

## MATTER

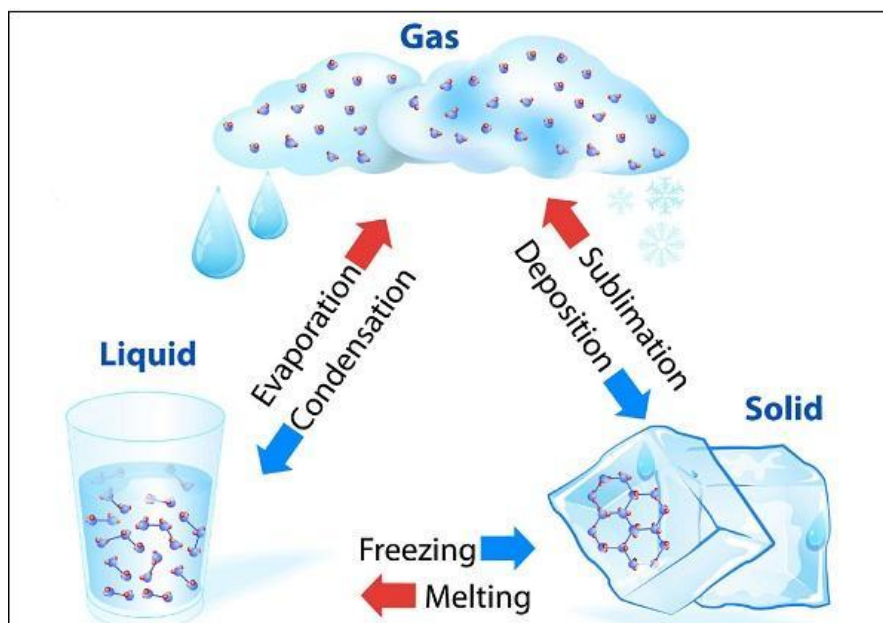
- Matter is made up of small particles.
- The matter around us exists in three states— solid, liquid and gas.
- The forces of attraction between the particles are maximum in solids, intermediate in liquids and minimum in gases.
- The spaces in between the constituent particles and kinetic energy of the particles are minimum in the case of solids, intermediate in liquids and maximum in gases.
- Particles of matter are continuously moving, that is, they possess what we call the kinetic energy. As the temperature rises, particles move faster. So, we can say that with increase in temperature the kinetic energy of the particles also increases.
- The states of matter are inter-convertible. The state of matter can be changed by changing temperature or pressure.

### Diffusion

- The mixing of a substance with another substance due to the motion of its particles is called diffusion. It is one of the properties of material.
- The diffusion of one substance to another substance goes on until a uniform mixture is formed.
- Diffusion takes place in gases, liquids and solids.
- **Diffusion** increases on increasing the temperature of the diffusing substance.

### States Of Matter

Matter around us exists in three different states— solid, liquid and gas. These states of matter arise due to the variation in the characteristics of the particles of matter.



### The Solid State

- Solids have a definite shape, distinct boundaries and fixed volumes, that is, have negligible compressibility.
- Solids have a tendency to maintain their shape when subjected to outside force.
- Solids may break under force but it is difficult to change their shape, so they are rigid.

### The Liquid State

- Liquids have no fixed shape but have a fixed volume. They take up the shape of the container in which they are kept.
- Liquids flow and change shape, so they are not rigid but can be called fluid.
- The rate of diffusion of liquids is higher than that of solids.
- Particles move freely and have greater space between each other as compared to particles in the solid state.

### The Gaseous State

- Gases are highly compressible as compared to solids and liquids.
- Gases have lower density than other states of matters.
- The liquefied petroleum gas (LPG) cylinder that we get in our home for cooking or the oxygen supplied to hospitals in cylinders is compressed gas.
- The oxygen supplied to hospitals in cylinders is compressed gas.
- Compressed natural gas (CNG) is used as fuel these days in vehicles.
- The rate of diffusion of gas is higher than that of solids and liquids.
- We come to know of what is being cooked in the kitchen without even entering there, the smell of hot cooked food reaches us in seconds because rate of diffusion of gas is higher

than that of solids and liquids.

## Matter Can Change Its State

Water can exist in three states of matter –

- Solid, as ice,
- Liquid, as the familiar water, and
- Gas, as water vapour.

## Effect Of Change of Temperature

- Increasing the temperature of solids, the kinetic energy of the 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 positions and start moving more freely. A stage is reached when the solid melts and is converted to a liquid. The minimum temperature at which a solid melts to become a liquid at the atmospheric pressure is called its **melting point**.
- **The melting point of ice is 273.15 K.**
- 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 the liquid starts changing into gas. The temperature at which a liquid starts boiling at the atmospheric pressure is known as its **boiling point**.
- State of matter can be changed into another state by changing the temperature.



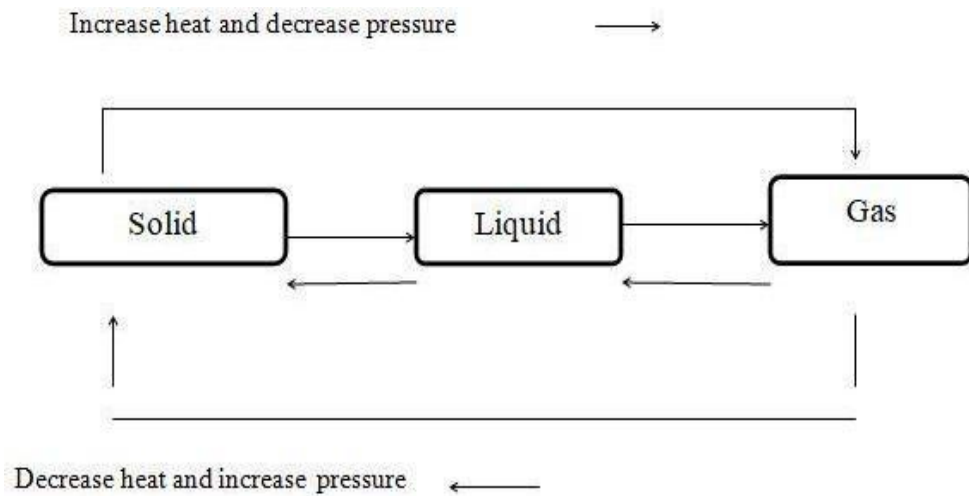
## Latent Heat

The heat energy required to convert a solid into a liquid or vapour, or a liquid into a vapour, without change of temperature known as latent heat.

## Effect Of Change of Pressure

- Increasing or decreasing the pressure can change the state of matter.
- Pressure and temperature determine the state of a substance, whether it will be solid, liquid or gas.
- Gases can be liquefied by applying pressure and lowering temperature and liquid also convert to solid by applying the pressure and lowering the temperature.
- Atmosphere (atm) is a unit of measuring pressure exerted by a gas.

- The unit of pressure is Pascal (1 atmosphere =  $1.01 \times 10^5$  Pa).



### Solid Carbon Dioxide

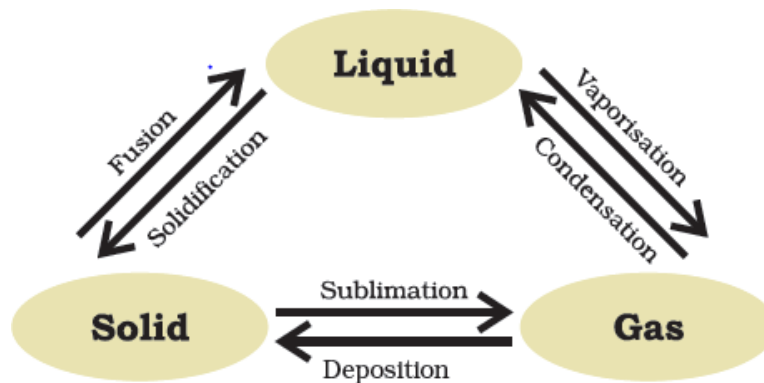
- It is stored under high pressure.
- Solid  $\text{CO}_2$  gets converted directly to gaseous state on decrease of pressure to 1 atmosphere\* without coming into liquid state. This is the reason that solid carbon dioxide is also known as dry ice.

### Sublimation

- Sublimation is the change of solid state directly to gaseous state without going through liquid state.

### Evaporation

- Evaporation is a surface phenomenon. Particles from the surface gain enough energy to overcome the forces of attraction present in the liquid and change into the vapour state.
- Rate of evaporation depends upon the surface area exposed to the atmosphere, the temperature, the humidity and the wind speed.



## The Fourth State of Matter

- Plasma is the state that consists of super energetic and super excited particles.
- The super excited particles are found in the form of ionized gases. E.g. the fluorescent tube (which contains helium gas) and neon sign bulbs (which contain neon gas) consist of plasma.

## Some Measurable Quantities and Their Units

Quantity	Unit
Temperature	Kelvin
Length	Metre
Mass	Kilogram
Weight	Newton
Volume	Cubic Metre
Density	kilogram per cubic metre
Pressure	Pascal