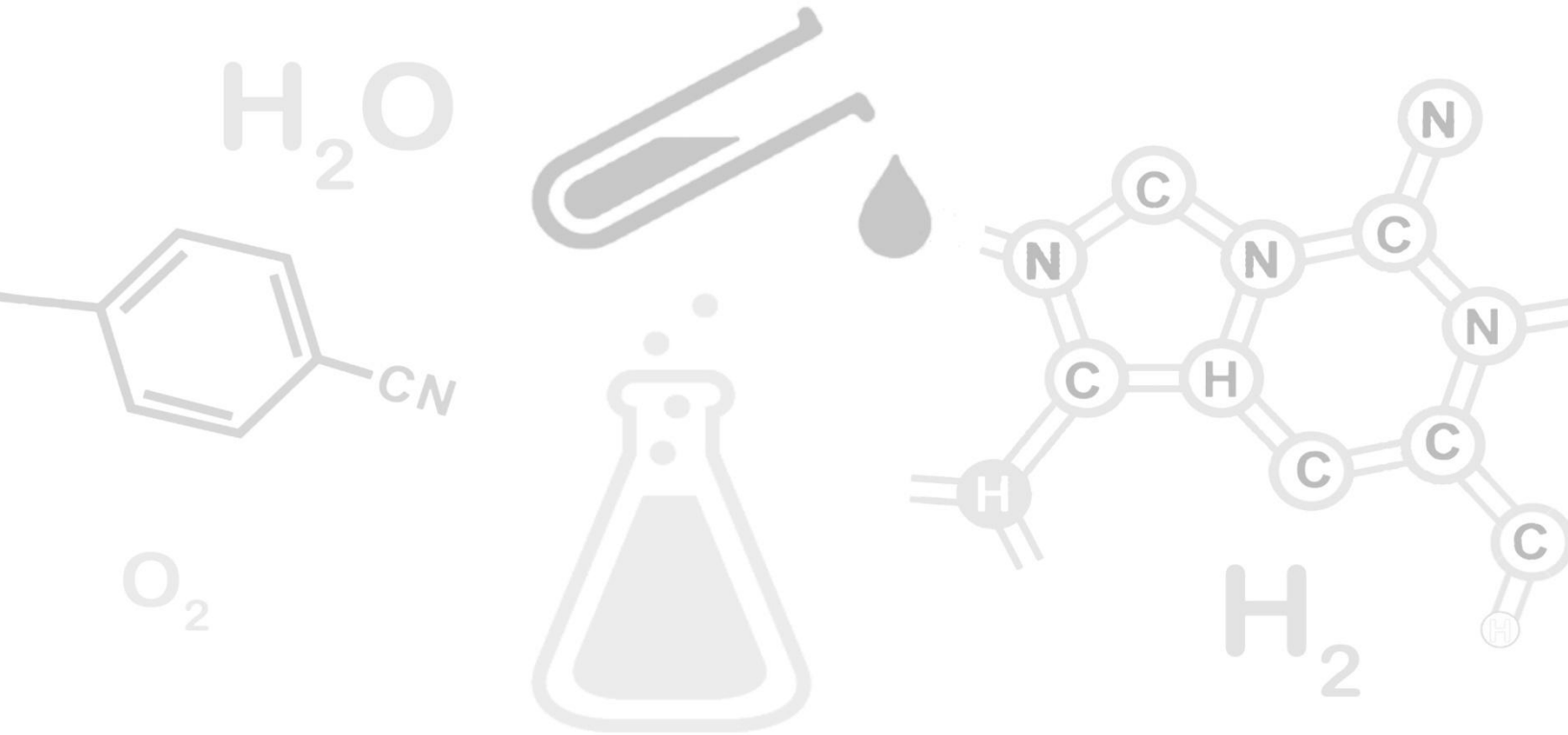
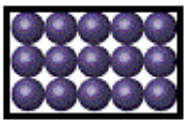
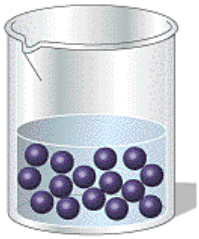
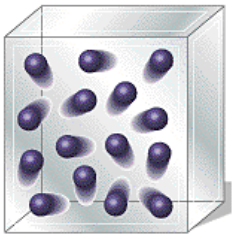
CHEMISTRY



Matter Around Us

States of Matter

Solid State	Liquid State	Gaseous State
		
In solids, the space between the particles is very less.	In liquids, the space between the particles is slightly more as compared to solids. The particles of liquid can slip and slide over each other.	In gases, the particles are much farther apart from one another as compared to solids and liquids. They have a very disorderly arrangement of particles compared to solids and liquids.
The force of attraction between the particles is strong. Thus, particles in solids are closely packed.	The force of attraction between the particles is strong enough to hold the particles together but not strong enough to hold the particles in a fixed position.	The force of attraction between the particles is negligible; hence, particles of a gas move freely in all directions. Thus, gases can mix or diffuse into other gases.
The kinetic energy of the particles is very less, and hence, solids have an orderly arrangement of the particles. Therefore, solids have a fixed shape and a fixed volume.	The kinetic energy of the particles is more than that of solids. Thus, liquids have a disorderly arrangement of particles compared to solids.	The particles of a gas have maximum kinetic energy. They move with high speed in all directions and can exert pressure on the walls of the container.
Solids maintain their shape even when they are subjected to external force, i.e. they are **rigid**.	Liquids do not have a fixed shape but have a fixed volume. Liquids take up the shape of the container in which they are poured, i.e. they are **fluid**.	Gases neither have a definite shape nor a definite volume. They fill up the container completely.
Solids cannot be compressed.	Liquids cannot be compressed much. The compressibility of liquids is almost negligible.	Gases can be compressed easily. For example, the LPG cylinders used at home and the CNG cylinders used in vehicles.

Diffusion

Intermixing of particles of two different types of matter on their own is called diffusion.
The rate of diffusion increases on increasing the temperature of the diffusing substance (by heating).

- **Examples of diffusion in the Gases:**
  1. The smell of food being cooked in the kitchen reaches us even from a considerable distance due to diffusion.
  2. The fragrance of a burning incense stick spreads all around due to diffusion.
  3. The smell of perfume spreads due to the diffusion of perfume vapors into air.

- **Examples of diffusion in the Liquids:**
  1. Colour of potassium permanganate into water on its own is due to the diffusion of potassium permanganate particles in water.
  2. The spreading of ink in water is due to the diffusion of ink particles in water.

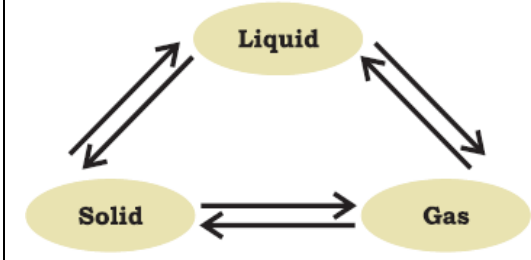
- **Examples of diffusion in the Solids:**
  1. If two metal blocks are bound together tightly and kept undisturbed for a few years, then the particles of one metal are found to have diffused into the other metal.
  2. If we write something on a blackboard and leave it uncleaned for atleast 10 to 15 days, then we will find that it becomes quite difficult to clean the blackboard afterwards. This is because some of the particles of chalk have diffused into the surface of blackboard.

Characteristics of Particles of Matter

The particles of matter -
- Are very small.
- Have spaces between them.
- Are continuously moving.
- Attract each other.

Change of State of Matter (Phase Transition)

- The phenomenon of change from one state of matter to another, and then back to the original state is called the interconversion of states of matter.
- Matter can be transformed from one state to another by changing temperature or by changing pressure. This transformation is called a change in state.



Interconversion of States of Matter

Change of state is affected by changes in the conditions such as
- Changing the temperature.
- Increasing or decreasing the pressure.
- Changing both temperature and pressure.

Effect of Change of Temperature

- On increasing the temperature of solids, the kinetic energy of particles increases.
- Due to the increase in kinetic energy, the particles start vibrating with greater speed.
- The energy supplied by heat overcomes the forces of attraction between the particles. The particles leave their fixed position and start moving freely.

Melting point: (Solid → Liquid)

The temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point. Melting point is the characteristic property of a substance. For example, the melting point of ice is 0°C (273 K).

Fusion or Solidification (Liquid → Solid)

The process, in which a liquid changes to its solid form, on cooling at a specific temperature, is called fusion or solidification.

Latent Heat

The hidden heat which breaks the force of attraction between the molecules is known as latent heat. Because the heat energy is hidden in the bulk of the matter, it is called latent heat.

Latent Heat of Fusion

The heat energy required to convert 1 kilogram of solid into liquid at atmospheric pressure at its melting point is known as the latent heat of fusion.

- When we supply heat energy to water, particles start moving even faster.
- At a certain temperature, a point is reached when the particles have enough energy to break free from the forces of attraction of each other. At this temperature, liquid starts changing into gas.

Boiling Point: (Liquid → Gas)

The temperature at which a liquid starts boiling at the atmospheric pressure is called its boiling point. Boiling is a bulk phenomenon. Particles from the bulk of the liquid gain energy to change into vapor state. For example, boiling point of water is 100°C. (Or 100°C = 273 + 100 = 373 K)

Latent Heat of Vaporization

The heat energy required to convert 1 kilogram of liquid into gas at atmospheric pressure at its boiling point is known as the latent heat of vaporization.

Condensation (Gas → Liquid)

The process, in which a gas, on cooling, turns into a liquid at a specific temperature, is called condensation or liquefaction.

Sublimation: (Solid ⇌ Gas)

- A change of state of a substance directly from solid to gas without changing into a liquid state or vice versa is called sublimation.
- The common substances which undergo sublimation are camphor, naphthalene, ammonium chloride, solid carbon dioxide and iodine.

We can use another unit called Kelvin to measure temperature. The relation between Kelvin scale and Celsius scale of temperature can be written as:

Temperature on Kelvin scale = Temperature on Celsius scale + 273

Example: To convert the temperature of 25°C to the Kelvin scale.

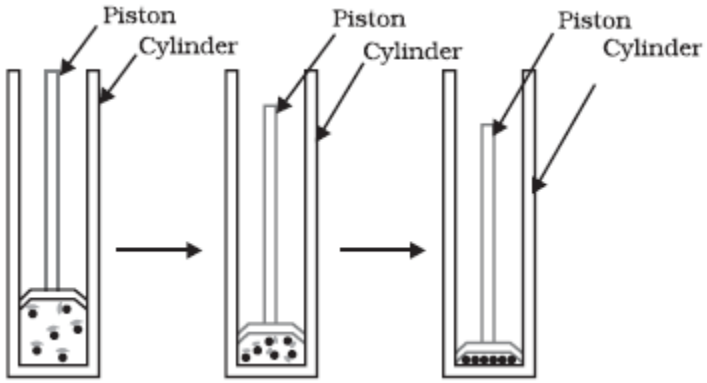
Temperature on the Kelvin scale = Temperature on Celsius scale + 273.

= 25 + 273

= 298 K

Thus, a temperature of 25°C on Celsius scale is equal to 298 K on the Kelvin scale.

Effect of Change of Pressure



- Gases can be liquefied by applying pressure and reducing temperature.
- In a gaseous substance, there is a lot of space between the particles. If pressure is applied, the particles of the gas come closer and the gas is compressed.
- When a gas is compressed, heat is produced due to compression.
- So while applying pressure, it is necessary to decrease the temperature in order to take away the heat produced during compression.

Evaporation (Liquid → Gas)

The process of conversion of a substance from the liquid state to gaseous state at any temperature below its boiling point is called as **evaporation** or **vaporisation**.
Evaporation is a surface phenomenon.

Factors Affecting Evaporation

1. **The rate of evaporation increases on increasing the surface area of the liquid.**
   - Evaporation is a surface phenomenon. If the surface area is increased, then the rate of evaporation increases.
   - Example: While putting clothes for drying, we spread them out.
     Tea kept in a saucer cools faster than the tea kept in a cup.

2. **The rate of evaporation increases by increasing the temperature.**
   - With the increase of temperature, more number of particles get enough kinetic energy to go into the vapour state.

3. **Decrease in the humidity increases the rate of evaporation.**
   - Humidity is the amount of water vapour present in air.
   - The air around us cannot hold more than a definite amount of water vapor at a given temperature.
   - If the amount of water in air is already high, then the rate of evaporation decreases.

4. **An increase in wind speed increases the rate of evaporation.**
   - With the increase in wind speed, the particles of water vapour move away with the wind decreasing the amount of water vapour in the surroundings.
   - Thus, clothes dry faster on a windy day.

Difference between Evaporation and Boiling

Evaporation	Boiling
1. It is a surface phenomenon.	1. It is a bulk phenomenon.
2. It is a slow process.	2. It is a rapid process.
3. It takes place all temperatures but below the boiling point.	3. It takes place at a definite and constant temperature.