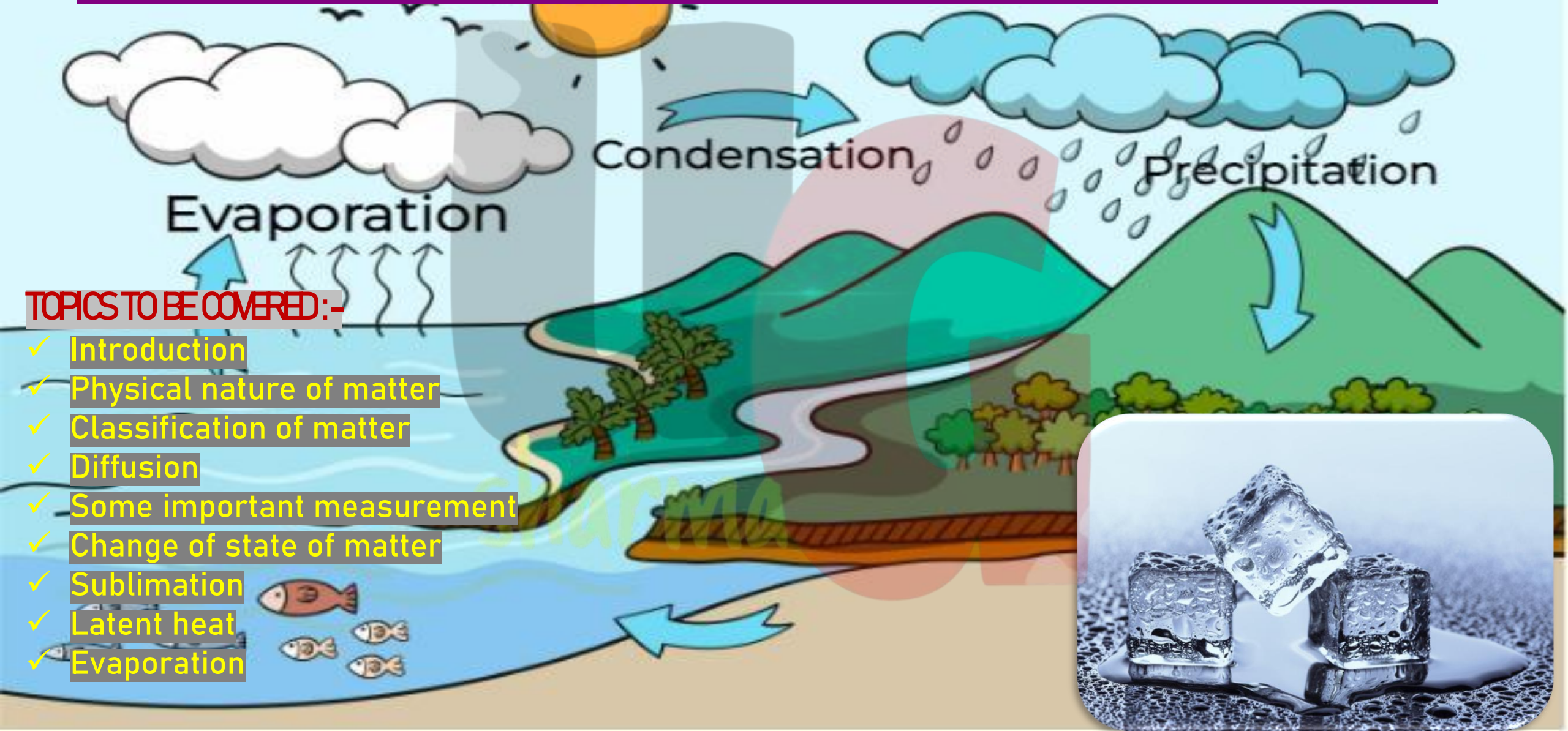
MATTER IN OUR SURROUNDING



TOPICS TO BE COVERED :-

- ✓ Introduction
- ✓ Physical nature of matter
- ✓ Classification of matter
- ✓ Diffusion
- ✓ Some important measurement
- ✓ Change of state of matter
- ✓ Sublimation
- ✓ Latent heat
- ✓ Evaporation

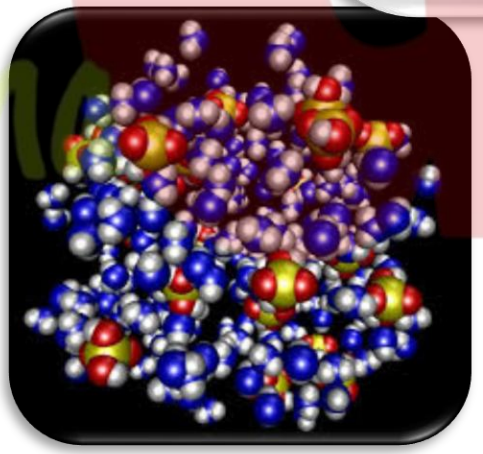
Introduction

Matter :- Anything that that occupy space and have mass is known as matter.

Early Indian philosophers classified matter in the form of five basic elements – the "Panch Tatva" – air, earth, fire, sky and water. According to him everything, living and non-living was made up of these five basic elements.

Physical Nature of Matter

- Matter is made up of tiny particles. These particles is known as **atom**.

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Characteristics of particles of matter

- Particles of matter have space between them.
  - The space between the particle of matter is known as **intermolecular/ interparticle space**.
  - Intermolecular space :- solid < liquid < gas
  - Movements of particles depends on intermolecular space. Therefore, movements of particles is minimum in solid, more in liquid and maximum in gas.

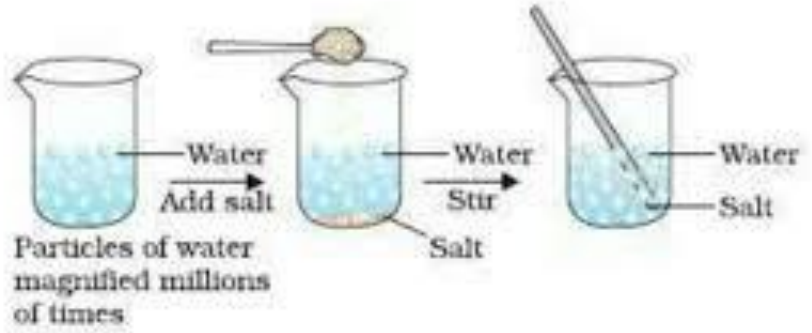
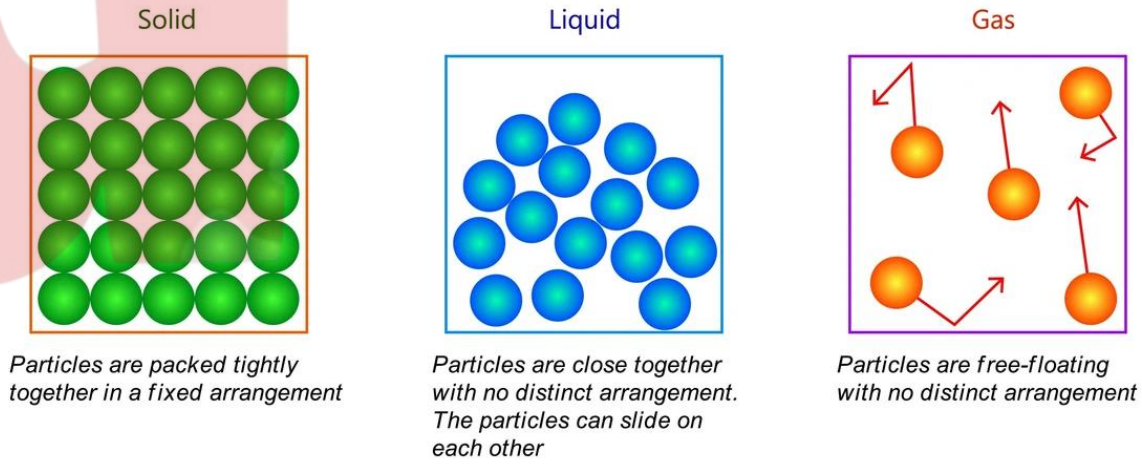


Fig. 1.1: When we dissolve salt in water, the particles of salt get into the spaces between particles of water.

Brownian motion :- The zig - zag motion of a small particles suspended in a liquid or gas is called Brownian motion.

PARTICLE ARRANGEMENT IN PHASES OF MATTER

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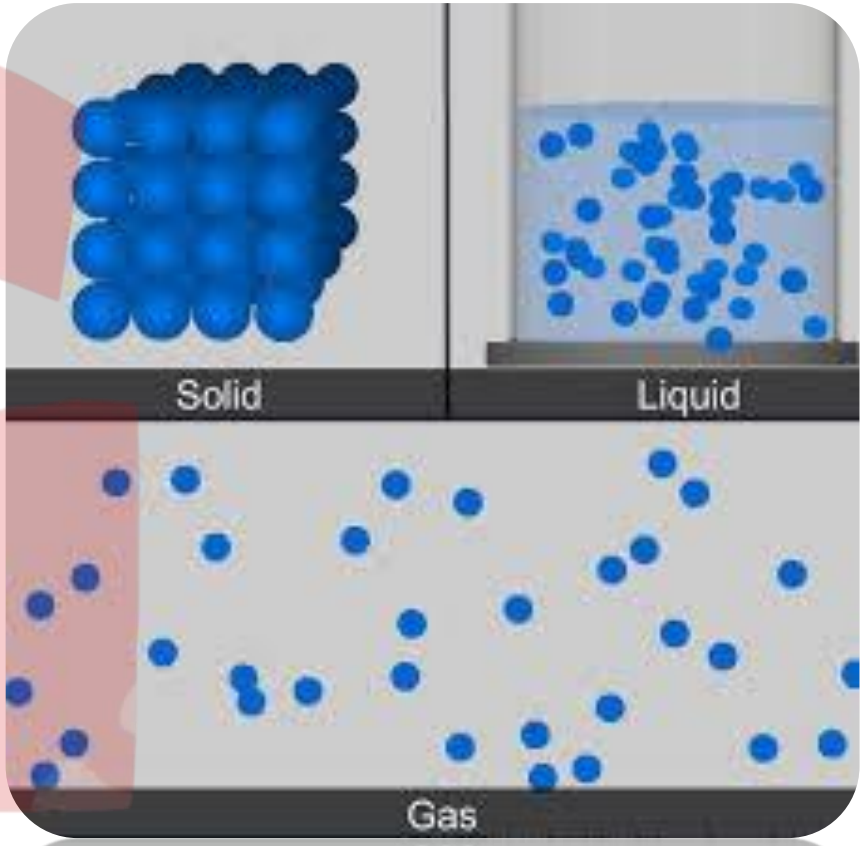
Characteristics of particles of matter

- ❑ Particles of matter are continuously moving.

➢ The moving particles having kinetic energy which increases with increase in temperature.

- ❑ Particles of matter attract each other.

➢ The force of attraction between the particles of matter is known as **intermolecular / interparticle force**.
➢ Intermolecular force:- solid > liquid > gas




HOT
COLD

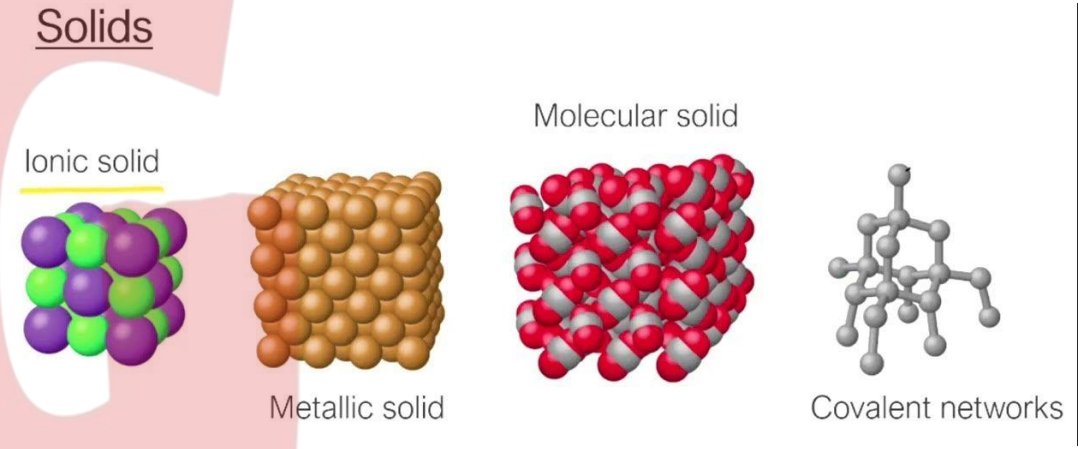
CLASSIFICATION OF MATTER

On the basis of physical properties, matter can be classified into three categories:-

1. SOLID
2. LIQUID
3. GAS

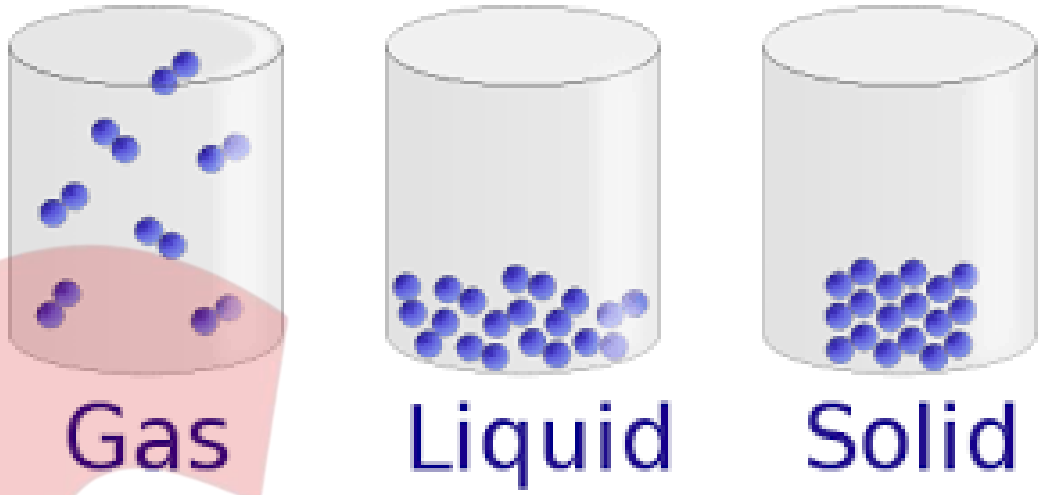
Properties of solid :-

- Solid are rigid.
- Solid have fixed shape and fixed volume.
- Solid cannot compressed much.
- Solid have high density.
- Solid do not fill their container completely.
- Solid have very little space between their particles.



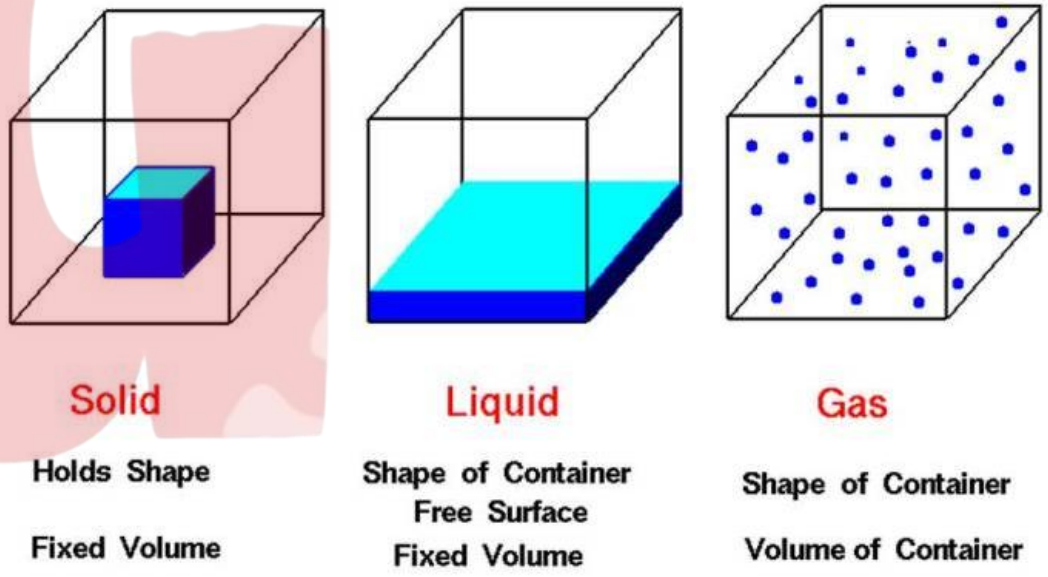
Properties of liquid :-

- Liquids are fluid (can flow easily).
- Liquids have not fixed shape but fixed volume.
- Liquids can compressed little.
- Liquid have intermediate density.
- Liquids do not fill their container completely.
- Liquid have moderate space between their particles.



Properties of Gas :-

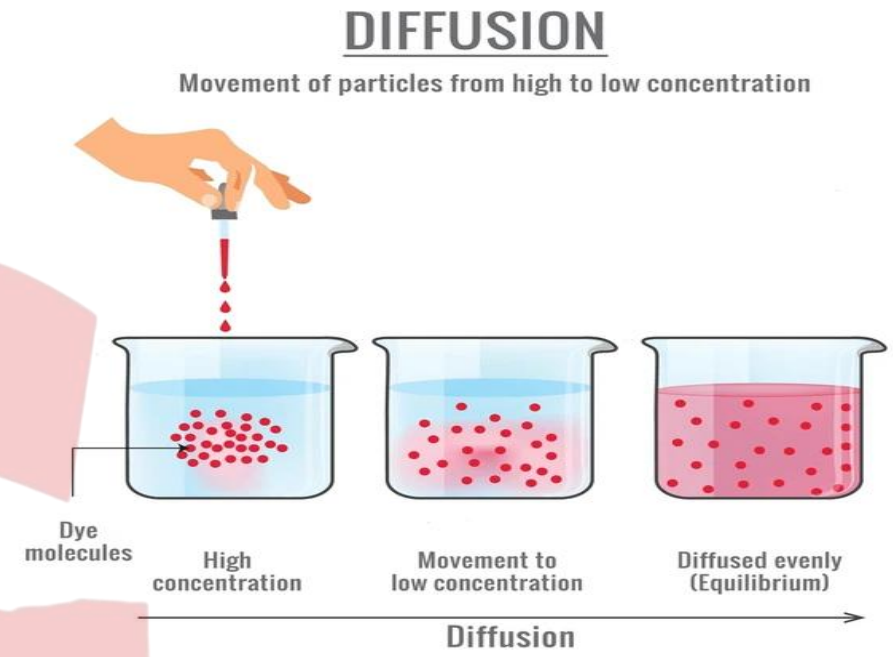
- Gases are fluid (can flow easily).
- Gases have neither fixed shape nor fixed volume.
- Gases can compressed easily.
- Gases have very low density.
- Gases fill their container completely.
- Gases have large space between their particles.

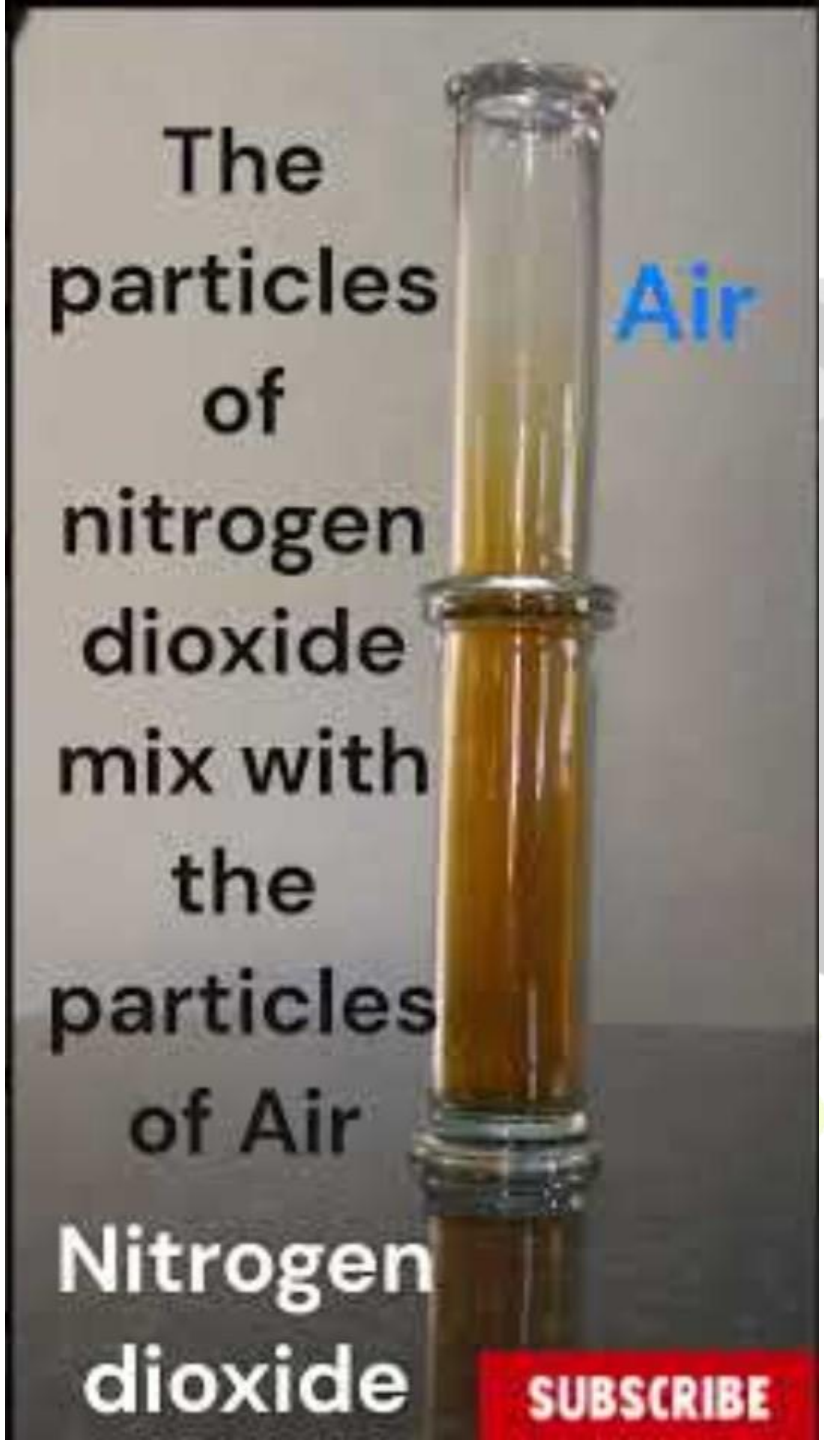


Comparison	Solids	Liquids	Gases
Particles	Tightly packed	Loosely packed	Independent
Shape	Fixed	Not fixed	Not fixed
Volume	Fixed	Fixed	Not fixed
Rigidity	High	Less	Negligible
Forces	Strongest	Intermediate	Weakest
Fluidity	Not a chance	Yes	Yes
Compressibility	No	Slight	High
Density	High	Low	Very low
Diffusibility	No	Less	High
Kinetic energy	Low	Intermediate	High
Examples	Crystalline and Amorphous solids	All fluids	O_2, CO_2, SO_2, NO_2, etc

DIFFUSION

- The spreading out or mixing of a substance with another substance due to the motion of its particles is called **diffusion**.
- Rate of diffusion :- solid < liquid < gas
- The rate of diffusion increases with temperature.
- The smell of food being cooked, perfume, Agarbatti (incense stick), etc spread due to diffusion




The particles of nitrogen dioxide mix with the particles of Air
Air
Nitrogen dioxide
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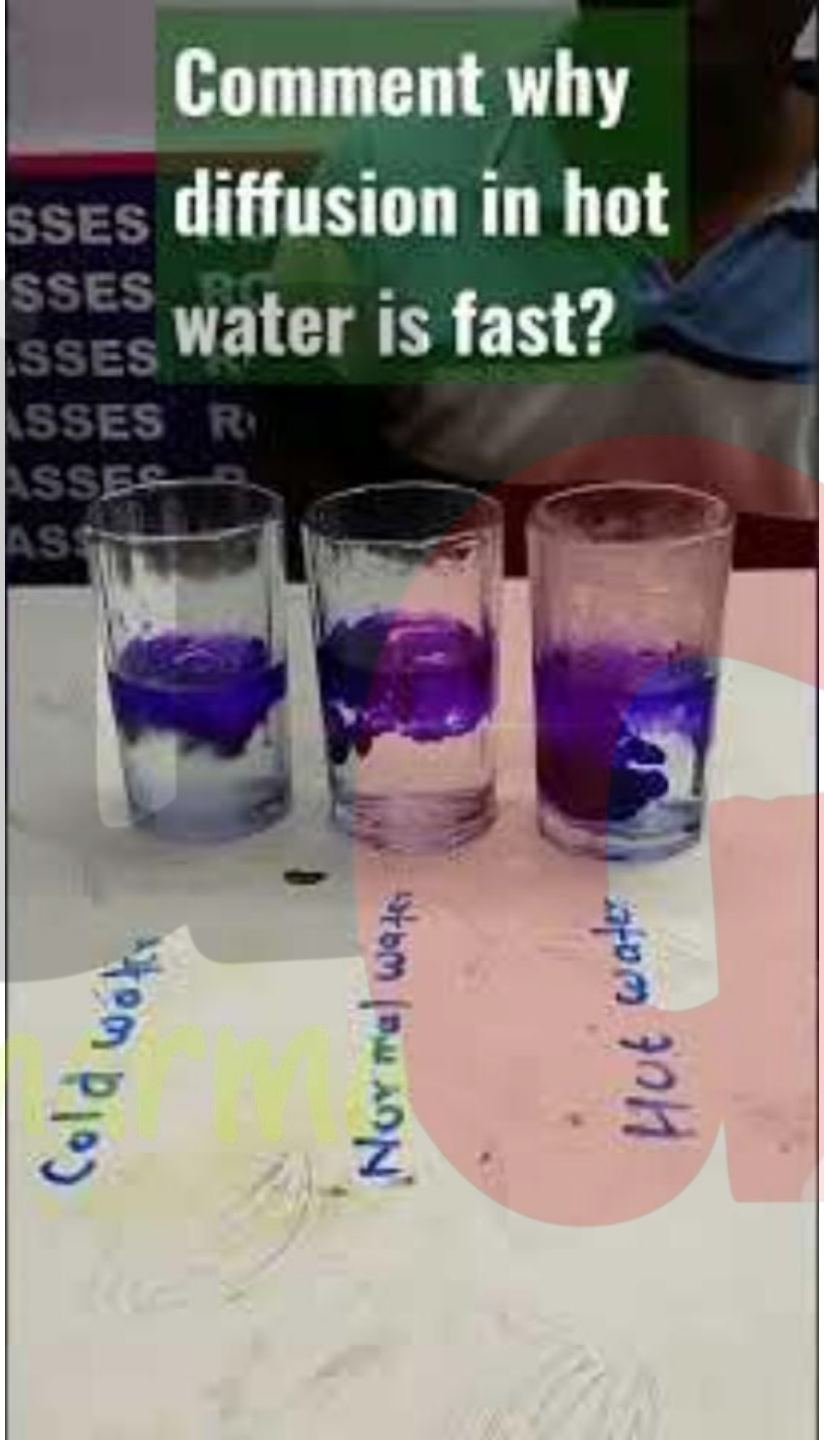

Comment why diffusion in hot water is fast?
Cold water
Normal water
Hot water

SOME IMPORTANT MEASUREMENT

Temperature

- The common unit of measuring temperature is “degree Celsius” denoted by ◦C.
- It’s a S.I unit is Kelvin (K).

0^oC =273K (Actual 0^oC + 273.16K)

Relation between kelvin scale & Celsius scale

$$T(k) = T(C) + 273$$
$$\rightarrow T(C) = T(K) - 273$$

eg:- 25°C = 25+ 273 = 298k

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

C – *temperature in degree celcius*

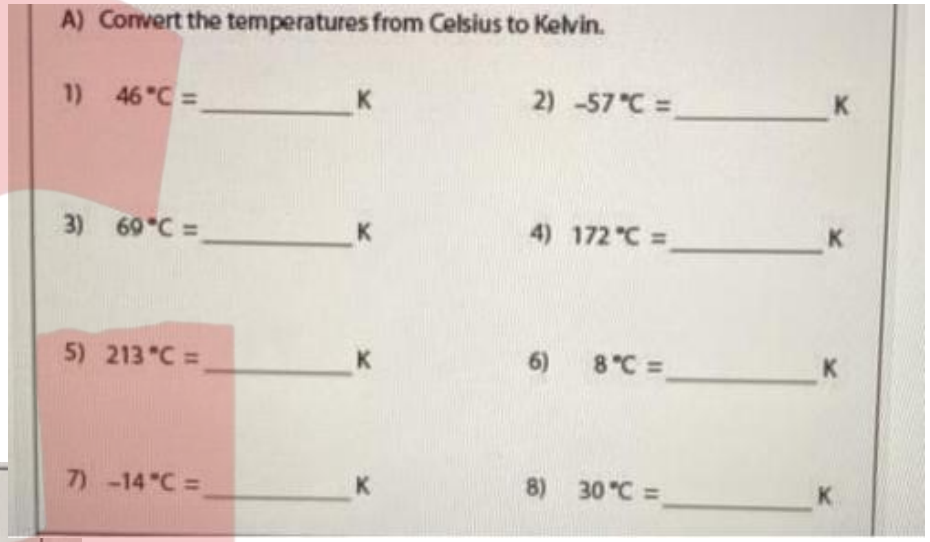
F – *temperature in degree Fahrenheit*

$$\left(10 \times \frac{9}{5}\right) + 32 = F$$

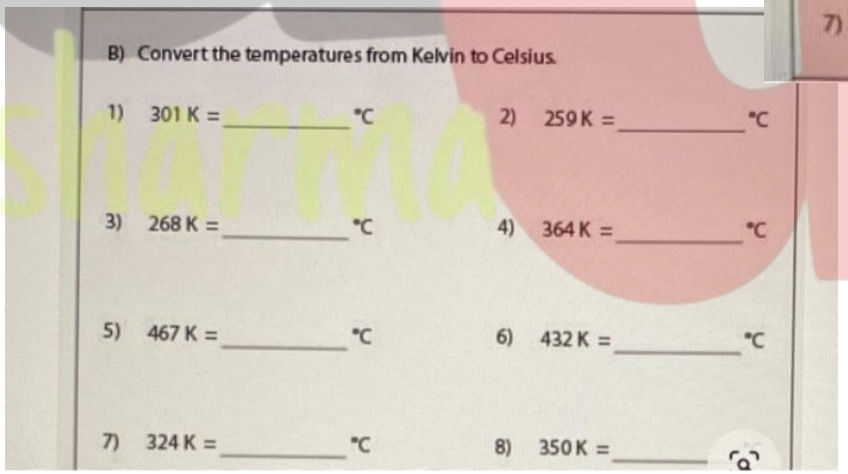
$F = 50$

Thus,

$10°C = 50\,°F$


A) Convert the temperatures from Celsius to Kelvin.

1) 46 °C = _____ K
2) -57 °C = _____ K
3) 69 °C = _____ K
4) 172 °C = _____ K
5) 213 °C = _____ K
6) 8 °C = _____ K
7) -14 °C = _____ K
8) 30 °C = _____ K


B) Convert the temperatures from Kelvin to Celsius.

1) 301 K = _____ °C
2) 259 K = _____ °C
3) 268 K = _____ °C
4) 364 K = _____ °C
5) 467 K = _____ °C
6) 432 K = _____ °C
7) 324 K = _____ °C
8) 350 K = _____

SOME IMPORTANT MEASUREMENT

Pressure

- Atmospheric (atm) is a unit of measuring pressure exerted by gases.
- The unit of pressure is Pascal (Pa).
- 1 atm = 1.01×10^5 Pa
- The pressure of air in atmosphere is called “atmospheric pressure”
- The atmospheric pressure at sea level is 1 atm and it is taken as normal atmospheric pressure.
- Atmospheric pressure decreases with increase in height.

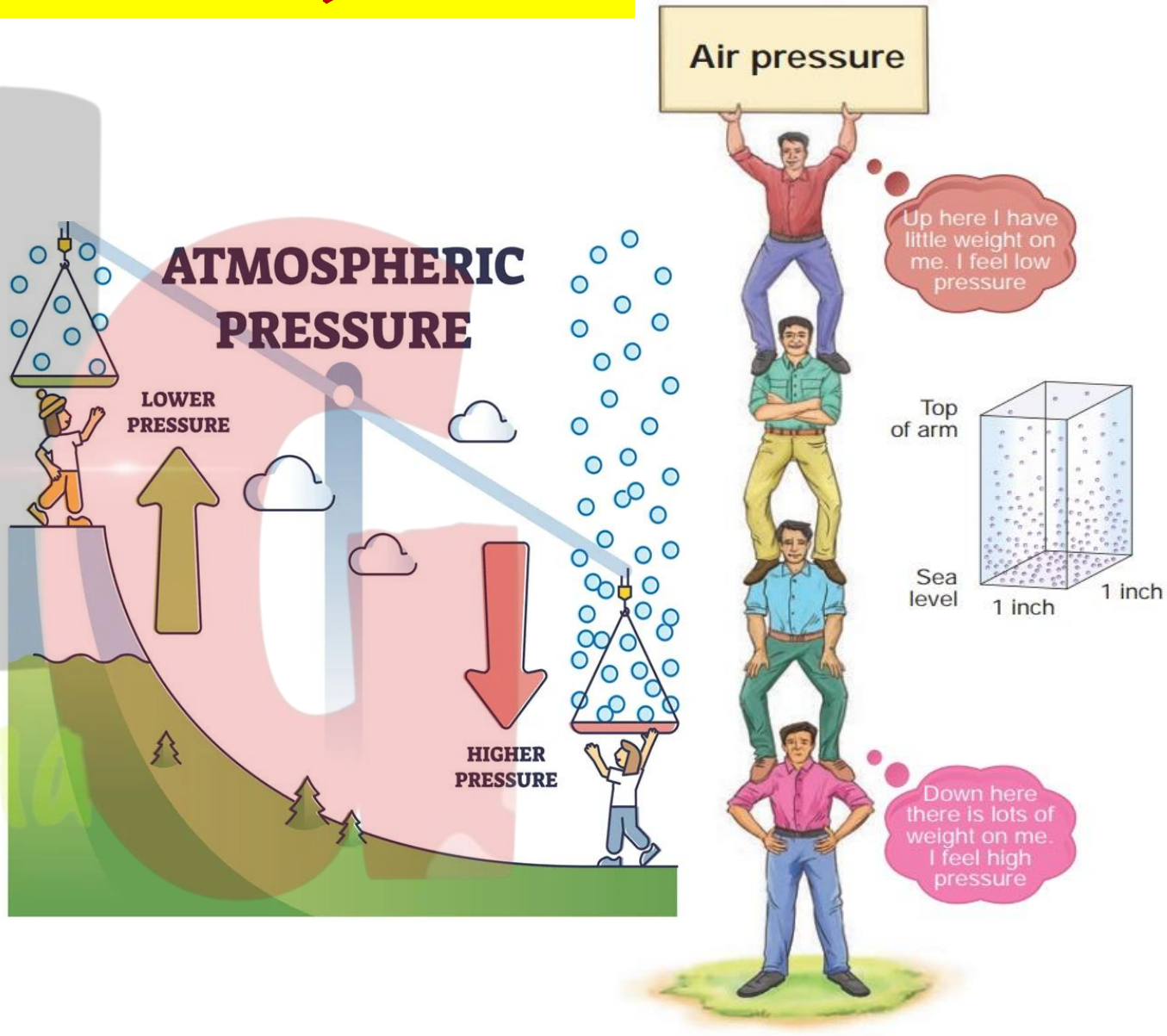


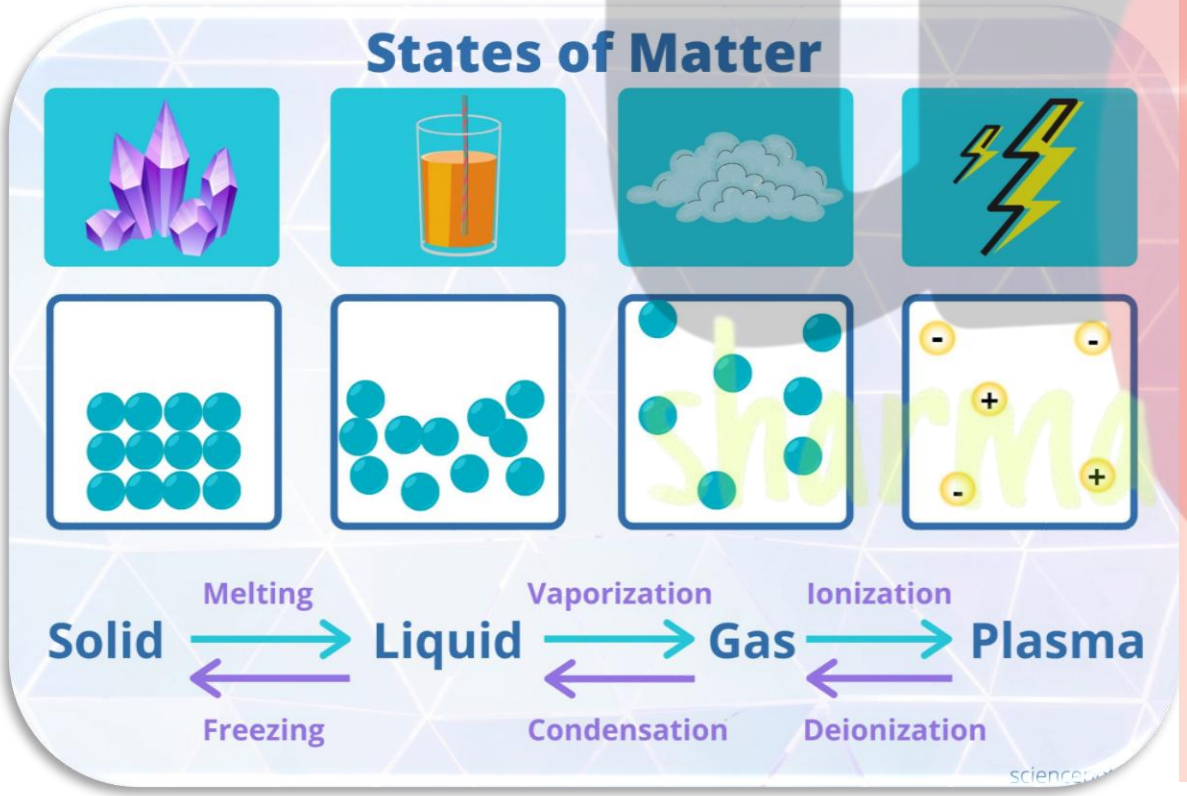
Figure 1.9 Atmospheric pressure

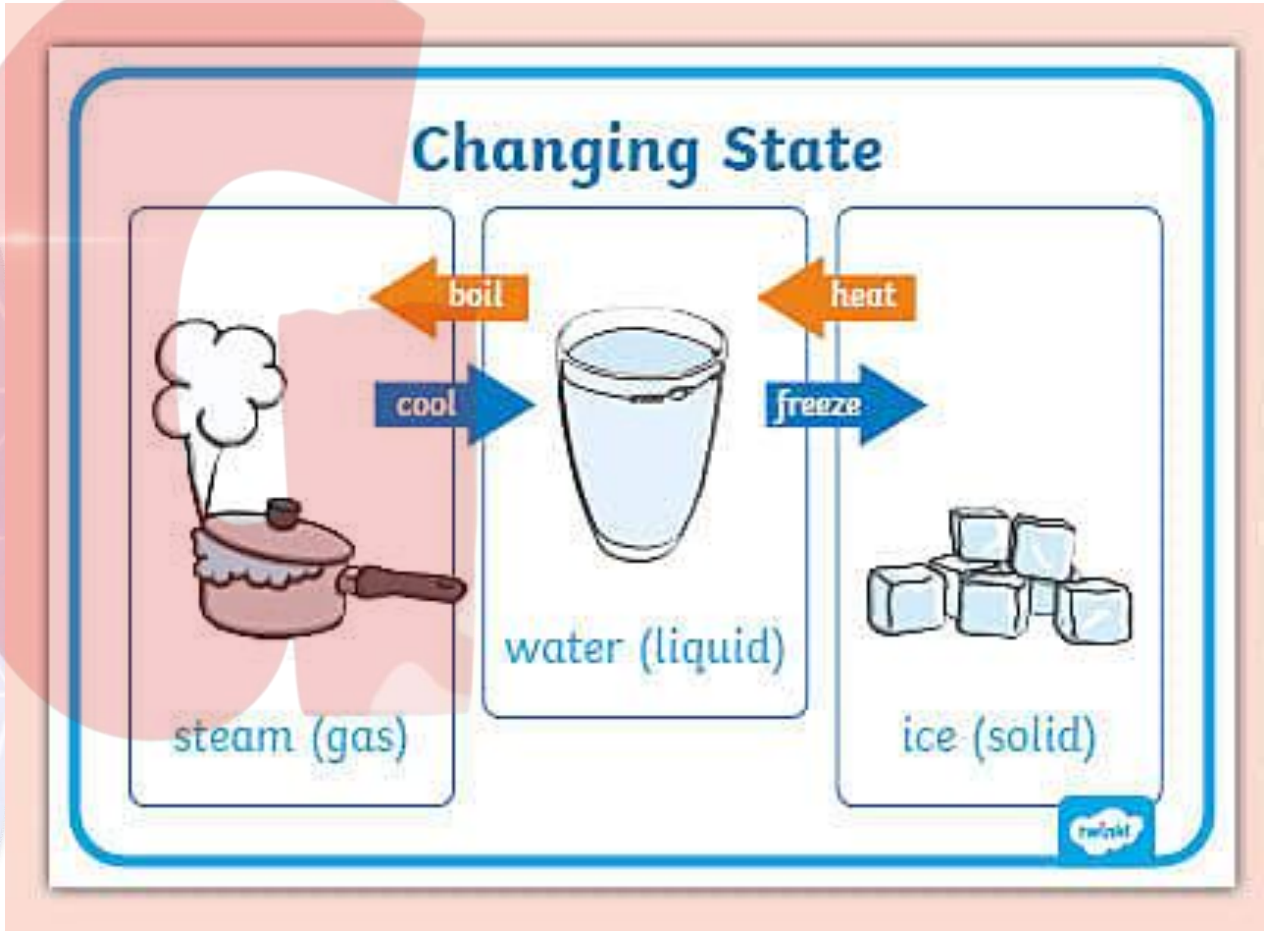
CHANGE OF STATE OF MATTER

How can we change in the physical state of matter ?

Ans :- We can change the physical state of matter in two ways :-

1. By changing temperature, and
2. By changing the pressure





CHANGE OF STATE OF MATTER

1.By changing in the Temperature

i. Melting

- The process in which solid convert into liquid on heating is known as melting.
- The temperature at which a solid substance starts to melt and change into a liquid at atmospheric pressure is called its melting point.
- It is also known as fusion
- Example melting point of ice is $0^{o}C$ (273 K).

CHANGE OF STATE OF MATTER

1.By changing in the Temperature

ii. Boiling

- The process in which liquid convert into gas on heating is known as boiling.
- The temperature at which a solid substance starts to boil and change into a gas at atmospheric pressure is called its boiling point.
- It is also known as vaporisation.
- Example :- boiling point of water is 100°C (373 K).
  boiling point of alcohol is 78°C (373 K).

CHANGE OF STATE OF MATTER

1.By changing in the Temperature

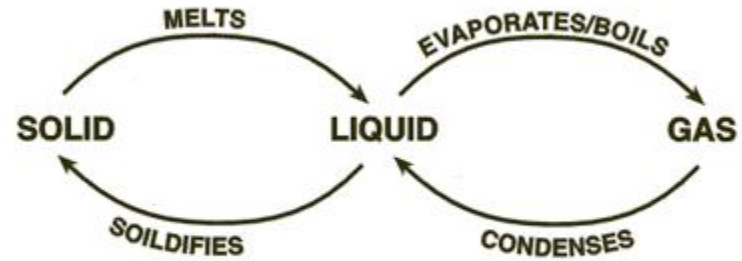
iii. Condenstion

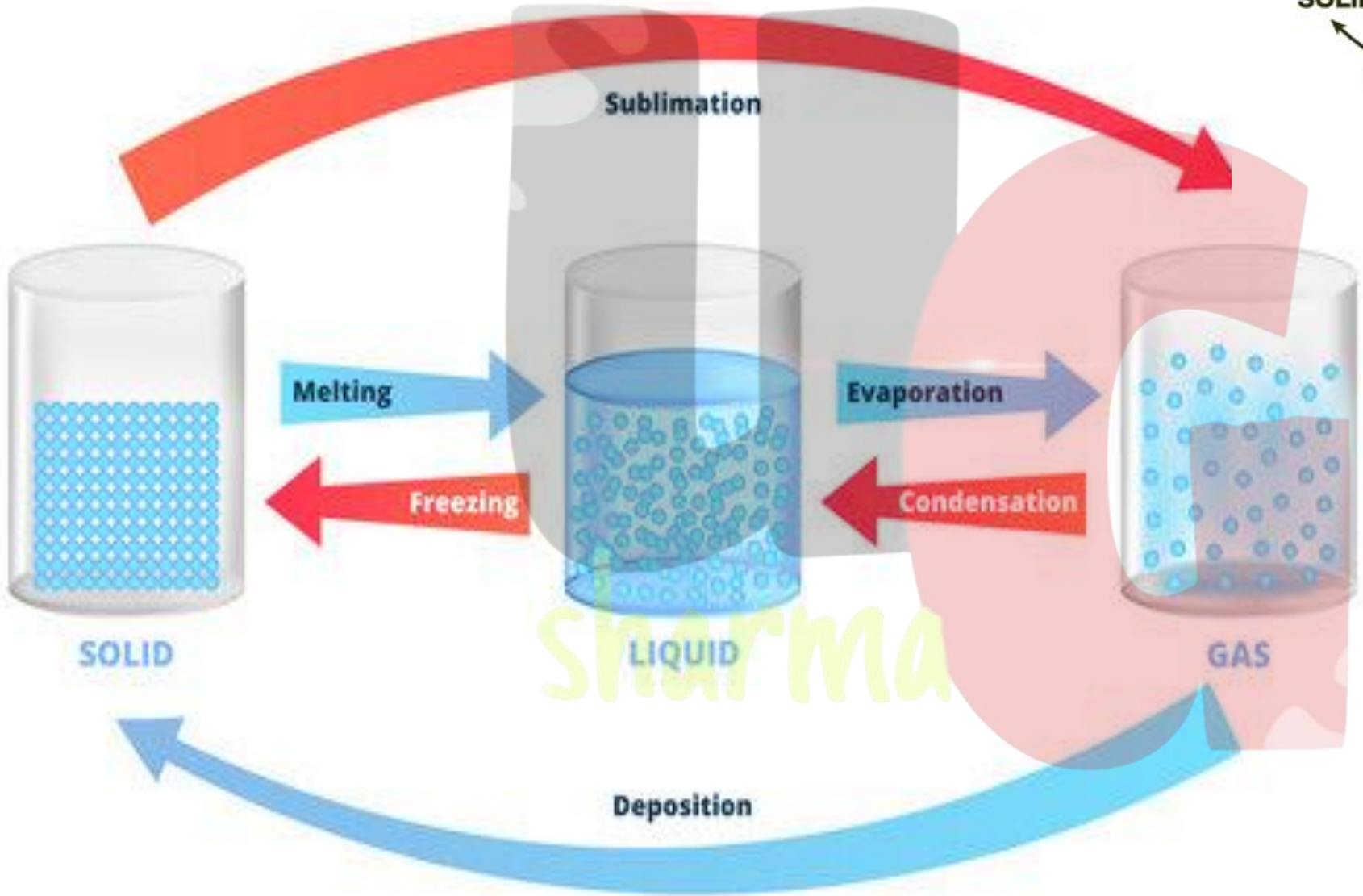
- The process of changing a gas (or vapour) into a liquid by cooling, is known as condensation.

iv. Freezing

- The process of changing a liquid into a solid by cooling is called freezing or solidification.

CHANGING STATES OF MATTER

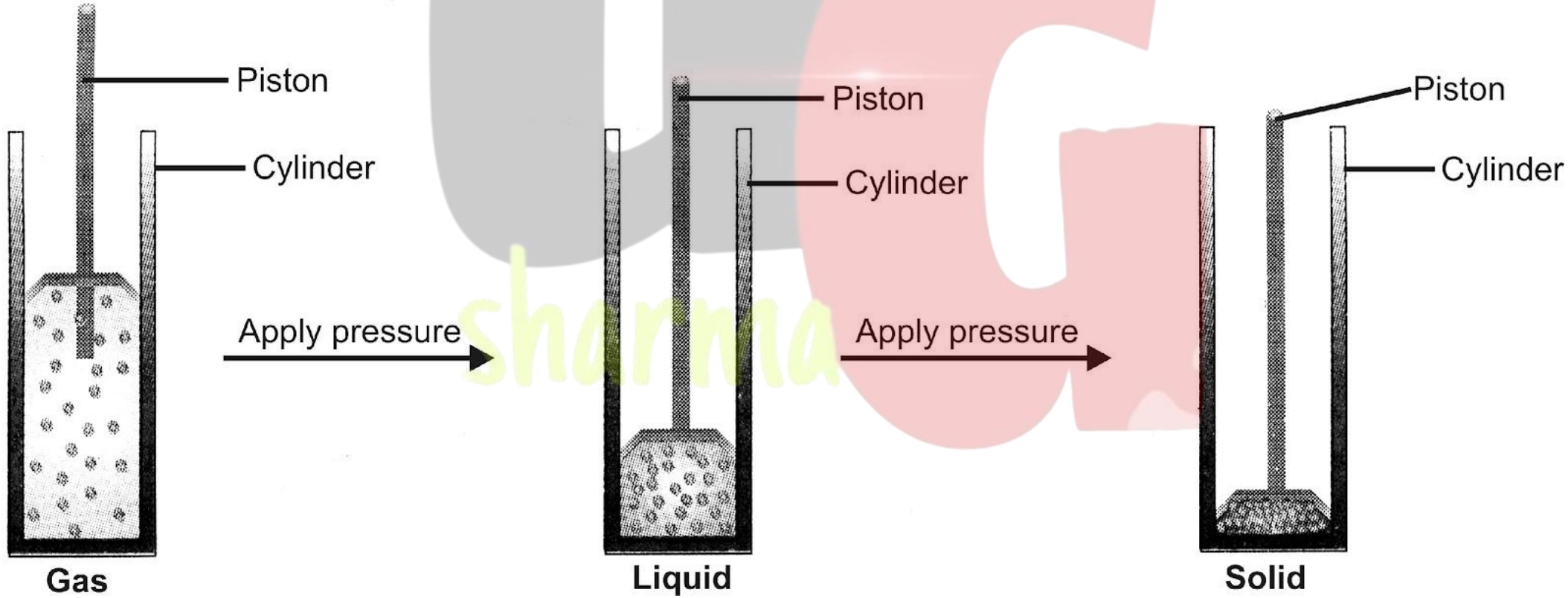




CHANGE OF STATE OF MATTER

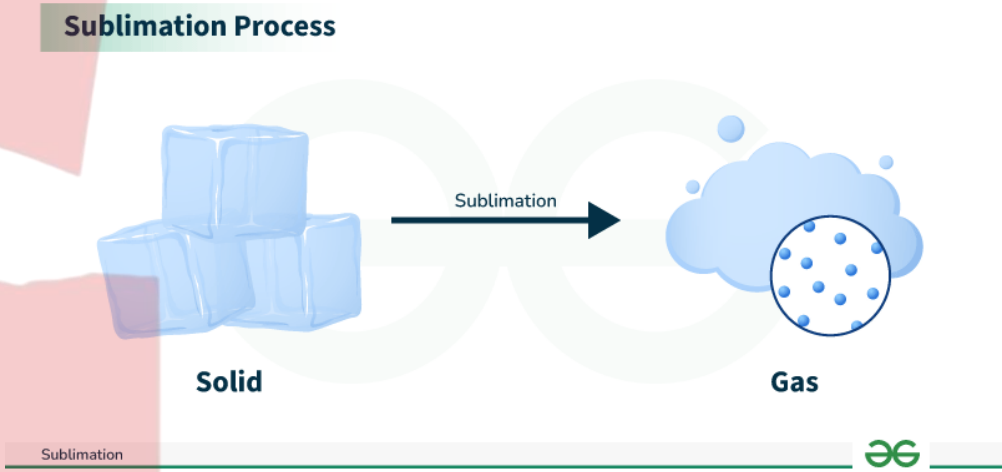
2. By changing in the Pressure

- Gases can be liquefied by applying pressure and lowering temperature,
- The applied pressure decrease the space between the particles and lowering temperature decrease kinetic energy which caused to change of gas into solid.
- Example :- solid Carbon dioxide (dry ice) liquid ammonia, LPG, etc



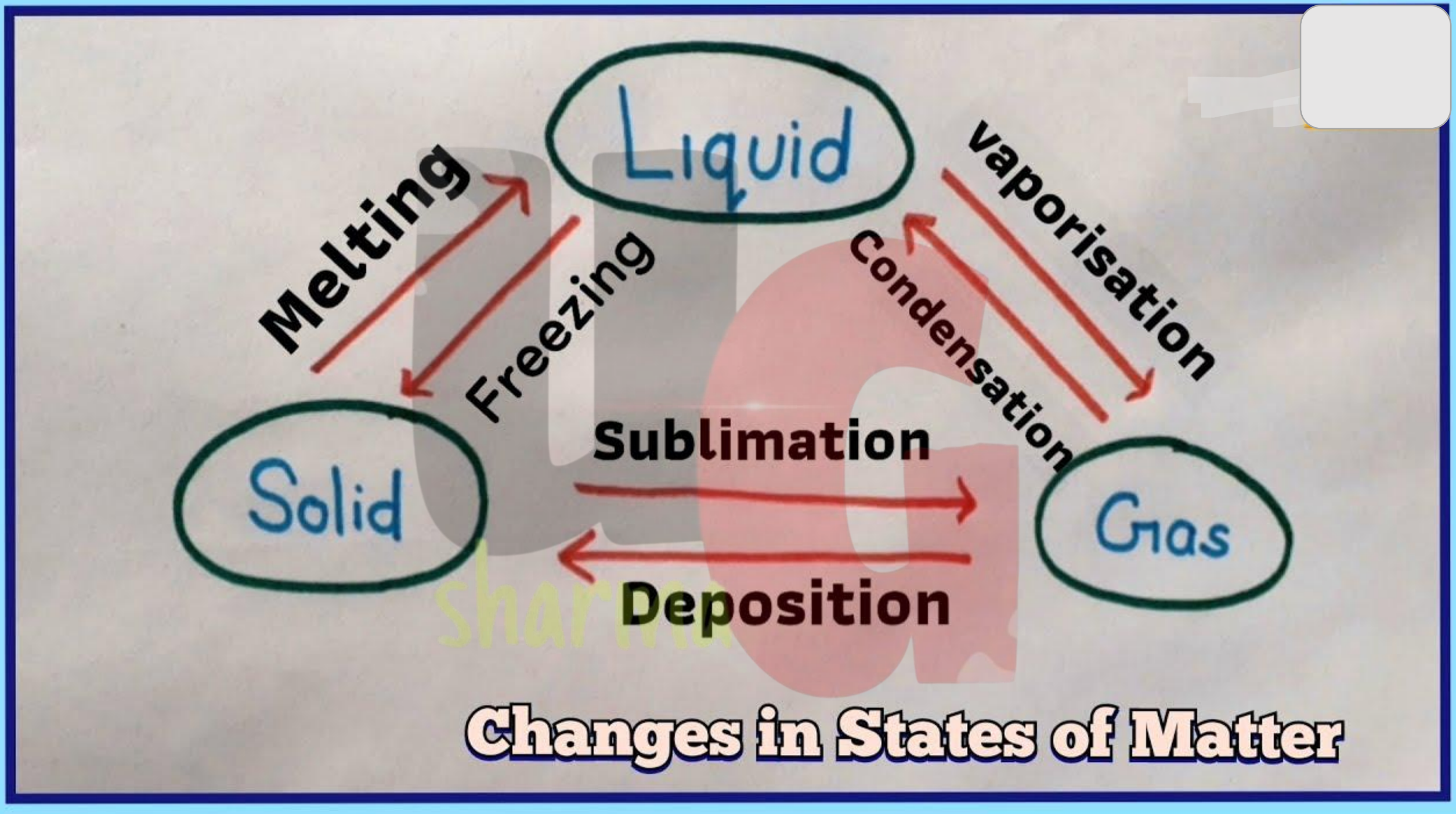
Sublimation

- The process of changing a solid directly into gas (or vapour) on heating (without coming into liquid) is known as sublimation.
- Example :- Ammonium chloride, Iodine, camphor, naphthalene, solid carbon (dry ice) and anthracene.



Deposition

- The process of changing a gas directly into solid (without going in liquid) is known as deposition.
- Example :- dry ice, formation of frost


Liquid
Melting
Freezing
vaporisation
condensation
Solid
Sublimation
Gas
Deposition
Changes in States of Matter

Latent Heat

- Latent means hidden.
- The heat energy which has to be supplied to change the state of substance is called **latent heat.**
- During fusion and vaporisation there is no any rise in temperature even we supply continuously heat, this heat energy goes to break the force of attraction between particles and increase its kinetic energy so that state can be change.

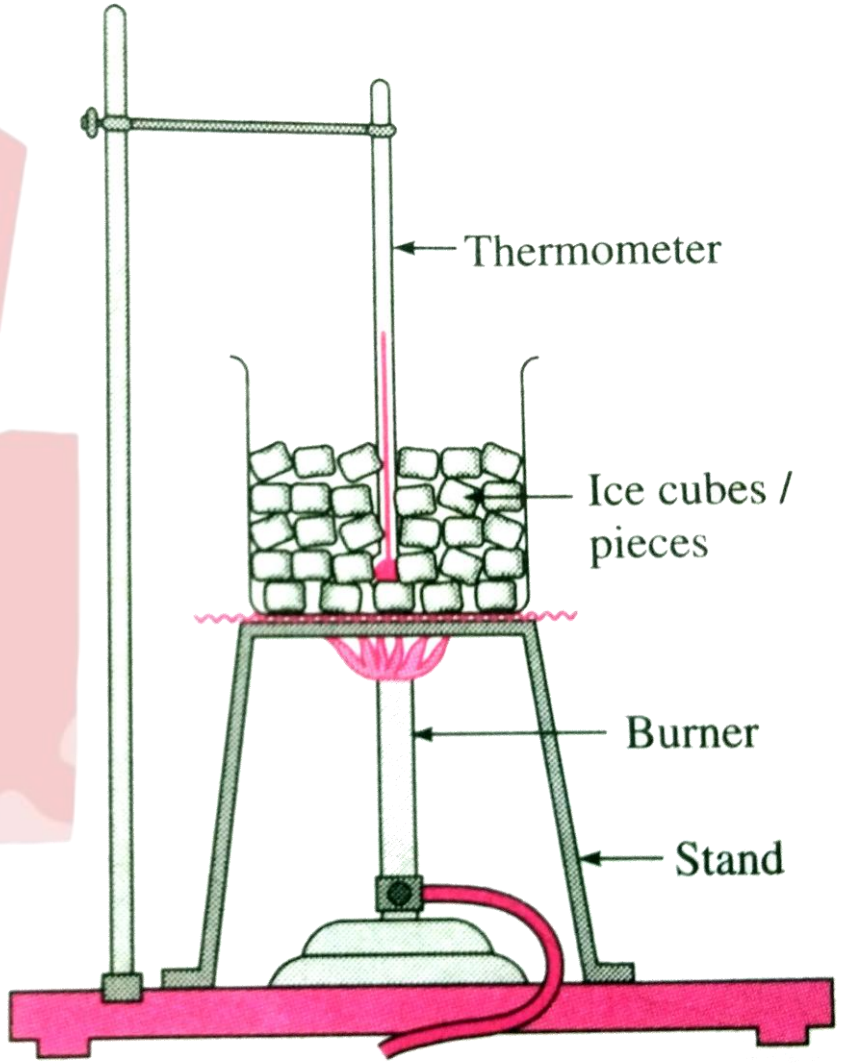
❑ There are two types of latent heat :-

1. **Latent heat of fusion :-**

The amount of heat energy that is required to change 1Kg of a solid into liquid at atmospheric pressure at its melting point is known as latent heat of fusion.

2. **Latent heat of vaporisation :-**

The amount of heat energy that is required to change 1Kg of liquid into gas (or vapour) at atmospheric pressure at its boiling point is known as latent heat of vaporisation.



Latent Heat

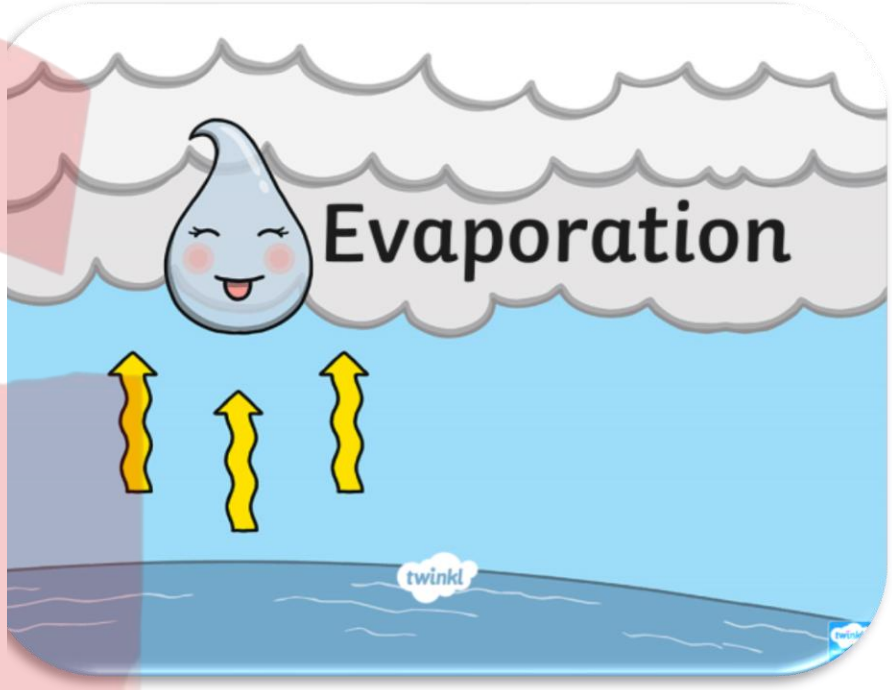
- Particles in a steam and liquid have more energy than particles in liquid and solid even their temperature is same because they contain an extra hidden form of energy i.e latent heat.
- State of matter i.e solid, liquid and gas are determined by temperature and pressure.

Evaporation

- A surface phenomena in which liquid change into vapours at any temperature below its boiling point is called Evaporation.

- Differences between evaporation and boiling

Evaporation	Boiling
Occurs at any temperature	Occurs at a definite temperature — the boiling point
Occurs at surface	Occurs within liquid
No bubbles formed	Bubbles appear

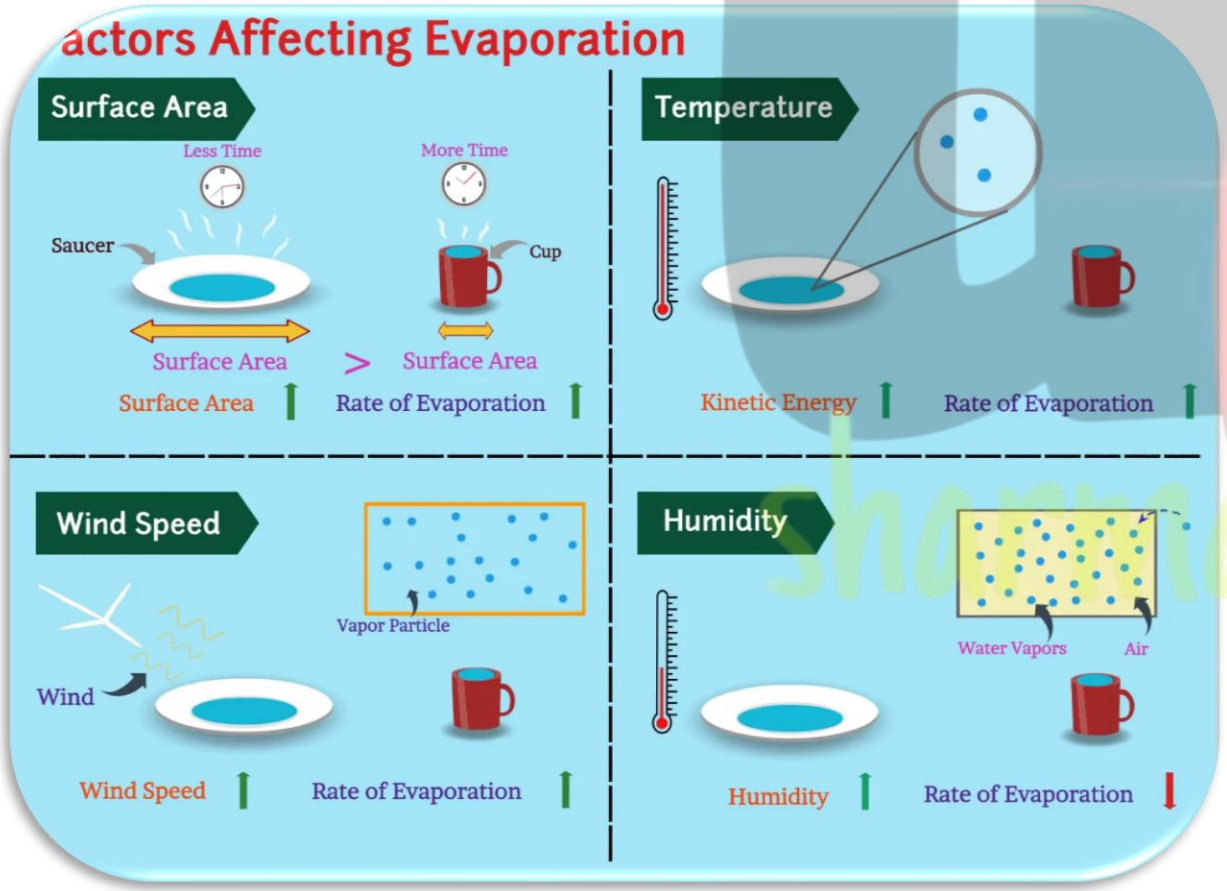


- Evaporation and boiling require latent heat of vaporization.

Factors affecting evaporation

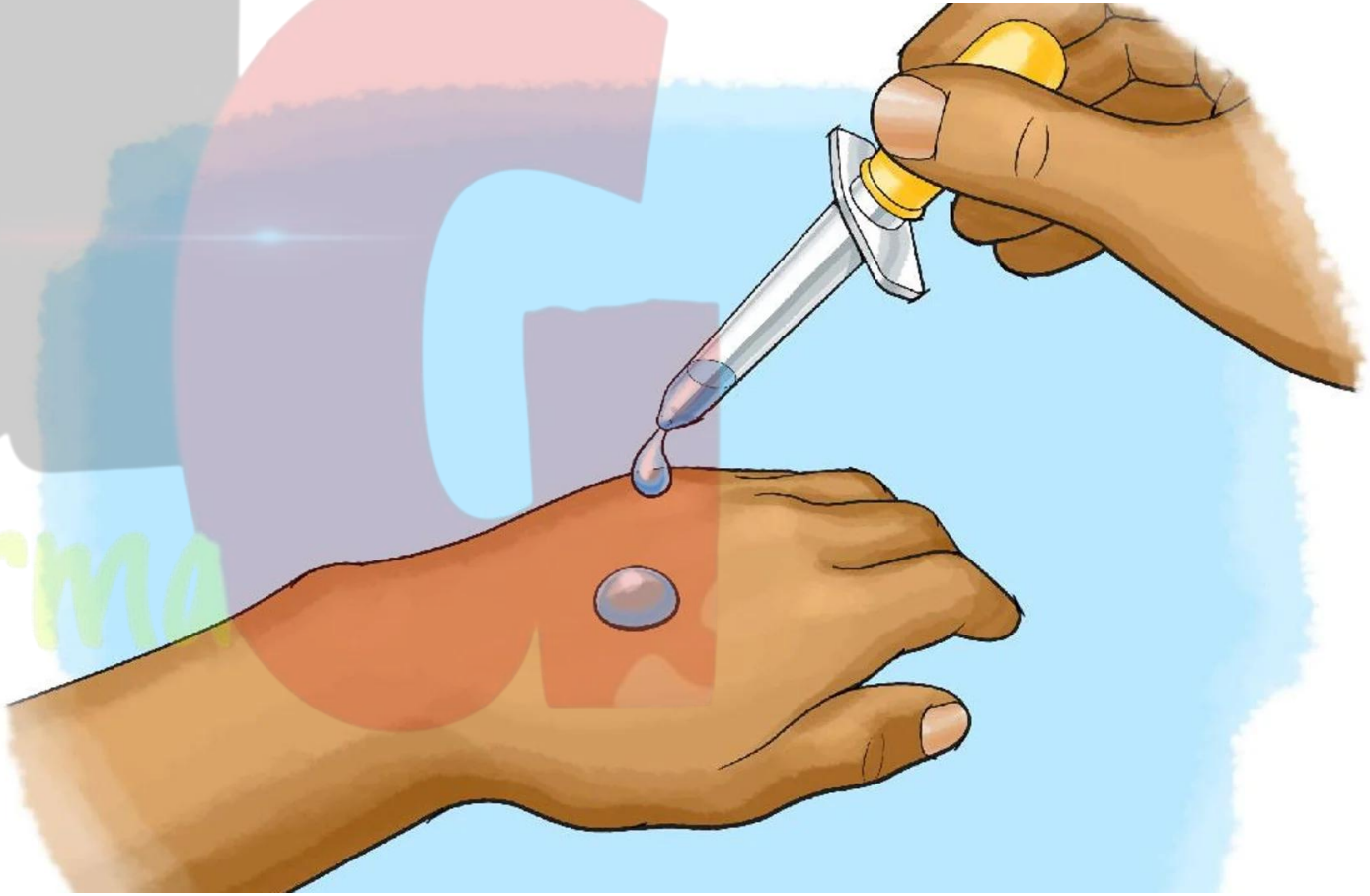
The rate of evaporation depends on :-

1. Surface area
2. Temperature
3. Humidity
4. Speed of air (wind)



How does evaporation cause cooling ?

The cooling caused by evaporation is based on the fact that when a liquid evaporate it takes latent heat of vaporisation from surrounding which on losing heat get cooled.



1. Why should we wear cotton clothes in summer ?
2. Why do we see water droplet on the outer surface of glass containing ice cold?

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