Class 9 Science – Chapter 1: Matter in Our Surroundings (Premium Notes)

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1. Introduction

Matter is the basic building block of the universe. Everything that we see, touch, or feel is made up of matter, from the tiniest grain of sand to the largest planet. It has mass and occupies space, which means it can be measured and observed. The study of matter helps us understand the physical world around us, its composition, and the changes it undergoes. Matter exists in different forms such as solids, liquids, and gases, each with unique properties. By exploring matter, we learn how substances interact, combine, and transform, forming the foundation of all scientific study.

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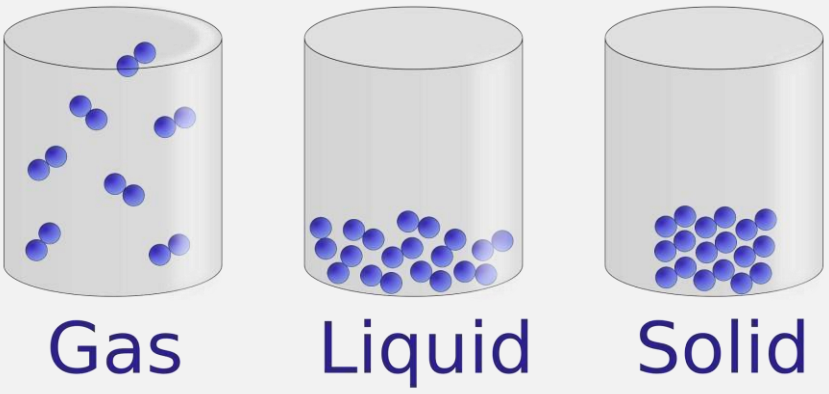
2. Physical Nature of Matter

- ***Particles of matter are very small — beyond the capability of the naked eye to see.***
- ***Evidence:***
    - ***Diffusion of ink in water.***
    - ***Sugar dissolving in water.***
- ***Key Points:***
    - ***Matter is made of particles.***
    - ***Particles have space between them.***
    - ***Particles are in constant motion. Particles attract each other.***

3. Characteristics of Particles of Matter



1. ***Have space between them → Interparticle space allows diffusion and mixing.***
2. ***Constantly moving → Brownian motion observed under microscope.***
3. ***Attract each other → Stronger in solids, weaker in gases.***

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4. States of Matter

(a) Solid

- ***Definite shape and volume.***
- ***High density.***
- ***Incompressible.***
- ***Strong interparticle forces.***
- ***Particles vibrate in fixed positions.***

(b) Liquid

- ***No fixed shape, fixed volume.***
- ***Less dense than solids.***
- ***Almost incompressible.***
- ***Weaker intermolecular force than solids.***

(c) Gas

- ***Neither fixed shape nor volume.***
- ***Highly compressible.***
- ***Very low density.***
- ***Weak intermolecular forces.***

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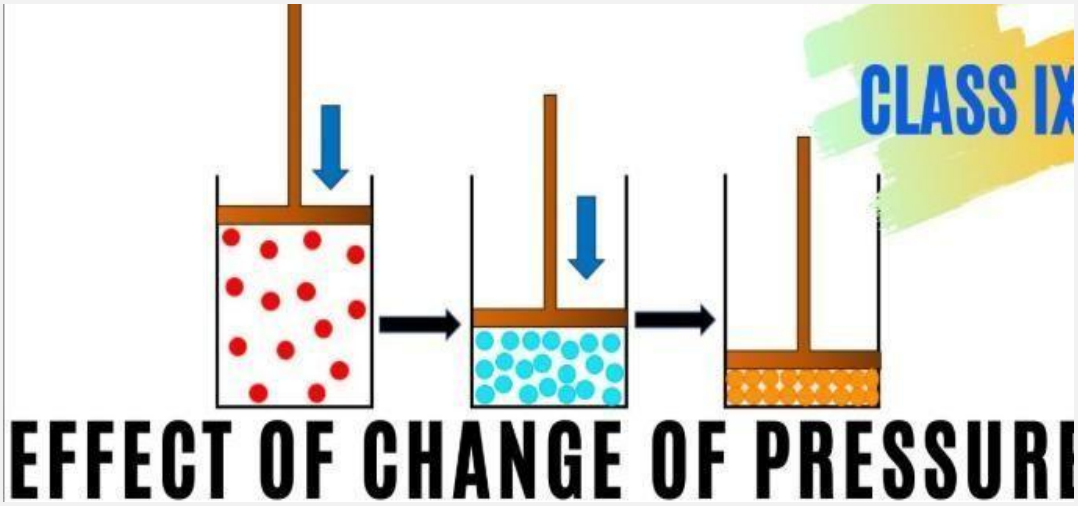
5. Properties Based on Particle Theory

The particle theory of matter explains that matter is made up of tiny particles (atoms or molecules) which are constantly moving and interacting. These properties help us understand the behavior of solids, liquids, and gases.

1. ***Matter is made up of particles*** ○ ***All matter consists of extremely small particles which cannot be seen with the naked eye but can be felt through their effects.***
2. ***Particles of matter are very small*** ○ ***The particles are so tiny that millions of them can fit in a pinhead. Their small size explains why substances can mix uniformly.***
3. ***Particles of matter have space between them*** ○ ***The amount of space depends on the state of matter: least in solids, more in liquids, and maximum in gases.***
4. ***Particles of matter are always moving*** ○ ***Particles possess kinetic energy and are in constant motion. This motion increases with temperature.***
5. ***Particles of matter attract each other*** ○ ***There are forces of attraction between particles. These are strongest in solids, moderate in liquids, and weakest in gases.***
6. ***Diffusion*** ○ ***The intermixing of particles of two different types of matter on their own is called diffusion.*** ○ ***It occurs due to the random motion of particles and is faster in gases than in liquids, and very slow in solids.*** ○ ***Example: The spreading of perfume in air or salt dissolving in water.***
7. ***Compressibility*** ○ ***Due to the spaces between particles, matter can be compressed.*** ○ ***Gases are highly compressible because they have large interparticle spaces, while liquids are slightly compressible, and solids are almost incompressible.***
    - ○ ***Example: LPG gas is stored in cylinders under high pressure due to its compressibility.***

6. Effect of Temperature & Pressure

- ***Increasing temperature → Increases kinetic energy → Changes state.***
- ***Increasing pressure → Brings particles closer.***



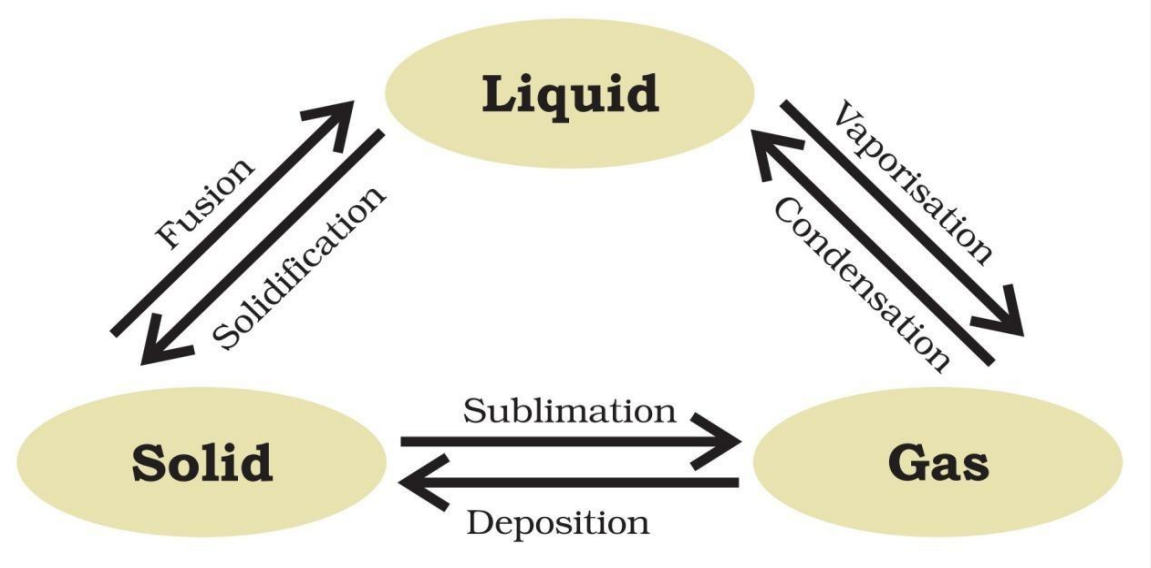
7. Change of State

(a) Melting (Fusion)
Solid → Liquid at melting point (e.g., Ice → Water at 0°C)

(b) Freezing
Liquid → Solid at freezing point.
(c) Vaporization (Boiling)
Liquid → Gas at boiling point (e.g., Water → Steam at 100°C).

(d) Condensation Gas → Liquid.

(e) Sublimation
Solid → Gas without becoming liquid (e.g., Camphor, Dry Ice).



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8. *Latent Heat*

- ***Latent heat of fusion: Heat absorbed to change 1 kg solid to liquid without temperature change.***
- ***Latent heat of vaporization: Heat absorbed to change 1 kg liquid to gas without temperature change.***

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9. *Evaporation*

- ***Conversion of liquid into vapour at any temperature below boiling point.***
- ***Factors affecting:***
    1. ***Surface area (↑ → evaporation ↑)***
    2. ***Temperature (↑ → evaporation ↑)***
    3. ***Humidity (↑ → evaporation ↓)***
    4. ***Wind speed (↑ → evaporation ↑)***

Cooling effect: Evaporation causes cooling because the particles take away heat energy from surroundings.

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10. Applications of Evaporation in Daily Life

1. Drying of clothes

- *When wet clothes are hung out, water particles gain energy from the sun or air and escape into the atmosphere. This gradual loss of water by evaporation dries the clothes.*

2. Cooling effect

- *Evaporation causes cooling because the faster-moving particles escape first, taking heat energy with them. This is why sweating cools our body or why fan or air-cooler cooling works.*

3. Formation of clouds and rain

- *Water from rivers, lakes, and oceans evaporates, rises into the atmosphere, and later condenses to form clouds. This is a key part of the water cycle.*

4. Concentration of solutions

- *Evaporation is used to increase the concentration of liquids, like making jaggery from sugarcane juice, salt from seawater, or concentrated fruit juices.*

5. Preservation of food

- *Evaporation reduces water content in food, which prevents the growth of microbes. Examples include drying grains, fruits, and fish for long-term storage.*

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11. Key Definitions

- *Matter: Anything that has mass and occupies space.*
- *Diffusion: Spreading of particles.*
- *Latent heat: Heat energy used to change state without temperature change.*

12. Common Exam Questions

1. Question:
Explain, with the help of particle theory, why evaporation causes cooling.
Answer:
During evaporation, the faster-moving (higher energy) particles escape from the liquid's surface. These particles take away heat energy, reducing the average kinetic energy of the remaining particles. This causes the liquid to cool.
Example: Sweating cools the human body as water evaporates from the skin.

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2. Question:
Define diffusion. Why is diffusion faster in gases than in liquids?
Answer:
Diffusion is the gradual mixing of particles of two substances due to their random motion.
Diffusion is faster in gases because gas particles are far apart and move freely, while liquid particles are closer and move slower.

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3. Question:
What is compressibility? Give one example of compressibility of gas in daily life.
Answer:
Compressibility is the ability of a substance to decrease in volume under pressure.
Example: LPG or CNG gas cylinders are filled under high pressure because gases are highly compressible.