

Diffusion:

Particles of matter intermix on their own with each other. They do so by getting into the spaces between the particles. This intermixing of particles of two different types of matter on their own is called diffusion.

Applications of Diffusion:**Dissolving a solid in a liquid:**

- When a crystal of potassium permanganate is placed in a beaker of water, the water slowly turns purple on its own, even without stirring.
- Both potassium permanganate crystal and water are made up of tiny particles.
- When the potassium permanganate crystal is put in water, the purple colored particles of potassium permanganate spread throughout water making the whole water look purple.
- Actually, on dissolving, the particles of potassium permanganate get into the spaces between the particles of water.
- This shows that the particles have spaces between them and are continuously moving on their own.

Mixing of two gases:

- Fragrance of an incense stick (agarbatti) lightened in one corner of a room, spreads in the whole room quickly.
- The particles of gases (or vapours) produced by burning the incense stick move rapidly in all directions and mix with the moving particles of air in the room
- This also shows that the particles of matter are constantly moving.

Brownian motion of particles (By Robert Brown):

- The random or zig-zag movement of microscopic particles in a fluid, as a result of continuous bombardment from molecules of the surrounding

Change of state of matter

Water exists in three states:

- Ice – solid
- Water – liquid
- Water Vapor – Gas

This is an indication that matter can change its states.

Change of State of Matter:

Physical states of matter can be interconverted into each other by following two ways:

1. By changing the temperature

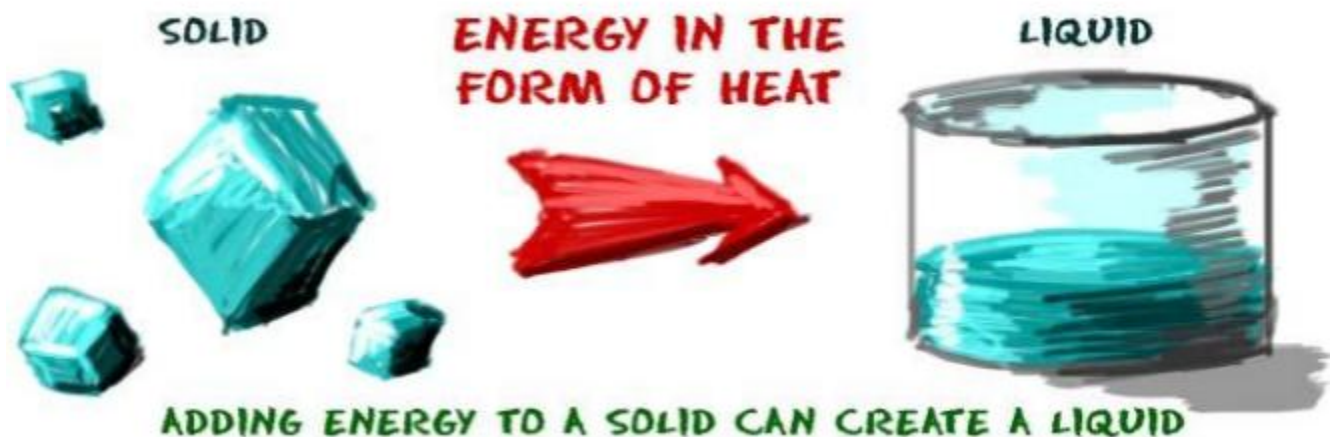
2. By changing the pressure

Effect of Change of Temperature

What happens to matter when we heat it?

1. Solids:

- As we heat solids, the kinetic energy between the particles of solids increases which decreases the force of attraction between them.
- They start vibrating and changing their positions. Slowly, due to heat the particles become free and a solid converts into liquid.
- **Melting Point** – The temperature at which solid melts to become a liquid at atmospheric pressure. **For Example**, the melting point of ice is 273.16 Kelvin.
- **Fusion** – The process of melting of a solid into liquid is called **Fusion**.



- In the melting process, once a solid reaches its melting point, its temperature does not increase further. So where does all the heat go? The heat present in the solid at time of melting is used by the particles to diminish the force of attraction between each other. The heat energy is therefore considered as hidden.
- **Latent Heat** – The heat energy which is used to break the force of attraction between the particles of matter is known as latent heat. Since the heat is hidden therefore it is called as **Latent Heat**.
- **Latent Heat of Fusion** – The amount of heat energy required to change 1 kg of a solid into liquid at atmospheric pressure at its melting point is known as the **Latent Heat of Fusion**.
- **Atmospheric Pressure** – Pressure exerted by the weight of the atmosphere.

2. Liquids:

- Just like in solids, the kinetic energy of particles of liquid increases, the force of attraction among them decreases and they start moving freely.
- As we keep on supplying the heat, a point comes when the particles overcome the forces of attraction completely.
- This is when a liquid starts changing into gas.



**ENERGY FROM A STOVE
HEATS UP LIQUID WATER
AND CREATES STEAM**

- **Boiling Point** - The temperature at which a liquid starts boiling at the atmospheric pressure is known as its **Boiling Point**. **For Example**, The boiling point of water is 373 Kelvin.
- **Latent Heat of Vaporization** – the amount of heat energy required to change 1 kg of a liquid into a gas at atmospheric pressure at its boiling point is known as **Latent Heat of Vaporization**.

What happens when we decrease the temperature?

1. Gases :

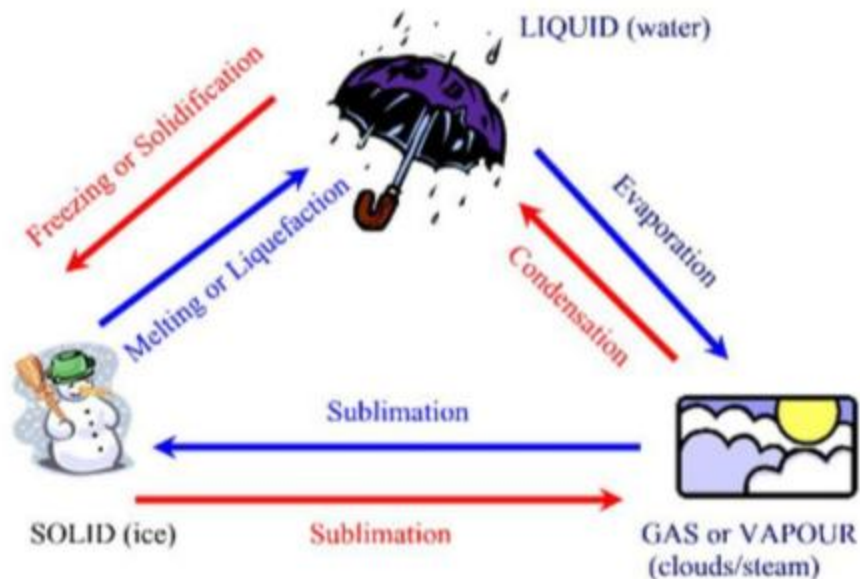
- The kinetic energy between the particles decreases and they turn into a liquid state.
- **Condensation / Liquefaction** – The process of converting a gas into a liquid by cooling down its temperature. **For Example**, The formation of clouds is due to condensation of water vapor from Earth.

2. Liquids :

- The kinetic energy between the particles decreases and they turn into a solid state. **For Example**, The formation of ice.
- **Sublimation** – change of state of a gas directly into solid and vice-versa is known as sublimation. **For Example**, Camphor is a solid that directly evaporates into the air without changing to a liquid state.

Therefore, by increasing or decreasing the temperature we can change the states of matter into one another. Here is a diagram that sums this up.

State of matter change triangle



Effect of change of Pressure

- By applying pressure, we can bring the particles of matter close to each other thereby, increasing the force of attraction among the particles.
- When we compress and decrease the temperature of a gas, the gas changes into a liquid.
- **Dry Ice** – Carbon dioxide in solid form is known as **Dry Ice**. It can directly turn into gas by decreasing the pressure to 1 atmosphere.