

Matter in Our Surrounding

**1. What is Matter?*

* **Definition:** Anything that has **mass** and occupies **space (volume)**.

* Examples: Air, Water, Iron, Wood, etc.

* Early Indian philosophers classified matter into **five elements (Panch Tatva)**: Air, Water, Earth, Fire, and Sky.

**2. Characteristics of Particles of Matter*

1. Matter is made up of tiny particles.
2. Particles of matter are very small and have space between them.
3. They are in continuous motion (kinetic energy).
4. They attract each other with varying force (intermolecular force).
5. Higher the temperature \rightarrow more kinetic energy \rightarrow faster motion.

**3. States of Matter*

(i) **Solid***

- * Definite shape & volume.
- * Rigid, incompressible.
- * High density, strong intermolecular force.
- * Very small intermolecular spaces.

(ii) **Liquid***

- * Definite volume but no definite shape (takes shape of container).
- * Flow easily \rightarrow **fluidity**.
- * Less intermolecular force than solids.
- * Can be compressed slightly.

(iii) **Gas***

- * Neither definite shape nor definite volume.
- * Freely movable particles.
- * High compressibility.

* Very weak intermolecular force.

* Examples: Oxygen, Carbon dioxide, Nitrogen.

🔑 **Special cases:**

* **Plasma** \rightarrow ionised gas (stars, neon lights).

* **Bose-Einstein Condensate (BEC)** \rightarrow formed at very low temperature (supercooled atoms).

4. Properties of Matter (based on States)

* **Diffusion:** Intermixing of particles without mechanical aid.

* Fastest in gases, slower in liquids, negligible in solids.

* **Compressibility:** Maximum in gases, very less in liquids, negligible in solids.

* **Fluidity:** Liquids & gases can flow (called fluids).

5. Change of State of Matter

Matter can change from one state to another by **changing temperature or pressure**.

(i) Effect of Temperature

* **Solid \rightarrow Liquid (Melting):** Heat supplied increases kinetic energy of particles, intermolecular forces weaken \rightarrow melting occurs at a **fixed temperature** called **melting point**.

* Ice melts at 0°C .

* **Liquid \rightarrow Gas (Vaporization):** At boiling point, liquid changes into vapour.

* Water boils at 100°C at 1 atm.

* **Latent Heat:** Hidden heat supplied without temperature change.

* **Latent heat of fusion:** Heat energy required to change 1 kg solid into liquid at melting point.

* **Latent heat of vaporization:** Heat energy required to change 1 kg liquid into gas at boiling point.

(ii) Effect of Pressure

* By **increasing pressure**, gases can be compressed into liquids.

* Example: LPG cylinder, CNG cylinder.

6. Evaporation

* **Definition:** The phenomenon of conversion of a liquid into vapour at any temperature below its boiling point.

* Evaporation causes **cooling** (because it takes latent heat from surroundings).

* Example: Water cools in an earthen pot, sweating cools our body.

Factors Affecting Evaporation

1. **Surface area** → More surface = faster evaporation.
2. **Temperature** → Higher temperature = faster evaporation.
3. **Humidity** → Higher humidity = slower evaporation.
4. **Wind speed** → Higher speed = faster evaporation.

7. Differences between Boiling and Evaporation

Boiling	Evaporation
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Takes place at a fixed temperature (boiling point).	Takes place at any temperature .
Occurs throughout the liquid.	Occurs only at the surface .
Requires external heat supply.	Takes heat from surroundings .

8. Interconversion of States of Matter

* Solid ↔ Liquid ↔ Gas

* Can be achieved by changing **temperature** or **pressure**.

* Important processes: Melting, Freezing, Vaporization, Condensation, Sublimation.

9. Important Terms

* **Melting Point:** Temperature at which a solid melts to become liquid (0°C for ice).

* **Boiling Point:** Temperature at which liquid boils (100°C for water at 1 atm).

* **Latent Heat:** Heat energy required to change state without change in temperature.

* **Sublimation:** Direct conversion of solid → gas without becoming liquid (e.g., camphor, naphthalene, dry ice).