CHEMISTRY
CHAPTER -1
NATURE OF MATTER

NOTES

Matter

Anything that occupies space, has mass and can be felt by one or more of our senses.
e.g. Books, Chairs, Tables, Pens, Plants, Animals, Water, etc.

Matter is made up of tiny particles.

Characteristics of particles of matter:

1. Particles of matter have space between them
2. Particles of matter are continuously moving
3. Particles of matter attract each other

Classification of matter:

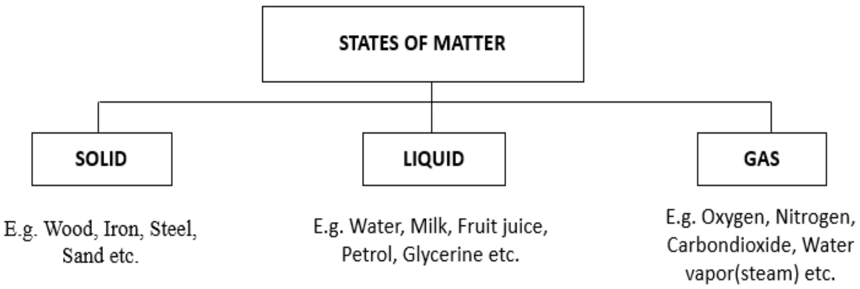
A. **Chemical Classification:** Depending upon the nature of the components, we can classify matter into two types:-

1. **Homogeneous matter**:-Matters which have uniform composition throughout.
   e.g. Salt solution.

2. **Heterogeneous matter**: - Matters consisting of two or more components which are unevenly distributed.
   e.g. : Mixture of Kerosene and Water, Muddy river water.

B. **Physical Classification:**

Based on the physical characteristic of matter, it is classified into three states i.e., solids, liquid and gases.



1. Solids:

-Fixed shape and definite volume
-Constituent particles are closely packed
-Inter particle distance is very small
-Incompressible
-High density and do not diffuse

2. Liquids:

-No fixed shape but fixed volume
-Constituent particles are less closely packed
-Inter particle distance are larger
-Incompressible
-Density is lower than solids and diffused

3. Gas:

-Neither fixed shape nor fixed volume
-Constituent particles are free to move about
-Inter particle distance are largest
-Highly compressible
-Density is least and diffused

Difference in the characteristic of states of matter

Solid	Liquid	Gas
Definite shape	Indefinite shape	Indefinite shape
Definite volume	Definite volume	Indefinite volume
Maximum force of attraction between particles	Less forces of attraction between particles compare to solid	Negligible force of attraction between particles
Have negligible compressibility	Slightly compressible	Can be compressed easily
Kinetic energy of particles is minimum	Kinetic energy of particles is more than solid	Kinetic energy of particles is maximum
Particles cannot move rather they vibrate only at their fixed position	Particles can slide over one another	Particles can move freely
Highest density	Density is lower than solid	Lowest density
Cannot flow	Floweasily	Floweasily

Interchanges in the states of matter:

Matter can change its state e.g., water can exist in three states of matter.
Solid in the form of ice, liquid in the form of water and gas as water vapour (steam).

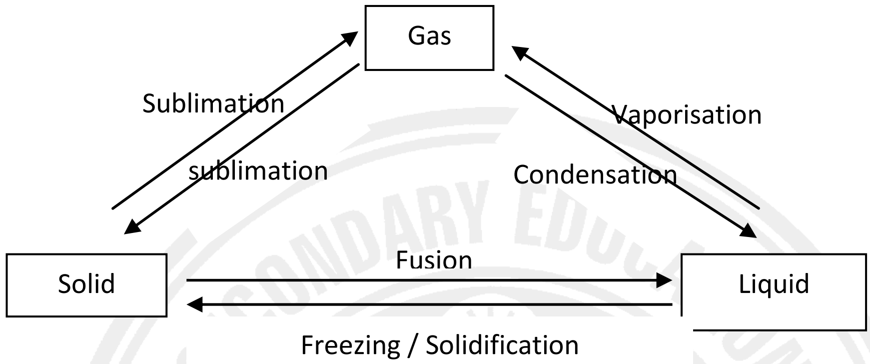


Fig. Diagram shows inter conversion of solids, liquids and gas

States of matter can be changed by changing temperature and or by changing the pressure.

A. EFFECT OF TEMPERATURE:

1. Solid to Liquid

$$\text{Solid} \underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}} \text{Liquid}$$

On increasing the temperature of solids, the kinetic energy of the particles increases which overcomes the forces of attraction between the particles thereby solid melts and is converted to a liquid. The process of melting, that is, change of solid state into liquid state is also known as **fusion.**

The fixed 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 0 °C(273.16K≃ 273 K)

2. Liquid to Gaseous

$$\text{Liquid} \underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}} \text{Gaseous}$$

On increasing the temperature of liquids particles start moving even faster thereby breaking the force of attraction between the particles and the liquid starts changing into gas. The process of change of liquid state into gaseous state at boiling point is called **vapourisation.**

The temperature at which a liquid starts boiling at the atmospheric pressure is called its **boiling point.**

The boiling point of water is 100 °C (373K) at one atmospheric pressure.

Latent heat: The hidden heat which breaks the force of attraction between the molecules during change of state.

Latent heat of fusion : The amount of heat energy required to change 1 kg of solid into liquid at its melting point.

Latent heat of vaporisation : Quantity of heat required to change 1 kg of the liquid to vapour at its boiling point.

3. **Solid to Gaseous**

$$\text{Solid} \underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}} \text{Gaseous}$$

The process of changing a solid directly into gaseous state on heating without changing into liquid state and of vapours into solid on cooling is called sublimation.

The solid particles formed when the gaseous state of a substance directly changes into solid states is called **sublimate.** The common substances which undergo sublimation are Iodine, Camphor, Naphthalene and Anthracene.

We can infer that the state of matter can be changed into another state by changing the temperature. Normally, a solid on heating changes into liquid state. The liquid state on further heating changes into gaseous state. Reverse happens when gaseous state is cooled. However there are solids which on heating directly changes into gaseous state, without changing into liquid state and vice versa.

B. EFFECT OF PRESSURE:

Increasing or decreasing the pressure can change the state of matter. Applying high pressure and lowering the temperature can liquefy gases.

Solid carbon dioxide is stored under high pressure. It gets converted directly to gaseous state on decrease of pressure to atmospheric pressure without coming into liquid state. For this reason, that solid carbon dioxide is known as **dry ice**.

Thus, we can say that pressure and temperature determine the state of a substance whether it will be solid, liquid or gas.

EVAPORATION:

The phenomenon of change of a liquid into vapours (gas) below its boiling point is called **evaporation**.

Factors affecting evaporation:

1. **Surface area**: The rate of evaporation increases with an increase of surface area.
2. **Temperature**: The rate of evaporation of a liquid increases with rise in temperature.
3. **Humidity:** The rate of evaporation decreases when humidity is high and vice versa.
4. **Wind speed**: Higher the wind speed the more is the rate of evaporation.

Evaporation causes cooling:

In an open vessel, the liquids keep on evaporating. The particles of liquid absorb energy from the surrounding to regain the energy lost during evaporation. This absorption of energy from the surrounding makes the surrounding cold.