without becoming liquid.
- Over time, naphthalene evaporates into the air, leaving no residue.

(b) We can get the smell of perfume sitting several meters away.

- Perfume contains volatile particles that **diffuse** rapidly in the air.
- The high kinetic energy of gas particles allows the fragrance to spread over a distance.

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4. Arrange the following substances in increasing order of forces of attraction between particles:

- The **force of attraction** is strongest in solids, weaker in liquids, and weakest in gases.
- **Order: Oxygen (gas) < Water (liquid) < Sugar (solid)**

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5. Physical state of water at:

(a) 25°C → Liquid (Normal room temperature)
(b) 0°C → Solid (Ice) and Liquid (Melting point of ice)
(c) 100°C → Liquid and Gas (Steam) (Boiling point of water)

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6. Justify the following statements:

(a) Water at room temperature is a liquid.

- It has **a definite volume but no fixed shape**, taking the shape of the container.
- The **intermolecular forces** in water are strong enough to keep it in the liquid state at room temperature.

(b) An iron almirah is a solid at room temperature.

- It has **a definite shape and volume**.
- The **intermolecular forces are very strong**, making it rigid and maintaining its shape.

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7. Why is ice at 273 K more effective in cooling than water at the same temperature?

- Ice at 273 K absorbs heat from the surroundings to **melt into water**.
- This requires **latent heat of fusion**, which **further cools** the surroundings.
- Water at 273 K does not need to absorb extra heat, so it is **less effective** in cooling than ice.

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8. What produces more severe burns, boiling water or steam?

- **Steam** causes more severe burns than boiling water at **the same temperature (100°C)**.
- This is because **steam contains additional latent heat of vaporization**, which is released upon condensation on the skin.
- This extra energy makes steam burns more painful and damaging.

#Note: Question No. 9 is a group discussion problem