States of Matter

- **Kinetic Theory of Gases**

1. **All matter is made up of molecules.**
2. All molecules of a substance are identical.
3. Molecules of different matter differ in composition, shape and size.
4. Molecules are continuously in motion.
5. Intermolecular forces depend on the distance between the molecules and the type of molecules.
6. Motion of molecules is affected by change in temperature – higher the temperature, more they move.

- **Intermolecular Force** – The attractive force between the molecules

- **Arrangement of molecules in Solids**

1. **Molecules are tightly packed**
2. Intermolecular forces are very strong
3. Molecules can only vibrate; no movement is allowed
4. Thus, solids have fixed shape and volume, and cannot be compressed
5. On heating, molecules vibrate more; the distance between the molecules increases slightly

- **Arrangement of molecules in Liquids**

1. **Molecules are slightly further apart than in solids.**
2. Intermolecular forces are also less strong.
3. Molecules can move from their positions in liquids.
4. Thus, liquids flow and take the shape of the container.

5. Liquids do not have definite shape, but they do have definite volume.

6. On heating, molecules vibrate and move faster; it only expands slightly

7. Liquids can only be compressed a little.

- **Arrangement of molecules in Gases**

1. **Molecules are far apart; hardly any interaction between them**

2. Intermolecular forces are negligible.

3. Molecules are free to move around.

4. It has no definite shape or volume.

5. A gas can easily be compressed.

- Everything around us is composed of matter.
- There are five states of matter- solid, liquid, gaseous, plasma and Bose-Einstein condesate
- **Solid phase**
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    - Permanent change in shape is difficult
    - Negligible compressibility
    - Definite shape, size, and boundary
    - No particle motion

- **Liquid phase**
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    - No fixed shape and boundary
    - Have a fixed volume
    - Low compressibility
    - Lesser particle motion

- **Gaseous state**
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    - No fixed shape, volume, and boundary
    - Highly compressible

- Gases exert pressure
- High particle motion

Solid	Liquid	Gas
Definite shape	No definite shape	No definite shape
Occupies space	Occupies space	Occupies space
Definite volume	Definite volume	No definite volume
Cannot be compressed	Slightly compressible	Highly compressible
Rigid	Not rigid	Not rigid
Does not diffuse in other solids	Can diffuse in other liquids	Can diffuse in other gases

- **Change of state**
  - A change of state occurs because heat energy breaks the force of attraction between particles. Kinetic energy of the particle increases.

- **Melting point**
  - The temperature at which a solid melts into a liquid at normal atmospheric pressure.
  - At melting point, the temperature does not change until all solid converts into liquid.

- **Latent heat**
  - The heat required to break the force of attraction between the particles at transition temperature. This heat becomes confined within the material and is called the latent heat.
  - Amount of heat required to change 1 kg of material to change its state at normal atmospheric pressure at transition temperature is called the latent heat for that transition.

- **Sublimation**
  - Solid $\rightleftharpoons$ gas [directly]
  - Example: Ammonium chloride

- **Effect of change of pressure**
  - If pressure is applied,
  - Melting point → decreases
  - Boiling point → increases

- **Dry Ice –** Solid CO_2 [directly converts to gas]

- **Laws of Chemical Combination**
- **Law of conservation of mass**
    - Mass can neither be created nor destroyed in a chemical reaction. It means that the sum of the masses of the reactants and the products remains the same during a reaction.