MATTER IN OUR SURROUNDINGS

→ In our surrounding we see a large variety of things with different Shapes, Size and Textures.
Ex.- Air, Food, Stones, Clouds, Stars, Plants, Animals, Water Droplet.

→ Everything in this universe is made up of material which scientists have named matter.

➢ **Matter:-** Matter is anything that occupies space and has mass is called Matter. Ex.- Water, Hydrogen, Oxygen, Sugar, Sand, Silver, Steel etc.

- **Characteristies of Particles of Matter:-**

→ Matter is made up of Tiny Particles.

→ Particles of matter are very small.

→ Particles of matter have space between them.

→ Particles of matter are continuously moving.

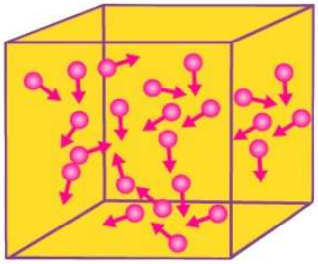
→ Particles of matter attract each other.

➢ **Diffusion:-** The spontaneous intermixing of particle of two different types of matter is called diffusion.

→ The rate of diffusion becomes faster with increase in temperature because at higher temperature the particles have more energy and hence more faster.

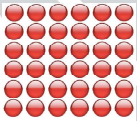
(i) Aroma of Perfumes.
(ii) Smell of hot sizzling food.
(iii) Smell of Burning incense stick (Agarbatti).

➢ **Brownian Movement (Robert Brown):-** The zig-zag movement of the small particles suspended in a liquid or gas is called Brownian Movement.



- **Physical Classification of Matter:-**

(i) Solid.
(ii) Liquid.
(iii) Gas.
(iv) Plasma.
(v) Bose Einstein Condensate (BEC).

➢ **Solid**  **:-** A solid has a definite shape and definite volume.

- **Properties of Solid:-**

→ A solid possesses a fixed volume and a definite shape, distinct boundaries and a definite mass.

→ Solids are rigid and almost incompressible.

→ Solids may break under force but it is difficult to change their shape.

→ Solids generally possess high densities, $\boxed{D = \frac{M}{V}}$

→ Solids do not exhibit diffusion.

→ In solids intermolecular forces of attraction are very very strong.

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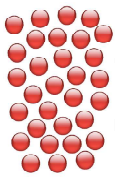
➢ **Liquids**  **:-** A liquid has a definite volume but no definite shape.

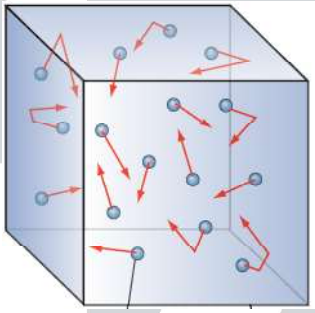
- **Properties of Liquids:-**

→ The matter in liquid state possesses a definite volume, a definite mass, but no definite shape.
→ Liquid are almost incompressible but are not rigid. They can flow from higher level to lower level.
→ Liquid have a property of fluidity and acquire the shape of the container in which they are kept.
→ Liquid can undergo diffusion. Ex.- Swimming.
→ Liquids also have high densities but less than that of solids.
→ In liquid intermolecular forces of attraction is weaker than solid.

➢ **Gases**  **:-** A gas has neither a definite shape nor a definite volume.

- **Properties of Gases:-**

→ The matter in gaseous state has neither definite volume nor definite shape but it has definite mass. It acquires the shape of the volume of the container. Ex.- LPG, CNG
→ Gases are highly compressible.
→ Gases exert pressure on the walls of the container in which they are stored.

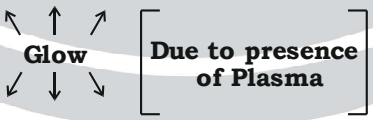


→ Gases can flow easily in all directions.
→ Gases have very low densities as compared to solids and liquids.
i.e. Solid > Liquid > Gases.

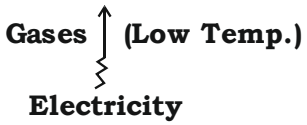
➢ **Plasma:-** Plasma is a mixture of free electrons and ions.

- **Properties of Plasma:-**

→ Plasma is considered the fourth state of matter, plasma occurs naturally in the stars.
Inside the stars, the temperature is so high that the atoms break down. This mixture of free electrons and ions in a star is called Plasma.
→ The sun and the other stars glow because of the pressure of plasma in them.



→ Plasma can also made on the earth by passing electicity through gases at less temperature. Plasma makes a fluorescent tube glow.



➢ **Bose Einstein Condensate:-**

→ In 1920, an Indian scientist Satyendra Nath Bose did some calculations for the 5th state of matter.

On the basis of these calculation, Albert Einstein predicted the existence of a new state of matter.

→ 5th state of matter was achieved finally by three scientists Cornell, Ketterle and Wieman of USA by cooling a gas of extremely low density to super low temperature.

Solids	Liquids	Gases
❖ Strong attraction between the particles.	❖ Moderate attraction between the particles.	❖ Very weak attraction between the particles.
❖ Particles are very close together and neatly arranged.	❖ Particles still very close but not neatly arranged.	❖ Particles are much far away from each other.
❖ Particles vibrates in places.	❖ Particles are able to slide passed each other.	❖ Particles move all around and bump into each other.
❖ Definite Shape.	❖ Indefinite Shape.	❖ Indefinite Shape.
❖ Definite Volume.	❖ Definite Volume.	❖ Indefinite Volume.

- **Characteristies of Solid, Liquid and Gas:-**

Properties	Solid	Liquid	Gas
1) Mass.	Definite.	Definite.	Definite.
2) Shape.	Definite.	Acquire the shape of container.	Acquire the shape of the container.
3) Volume.	Definite.	Definite.	Indefinite.
4) Compressibility.	Not Possible.	Almost Negligible.	High Compression.
5) Fluidity.	Not Possible.	Can Flow.	Can Flow.
6) Rigidity.	Highly Rigid.	Less Rigid.	Not Rigid.
7) Diffusion.	Slow.	Fast.	Very Fast.
8) Number of free Surace.	Many Number of free Surface.	Only one free Surface.	None
9) Density.	High	Slightly Lower.	Very Low.
10) Packing of Particles.	Most closely packed.	Less closely packed.	Lease closely packed.
11) Interparticle Forces.	Strongest.	Slightly weaker than in Solid.	Negligible.
12) Expansion on Heating.	Less	More than Solids	Most.
13) Motion of constituent Particles.	Oscillatory.	Translatory.	Translatory.
14) K.E. of Particles.	Least.	Large.	Very Large.

- **Can Matter change its State:-**

→ Matter can exist in three physical states. Solid, Liquid and Gas.

We can change the physical state of matter two ways.

(i) By changing the temperature.

(ii) By changing the pressure.

- **Solid to Liquid change (Melting):-**

→ When we heat a solid its particles become more energetic and K.E. of the particles increases. The energy supplied by heat overcomes the intermolecular forces of attraction between the particles. As a result the particles leave their mean position and break away from each other. After this solid melts and a liquid is formed. Ex.- Ice to Water.

→ "The temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point."

The process of melting is also called "Fusion". The melting point of ice is 0^{o} C. It may also be written as 273.15 K or 273 K.

$$0^{o}C = 273K$$

- **Liquid to Gas change (Boiling or Vaporization):-**

Ex.- Cloth get Dry (Boiling → Vaporization)

We get Sweat (Sweating → Perspiration)

→ When we supply heat energy to the liquid the particles of water start vibrating even faster. They become free to move and escape from the liquid. Thus the liquid evaporates i.e., starts changing into gas.

→ "The temperature at which a liquid changes into a gas or vapour at the atmospheric pressure is called its boiling point".

→ 'Boiling' is a bulk phenomenon.

→ **Gas to liquid change (condensation)**

→ The process of changing a gas (or vapour) to a liquid by cooling is called **Condensation**.

→ Condensation is the reverse of boiling (or vaporisation). When a gas is cooled enough (by lowering its temperature) then its particles lose so much K.E. that they slow down, move closer together until they start being attracted to each other and form a liquid.

→ Condensation is also called **Reverse of Vaporisation**.

- **Liquid to Solid Change (Freezing):-**

→ The process of changing a liquid into a solid by cooling is called **Freezing**.

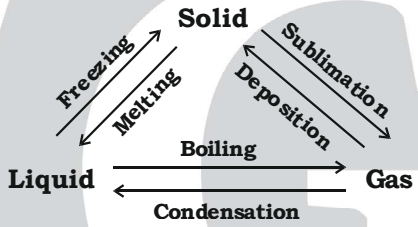
→ Freezing means Solidification.

→ Freezing is the reverse of Melting.

➢ **Sublimation:-** The changing of a solid directly into vapour on heating is called sublimation and changing of vapour into solid on cooling is known as deposition. Ex.- Camphor, Napthaline Ball.

i.e. $\text{Solid} \underset{\text{Deposition}}{\overset{\text{Sublimation}}{\rightleftharpoons}} \text{Gas}$

Inter-Conversion of States



➢ **Latent Heat:-** The heat energy which has to be supplied to L.H does not raise temperature but change the state of substance. (Latent means Hidden).

- **Latent Heat of Fusion:-**

→ The Latent heat of fusion (or melting) of a solid is the quantity of heat in Joules (J) required to convert 1 kg of the solid (at its melting point) to liquid without any change in temperature.

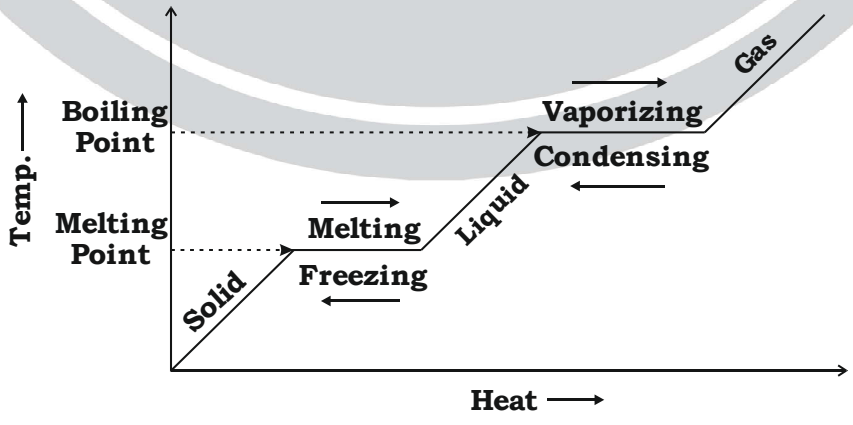
→ The latent heat of fusion of ice into water is 3.34×10^5 J/Kg.

- **Latent heat of Vaporisation (Liquid to Gas Change):-**

→ The latent heat of vaporization of a liquid is the quantity of heat in joules required to convert 1 kg of the liquid (at its boiling point) to vapour or gas without any change in temperature.

→ The latent heat of vaporisation of water is 22.5×10^5 J/Kg.

Temperature v/s Heat



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- **Change the state of a Substance is called L.H.:-**

Boiling	Evaporation
1. Boiling occurs only when the liquid is heated	1. Evaporation of a liquid takes place on its own
2. Boiling takes place at a specific temperature. Known as a boiling point of the liquid	2. Evaporation takes place at all temperature
3. Boiling occurs from the surface as well as from below the surface of the liquid	3. Evaporation is a surface phenomenon and occurs only from the surface of the liquid
4. No cooling is caused during boiling	4. Cooling is always caused during evaporation. Ex.- Cloth drying

➢ **Pressure:-** Gases are compressible because on applying pressure, the space between the gaseous particles decreases.

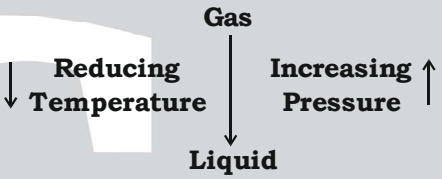
Therefore, gases can be compressed readily. (LPG)

- **Effect of change of Pressure:-**

→ It has bean observed that an applying pressure and reducing temperature, gases may be liquified.

→ When we apply pressure and reduce temperature the gases can be converted into liquid. i.e., Gases will be liquified.

→ The process of conversion of a gas into a liquid by increasing pressure or decreasing temperature is called liquidification.



➢ **Liquidification:-**

Mass : – The Quantity
Weight : – } Will see in Physics
Volume : –

Pressure:- Force experted by particles per unit area.

→ The atm pressure at sea level is 1 atm.

$$\text{Pressure} \leftarrow \boxed{P = \frac{F}{A}} \begin{matrix} \rightarrow \text{Force} \\ \rightarrow \text{Area} \end{matrix}$$

→ S.I unit is Pascals. (Pa)

→ Another unit is atm.

→ Another unit is Bar.

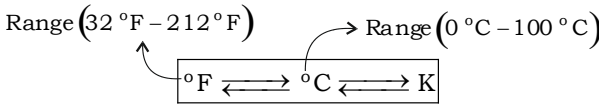
$1\ atm = 1.01 \times 10^5\ Pa$

$1\ bar = 1 \times 10^5\ Pa$

$1\ bar = 1.01\ atm$

Quantity	Unit	Symbol
Mass	Kilogram	Kg
Length	Meter	m
Temperature	Kelvin/Celcius	$K/^0C$
Weight/Force	Newton	N
Volume	Cubic Meter	m^3
Density	Kg/Cubic Meter	Kg/m^3
Pressure	Pascal	Pa

Temperature Conversions



$$^{\circ}F = \left(\frac{9}{5}\right)^{\circ} C + 32$$

$$K = {}^{\circ}C + 273.15$$
or
$$K = {}^{\circ}C + 273$$

Q. Body temperature 37°C into °F ?

Sol. $^{\circ}F = \left(\frac{9}{5}\right)^{\circ} C + 32$

$= \left(\frac{9}{5}\right)(37) + 32$

$= \frac{333}{5} + 32$

$= 66.6 + 32$

$= 98.6\ ^{\circ}F$

$K = {}^{\circ}C + 273.15$

$= {}^{\circ}C + 273\,(\text{approx})$

$= 37 + 273$

$K = 305$