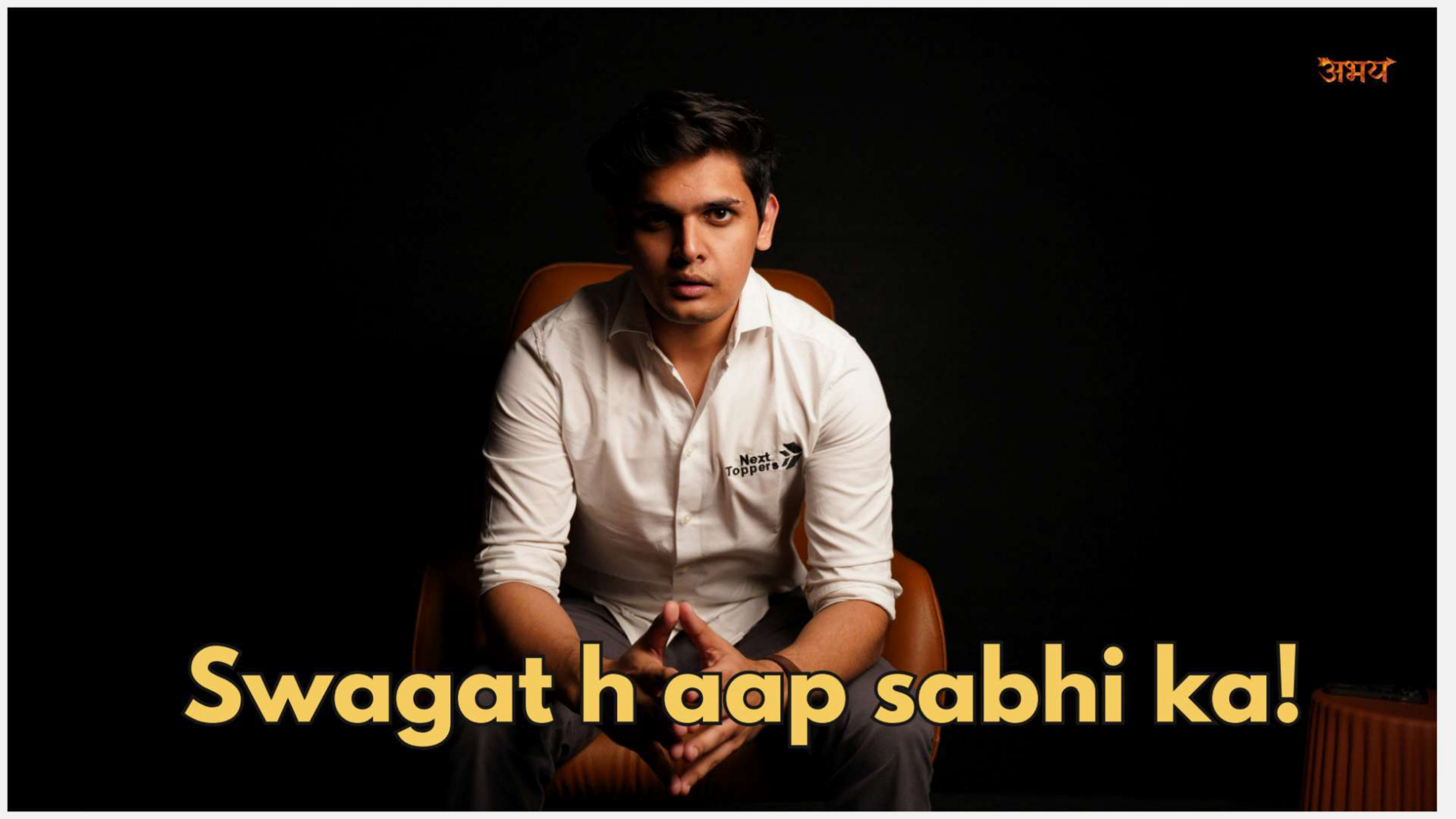
अभय

CLASS IX - SCIENCE

MATTER IN OUR SURROUNDINGS

PRASHANT KIRAD


अभय
Next Toppers
Swagat h aap sabhi ka!

PK HITS🔥

अभय

- Conversion of Temperature
- Diffusion
- Evaporation (Factors)

NYQ

APL

अभय

TOPICS TO BE COVERED

- Introduction to Matter
- Physical Nature of Matter
- Characteristics of Particles of Matter
- States of Matter
- Can Matter Change its State?
- Evaporation

अभय

MATTER

Matter is anything that has mass and occupies space.

Everything around us is made up of matter.

e.g. Air, water, rocks, living organisms, etc.

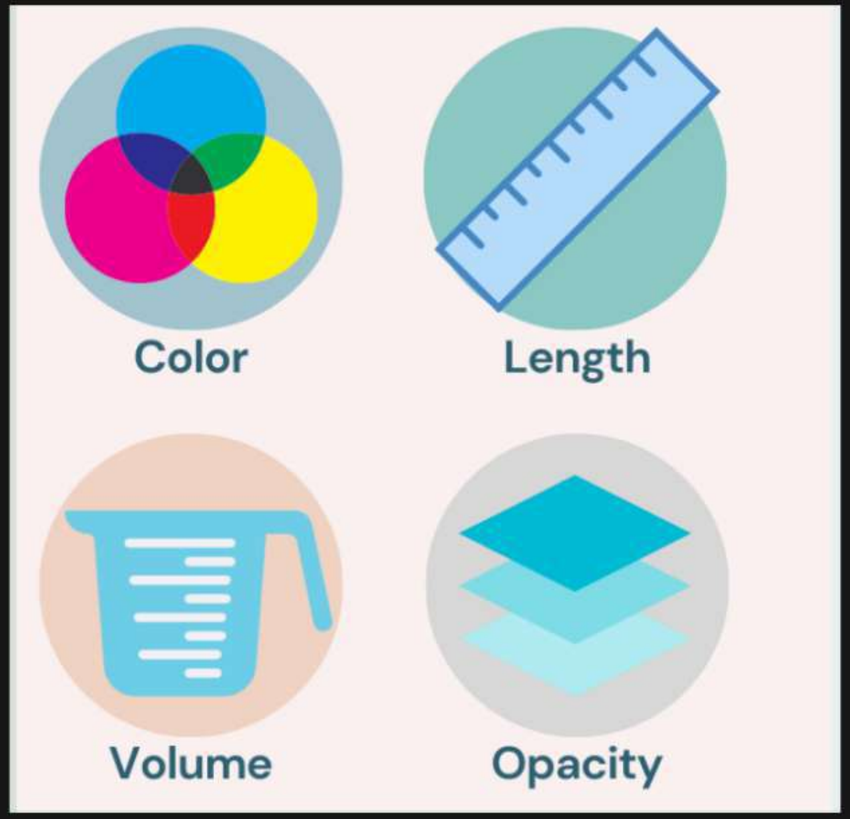
matter

matter

अभय

MATTER CAN BE CLASSIFIED BASED ON THEIR:

PHYSICAL PROPERTIES



CHEMICAL PROPERTIES

PHYSICAL NATURE OF MATTER

अभय

Matter is made up of Particles:

Matter consists of tiny particles that are indivisible and too small to be seen with the naked eye. These tiny particles are called atoms.

Dissolving salt in water demonstrates that particles of salt or sugar occupy the spaces between water particles, and hence matter consists of particles.

अभय

CHARACTERISTICS OF PARTICLE OF MATTER

- The particles of matter are very, very small.
- The particles of matter have spaces between them.
- The particles of matter are constantly moving.
- The particles of matter attract each other.

Sabse jyaada kaam ki baat!

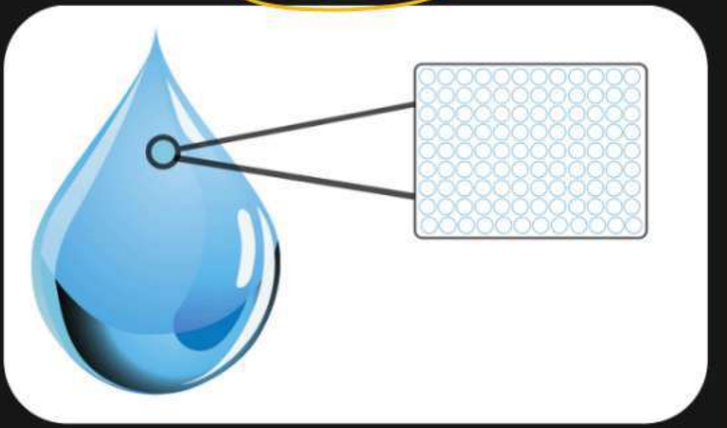
CHARACTERISTICS OF PARTICLE OF MATTER

अभय

1. How Small Are Particles?

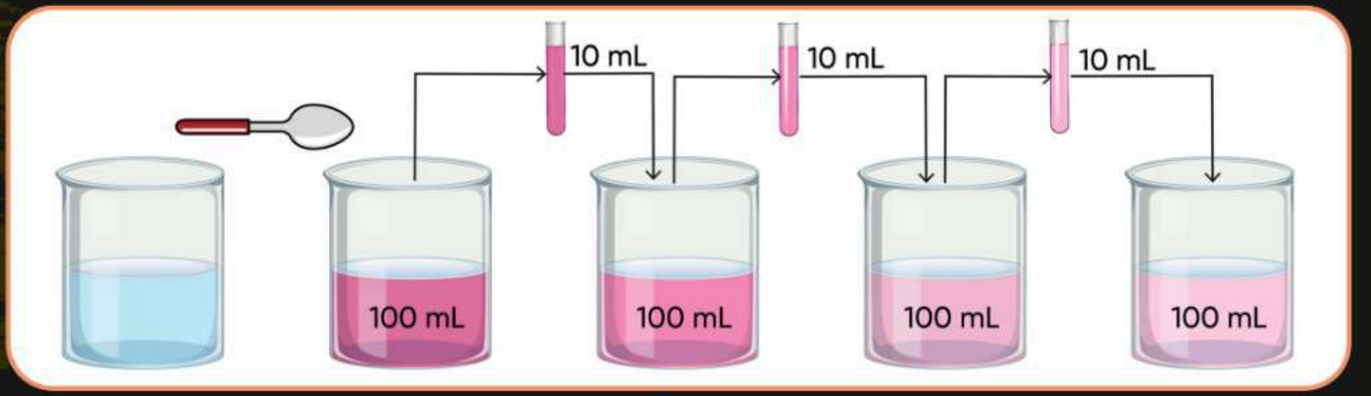
H_2O

Particles of matter are so small that they cannot be observed directly by our naked eyes but can be observed through experiments and can be seen under powerful microscopes.



$KMnO_4$

Experiment: Dissolving potassium permanganate shows even small particles are distributed in water.



90 ML

अभय

isske saath krke dekhna!!!

mummy will be like meri beti/ beta
kitne mann laga kr padh rahe h!

अभय

CHARACTERISTICS OF PARTICLES OF MATTER

2. Space Between Particles:

Particles of matter have spaces between them, which **allow them to move and interact** with each other.

Example: When we make tea, coffee or lemonade (nimbupaani), particles of one type of matter get into the spaces between particles of the other. This shows that there is enough space between particles of matter.

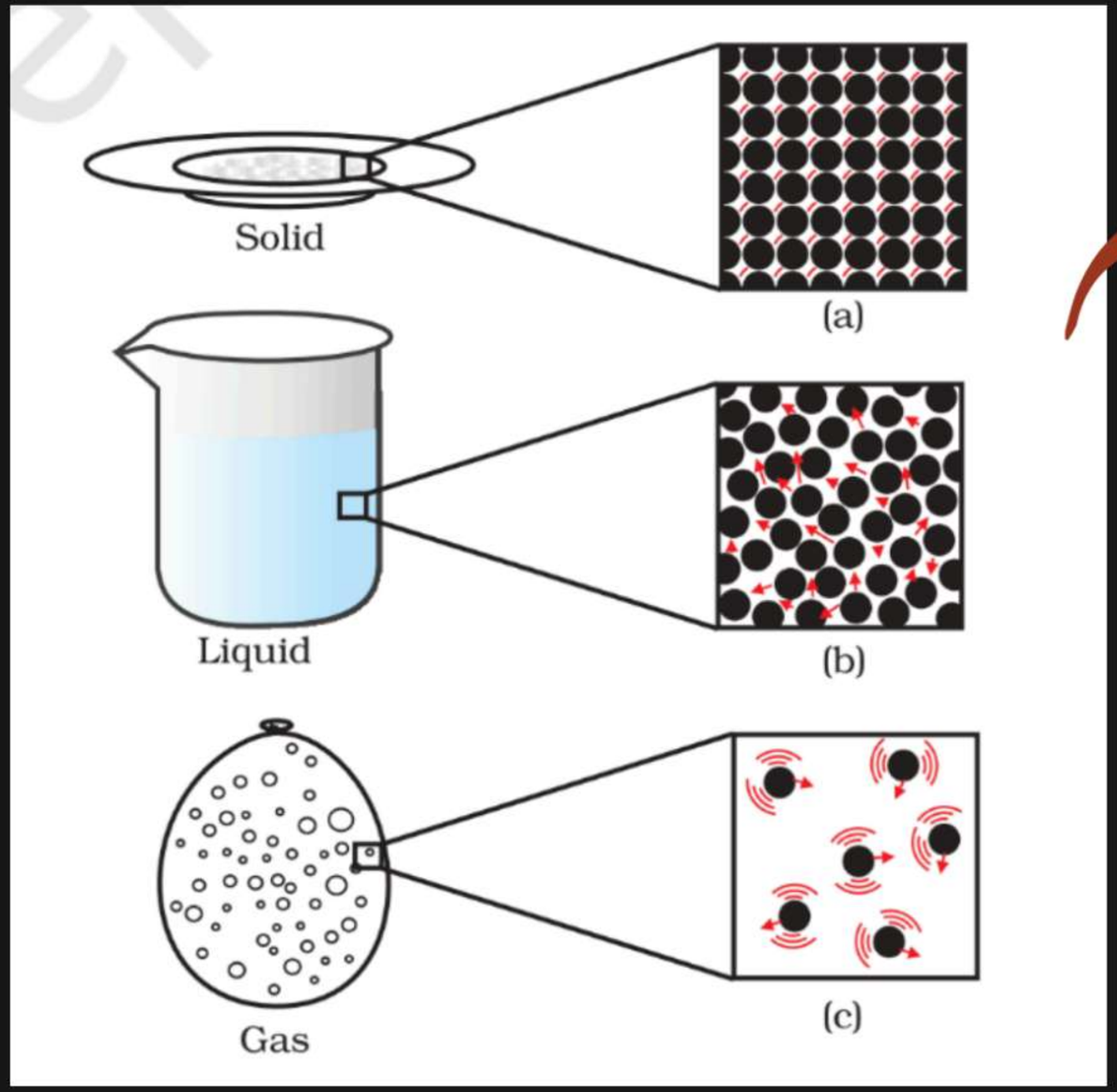
अभय

CHARACTERISTICS OF PARTICLES OF MATTER

3. Particles Are Continuously Moving:

Particles of matter are always in motion, exhibiting kinetic energy. This motion is more prominent in gases and less in solids.

Example: The diffusion of perfume/ incense stick in the air shows that the particles move randomly and spread out, filling the available space.



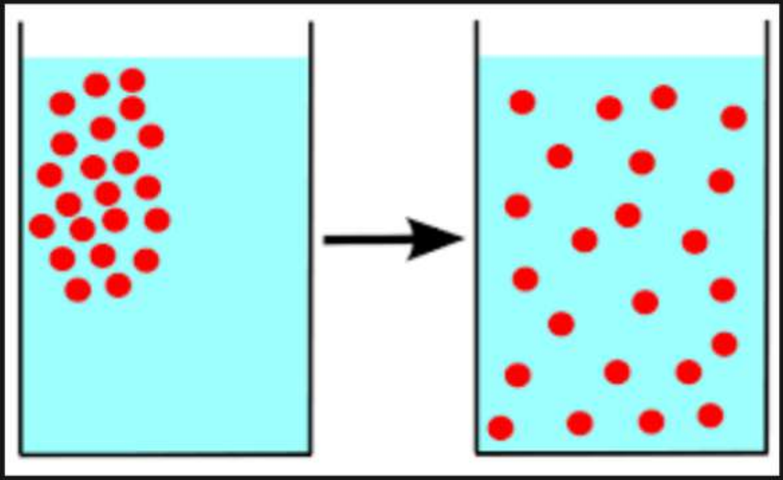
a, b and c show the magnified schematic pictures of the three states of matter.

The motion of the particles: solids < liquids < gases.

DIFFUSION

The mixing of a substance with another substance due to the motion or movement of its particles is called diffusion.

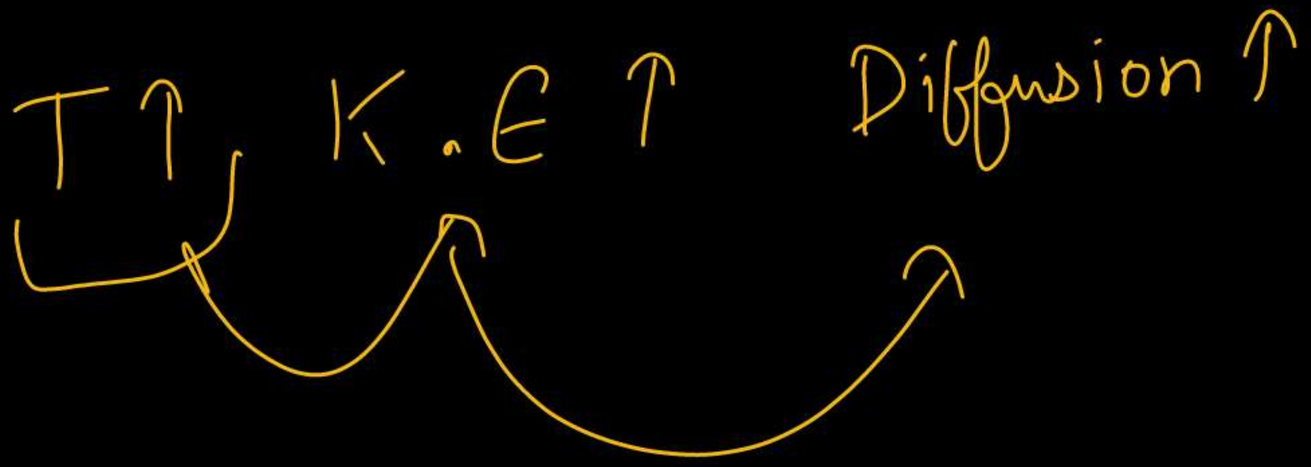
Diffusion happens in solids, liquids, and gases, but it is most noticeable in gases because the particles are more spread out and have higher kinetic energy.



Garam Khana → Smell

Thanda → ?

[Kinetic Energy]


T ↑
K.E ↑
Diffusion ↑

अभय

DIFFUSION EXAMPLES:

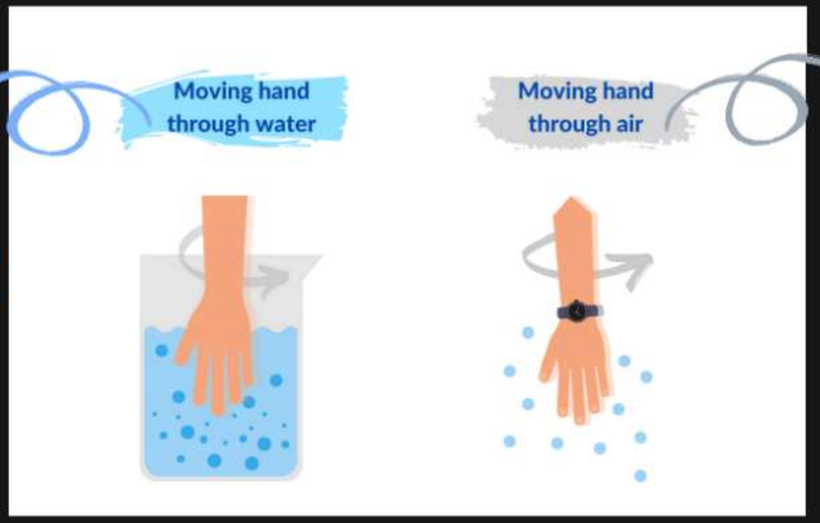
1. **Perfume or Incense Stick:** Fragrance spreads through the air by diffusion.
2. **Sugar in Water:** Sugar dissolves evenly in water due to diffusion.
3. **Ink in Water:** Ink spreads uniformly in water by diffusion.
4. **Oxygen in Blood:** Oxygen diffuses from lungs to blood; CO_2 diffuses out.
5. **Exchange of Gases in Plants:** CO_2 and O_2 diffuse in and out during photosynthesis and respiration.
6. **Tea in Hot Water:** Tea particles diffuse flavor and color into hot water.

CHARACTERISTICS OF PARTICLES OF MATTER

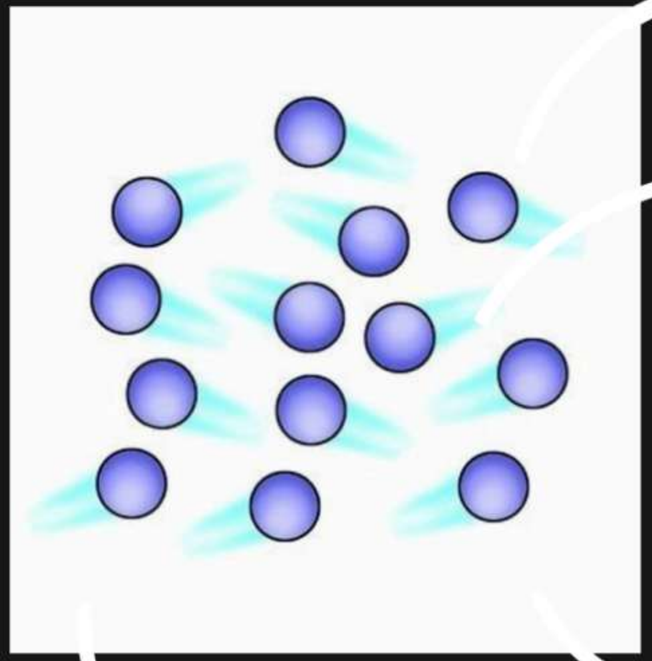
4. Particles Of Matter Attract Each Other:

Particles of matter attract each other with varying strength. The force of attraction is strongest in solids, weaker in liquids, and weakest in gases.

Example: We can move our hand through the air very easily but it is a little difficult in water, But is impossible to do so over solid substance like wood.



RECAP



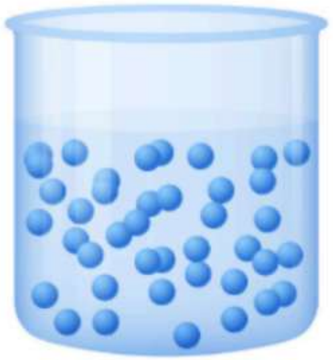
- PARTICLES OF MATTER ARE VERY SMALL
- PARTICLES OF MATTER ARE IN CONSTANT MOTION
- PARTICLES OF MATTER ATTRACT EACH OTHER
- PARTICLES OF MATTER HAVE SPACE BETWEEN THEM


Particles of matter be like:
Jalwa Hai Hamara Yahan

SOLID

- Rigid
- Fixed Shape
- Fixed Volume
- Cannot be squashed

LIQUID



- Not Rigid
- No Fixed Shape
- Fixed Volume
- Cannot be squashed

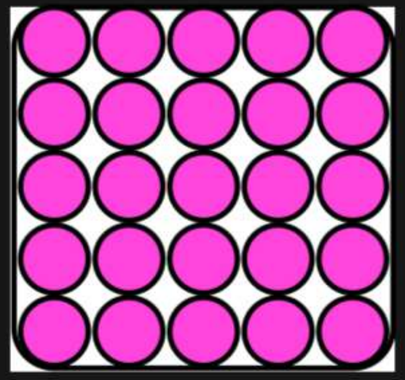
GAS

- Not Rigid
- No Fixed Shape
- No Fixed Volume
- Can be squashed

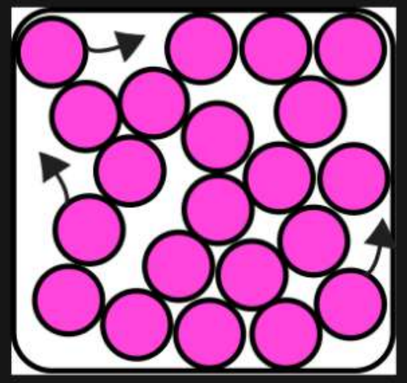
अभय

STATES OF MATTER

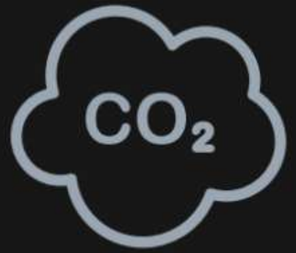
Solid

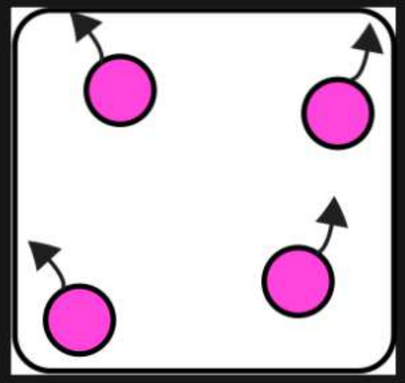


Liquid



Gas





Q. Why is a rubber band still considered a solid even though it can change its shape?

A rubber band is considered a solid because it has a definite shape and volume under normal conditions. It only changes shape temporarily when a force is applied and returns to its original shape when the force is removed.

Q. Why are substances like salt and sugar considered solids despite not having a fixed shape?

Salt and sugar are solids because each particle has a fixed shape and volume. When poured, the particles move collectively, but their individual solid nature remains unchanged.

Q. Why is a sponge considered a solid even though it can be compressed?

A sponge is considered a solid because its structure is rigid. It can be compressed due to the air trapped in its pores, which escapes under pressure, but the material itself remains solid.

FOA

अभय

Property	Solids	Liquids	Gases
Shape	Definite shape	Takes the shape of the container	No definite shape, fills the container completely
Volume	Definite	Definite	Indefinite
Compressibility	Negligible	Very slight	Highly compressible
Particle Arrangement	Tightly packed in a fixed arrangement	Loosely packed, particles can slide past each other	Very loosely packed, particles move randomly
Interparticle Space	Minimum	Moderate	Maximum
Interparticle Forces	Strongest	Moderate	Weakest
Kinetic Energy	Lowest	Moderate	Highest
Diffusion	Very slow	Faster than solids	Fastest
Examples	Ice, wood, iron	Water, milk, oil	Oxygen, nitrogen, carbon dioxide

Unconventional States of Matter

अभय

PLASMA

ions

Plasma is a state of matter where atoms are ionized, meaning they lose electrons, resulting in a mixture of free electrons and positively charged ions.

It is electrically conductive and responds strongly to electromagnetic fields.

↳ High Energy

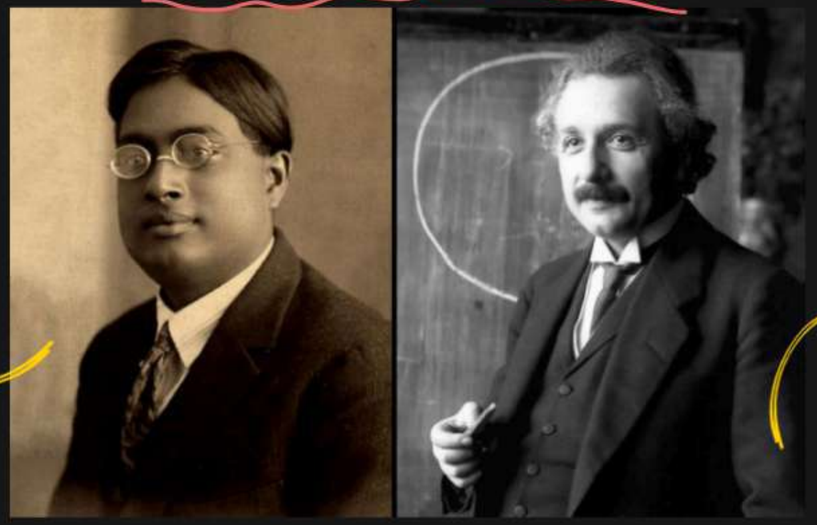
BOSE-EINSTEIN CONDENSATE

अभय

Indian physicist Satyendra Nath Bose made a study regarding the fifth state of matter. Based on his study, Albert Einstein predicted a fifth stateof matter called the ***Bose-Einstein Condensate.***

The Bose-Einstein Condensate or BEC is formed by cooling a gas of extremely low density to super low temperatures.

Satyendra Nath Bose



Albert Einstein

Solid, Liquid and Gas after knowing about BSE

अभय

Can matter change its state?

Yes, matter can change its state under different conditions such as temperature and pressure.

CHINTU

IMPORTANT CONVERSIONS IN TEMPERATURE

SI Unit of Temperature: Kelvin (K) is the SI unit.

Other units of Temperature: Celsius (°C) and Fahrenheit (°F)

Temperature Conversions:

1. **Celsius to Kelvin:**

   $K = C + 273$

2. **Kelvin to Celsius:**

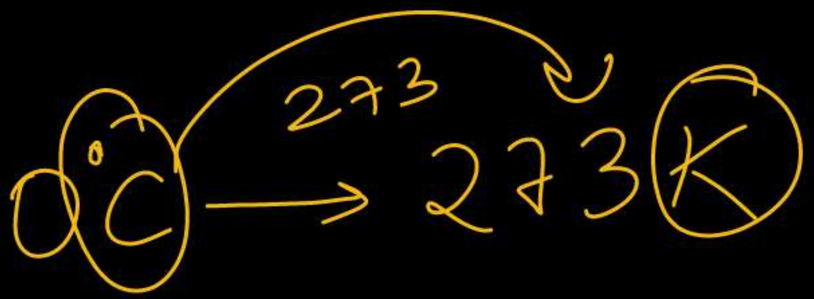
   $C = K - 273$

Quick Reference

0°C = 273 K

25°C = 298 K

100°C = 373 K



373 K - 273 K = 100 °C

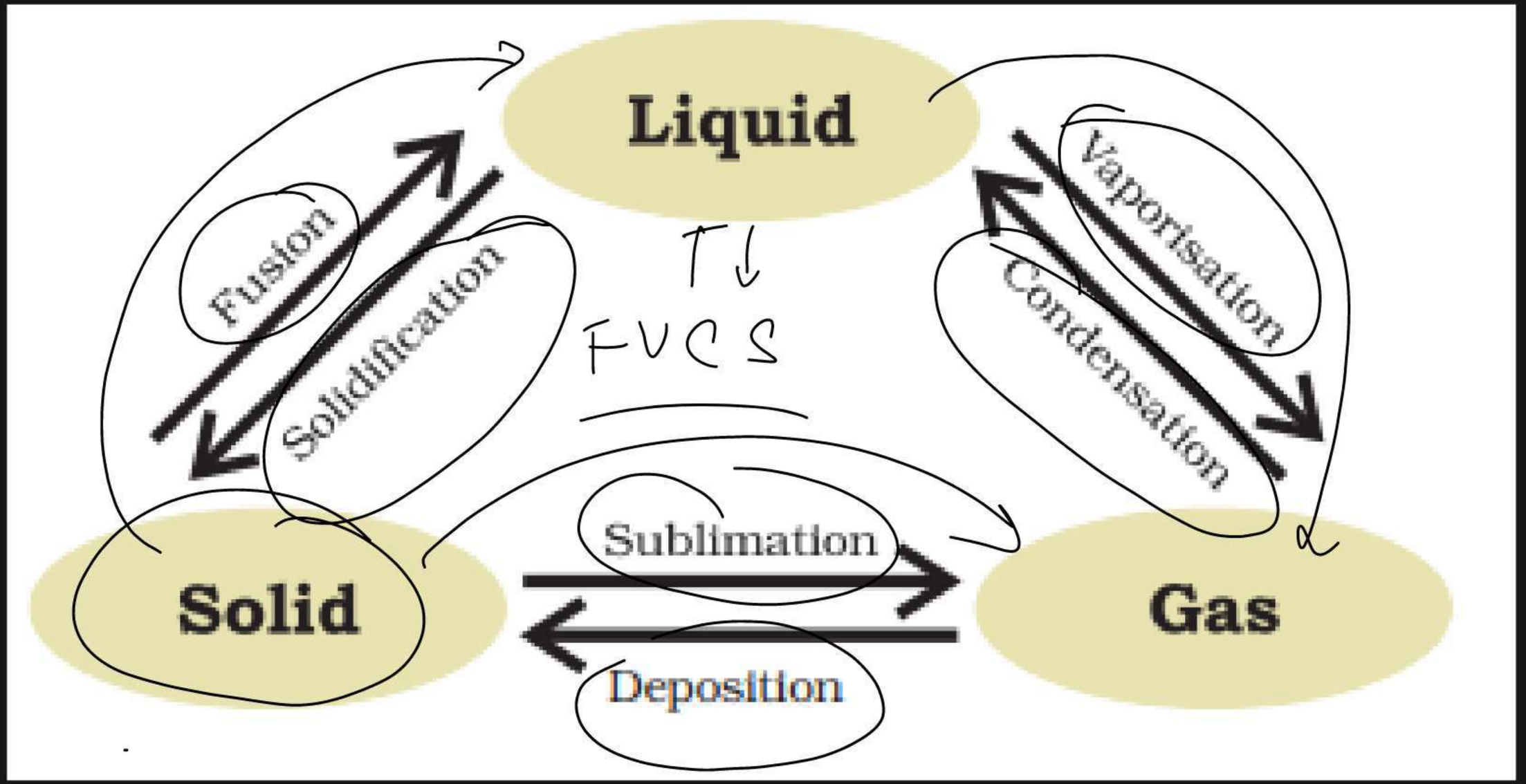
52 K - 273 = −221 °C

अभय

EFFECTS OF INCREASING TEMPERATURE ON MATTER

On increasing the temperature, the kinetic energy of the particles of the matter increases, and they begin to vibrate with higher energy. Therefore, the interparticle force of attraction between the particles reduces, and particles get detached from their position and begin to move freely.

- As a result, the state of matter begins to change.
- Solids undergo a phase change to form liquids.
- Similarly, liquids also undergo a phase change to form gases.


Liquid
Fusion
Solidification
Vaporisation
Condensation
T↓
FVCS
Sublimation
Solid
Gas
Deposition

Melting Point:

- The melting point is the temperature at which a solid changes into a liquid at atmospheric pressure by absorbing heat.

Example: If you took out the ice cubes from the freezer and placed them in a warm room, the ice would absorb energy from the warmer air around them.

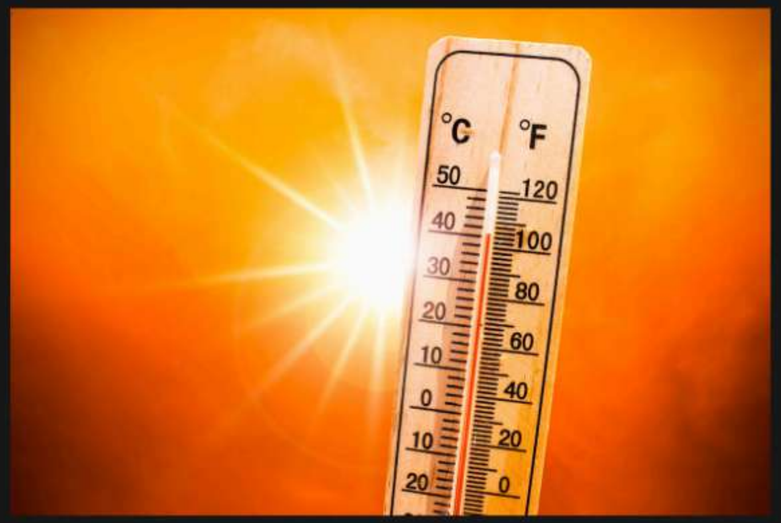
The Melting Point of Ice is 273.15 K (Kelvin) or 0 Degree Celsius

अभय

Latent Heat:

Hidden

Latent heat is the amount of heat energy absorbed or released by a substance during a change of state (solid to liquid, liquid to gas, or vice versa) without a change in its temperature.



*The word **latent means hidden***

Hence latent heat means heat which is hidden in beaker and does not cause any increase in temperature

Latent Heat of Fusion

- The heat energy required to change 1 kg of a solid into a liquid at its melting point without a temperature change.
- **Example:** Melting ice into water.
- **For water:** 334 kJ/kg.

Boiling:

100°C

When water is heated, its particles gain energy and move faster.
Boiling Point: The temperature at which a liquid converts into gas at normal atmospheric pressure.
Example: Water boils at 100°C (373 K).

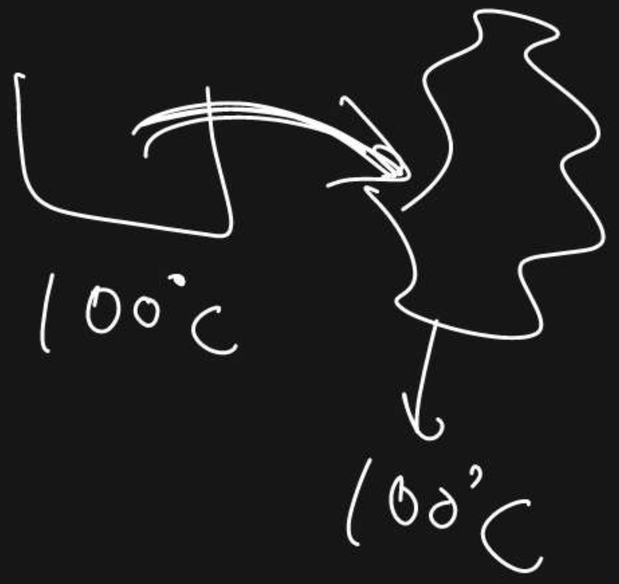
Bulk Phenomenon:

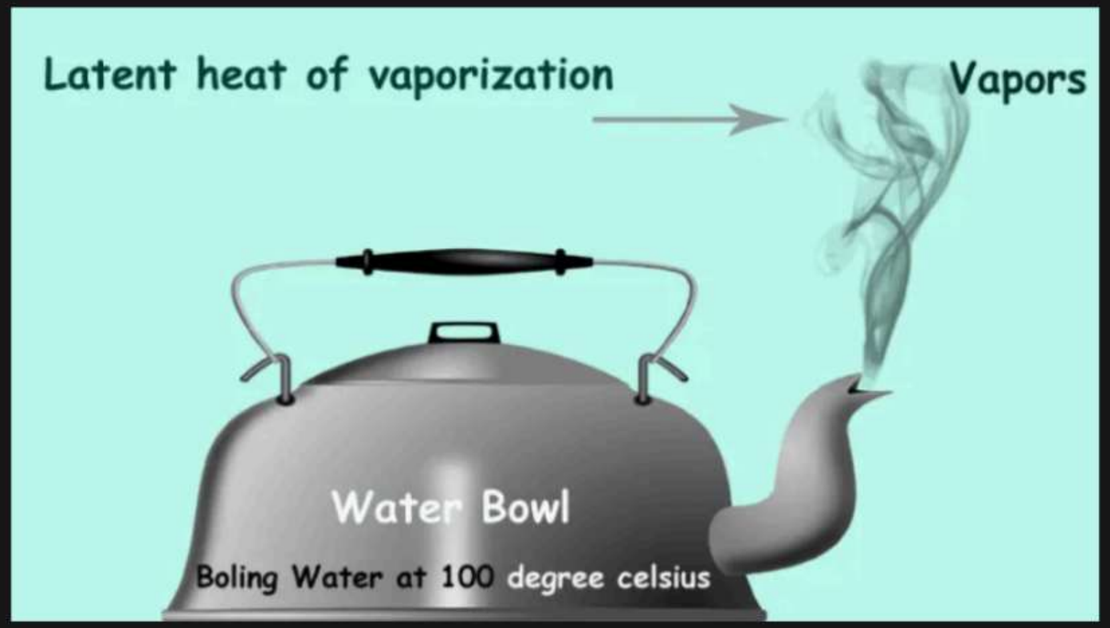
- Boiling affects all particles within the liquid, not just those at the surface.
- Heat energy from the liquid helps particles overcome attraction forces, allowing them to escape as gas.

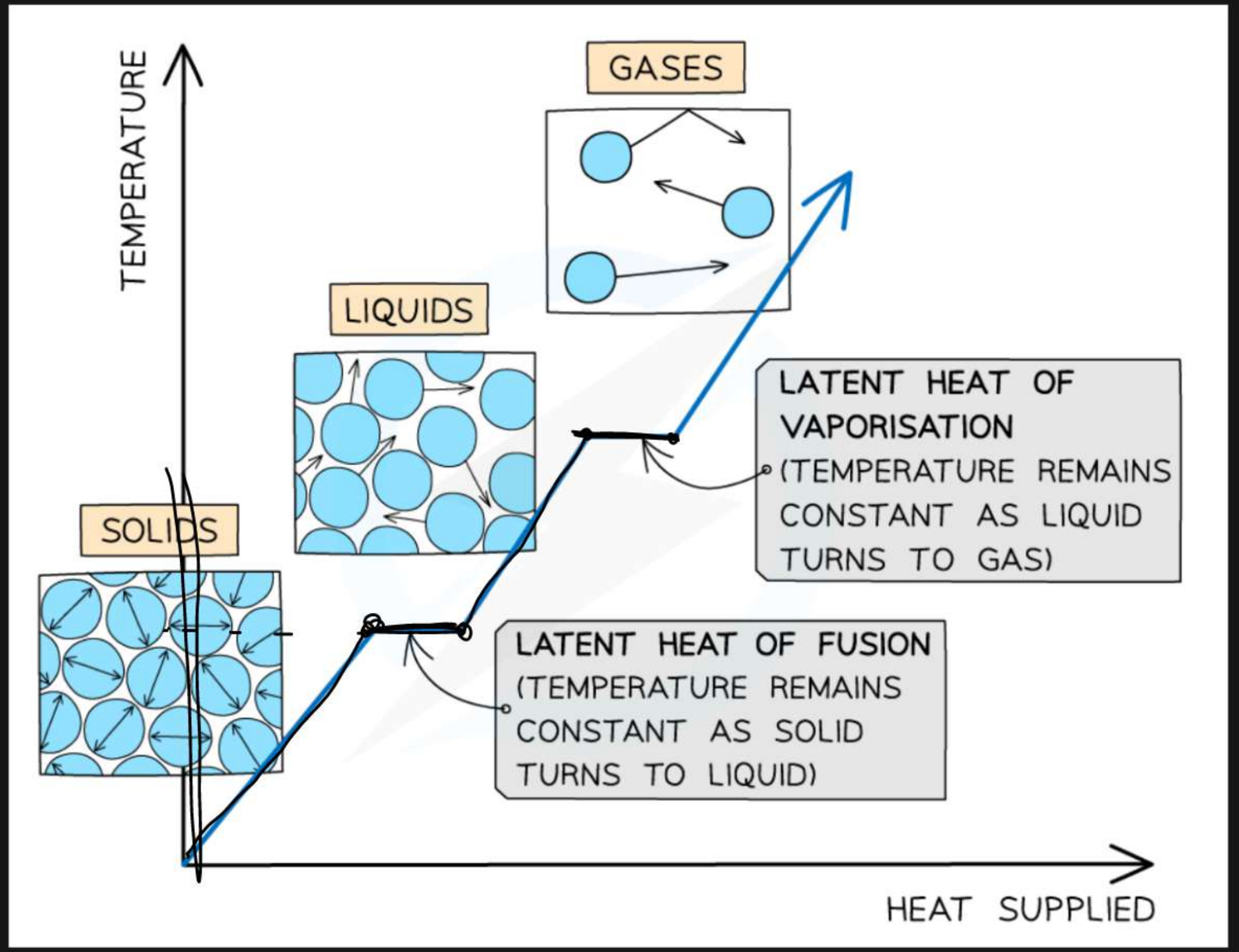
Latent Heat of Vaporization

अभय

- The heat energy required to change 1 kg of a liquid into a gas at its boiling point without a temperature change.
- **Example:** Boiling water into steam.
- **For water:** 2260 kJ/kg.






TEMPERATURE
GASES
LIQUIDS
SOLIDS
LATENT HEAT OF VAPORISATION
(TEMPERATURE REMAINS CONSTANT AS LIQUID TURNS TO GAS)
LATENT HEAT OF FUSION
(TEMPERATURE REMAINS CONSTANT AS SOLID TURNS TO LIQUID)
HEAT SUPPLIED

Sublimation

The transition of a substance directly from its **solid phase to the gaseous phase** without changing into the liquid phase is called sublimation.

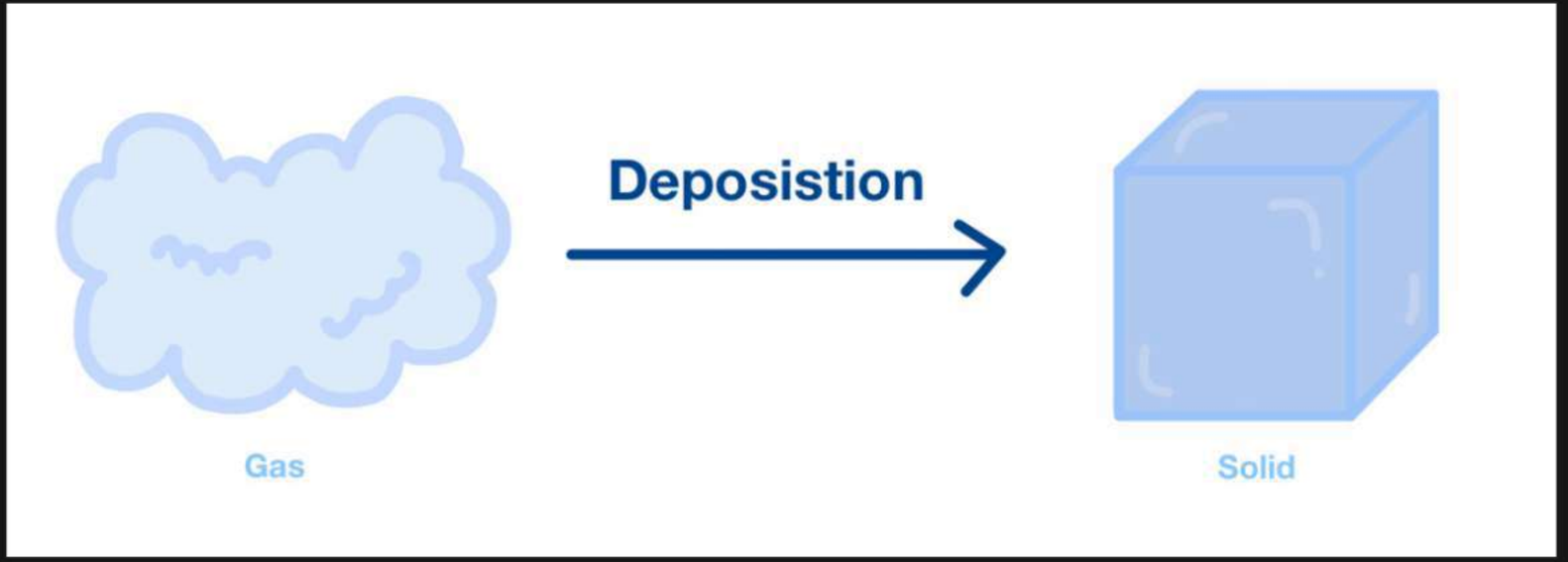
Example: Dry ice (Solid Carbon dioxide), Naphthalene balls,iodine etc.

Deposition

अभय

It means Conversion of Gas to Solid without conversion into liquid is called Deposition.

Example: In Winter, Ice accumulates on Window panes (This is because Water vapour-gas converts into ice-solid).



EFFECT OF CHANGE OF PRESSURE

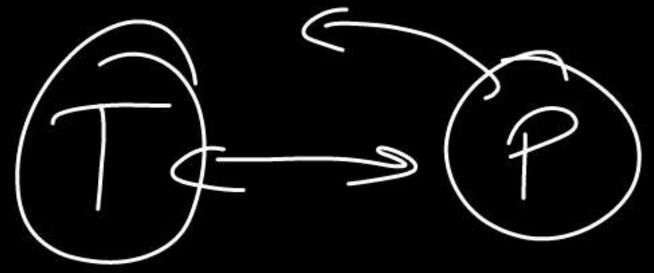
Pressure may be defined as the physical force applied to an object.

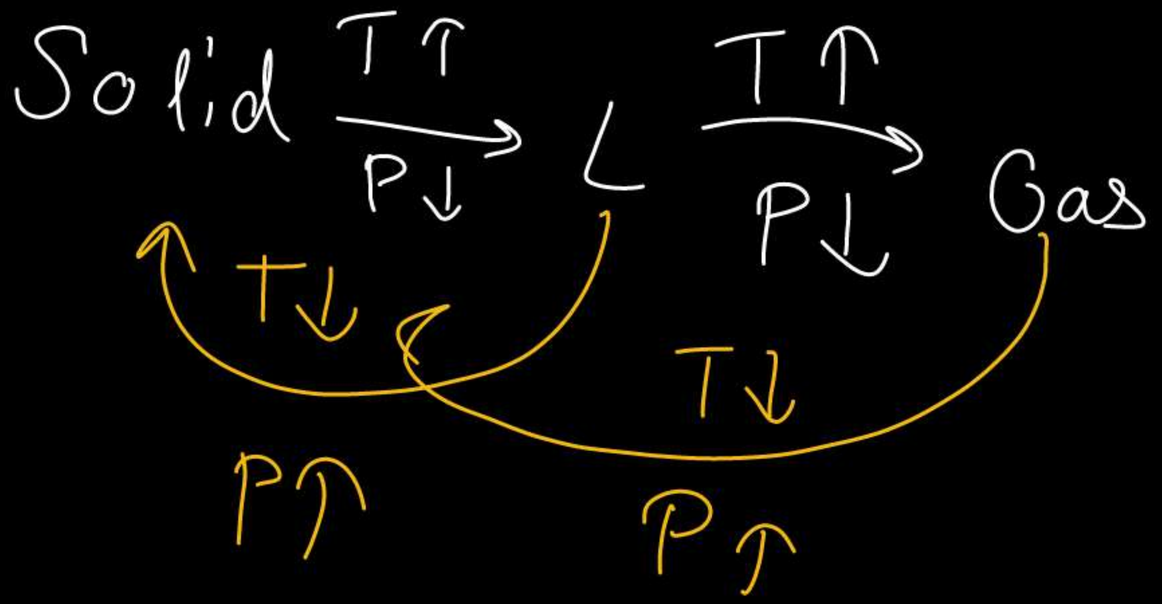
The particles of matter come closer to each other when pressure is applied.

Compressing Gases into Liquids or Solids

By increasing pressure, the particles of a gas are forced closer together, reducing the space between them. This can convert a gas into a liquid or even a solid at sufficiently low temperatures.

Example: Gases like carbon dioxide are compressed to form dry ice (solid CO_2).


T
P


Solid
T↑
P↓
L
T↑
P↓
Gas
T↓
T↓
P↑
P↑

Q → Solid ⟶ Gas T↑ P↓

(PT↓)

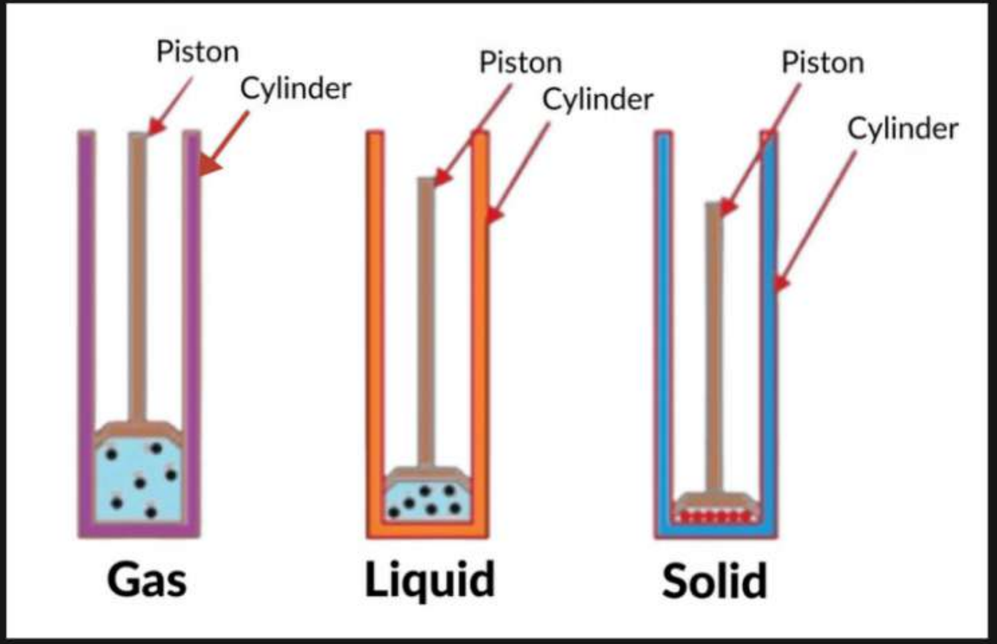
Q2 → Gas $\xrightarrow{T\downarrow\ P\uparrow}$ L

(PT↓)

Expanding Liquids or Solids into Gases

By decreasing pressure, the particles of a liquid or solid are allowed to move farther apart. This can help in converting them into gases.

Example: Water boils at a lower temperature at high altitudes because the atmospheric pressure is lower.



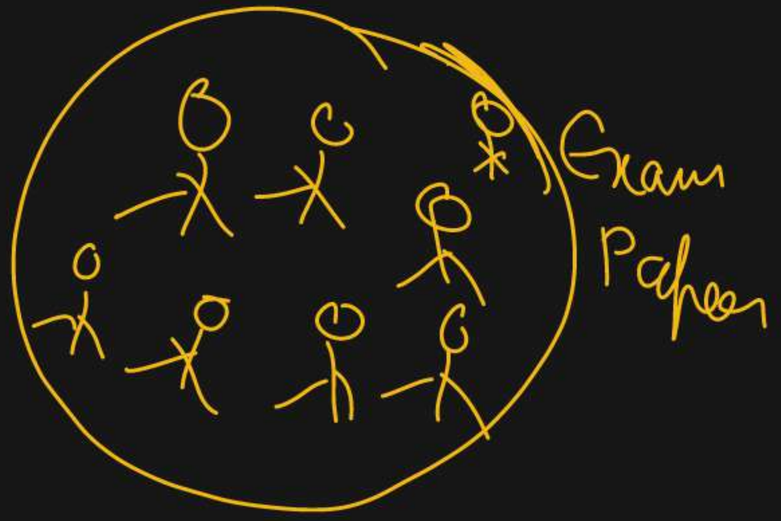

When there is a change in pressure, Matter be like:
Main toot gaya ab

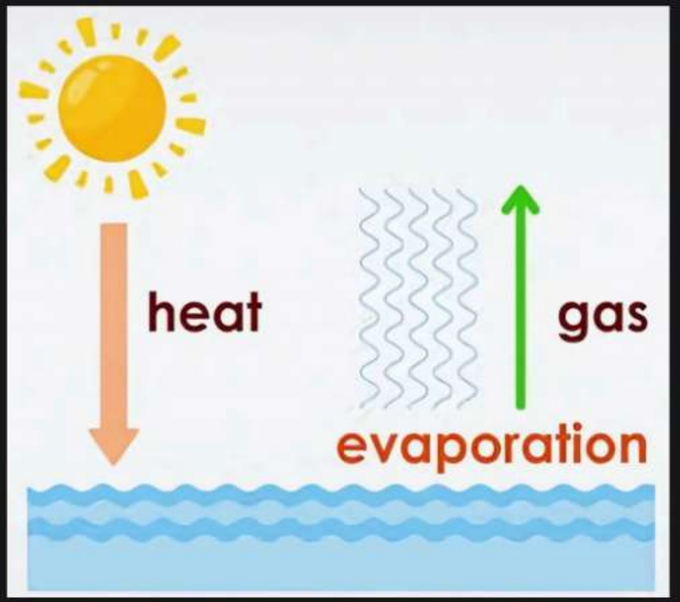
EVAPORATION

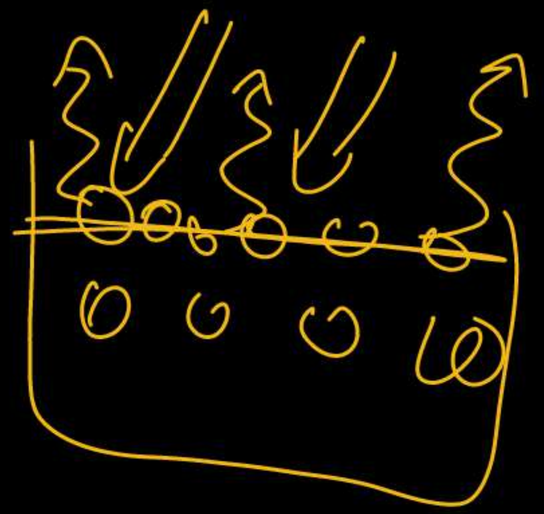
अभय

So: 100°C → 80°C
40°C

Evaporation is the process by which a liquid changes into a gas at temperatures below its boiling point. This occurs at the surface of the liquid and can happen at any temperature. It is a type of vaporization that takes place without the liquid reaching its boiling point.







Cooling of hot liquids

Hot liquids cool down by the process of evaporation

Drying Clothes

Water gets evaporated

Floor is dry after mopping

Floor dries after mopping due to evaporation

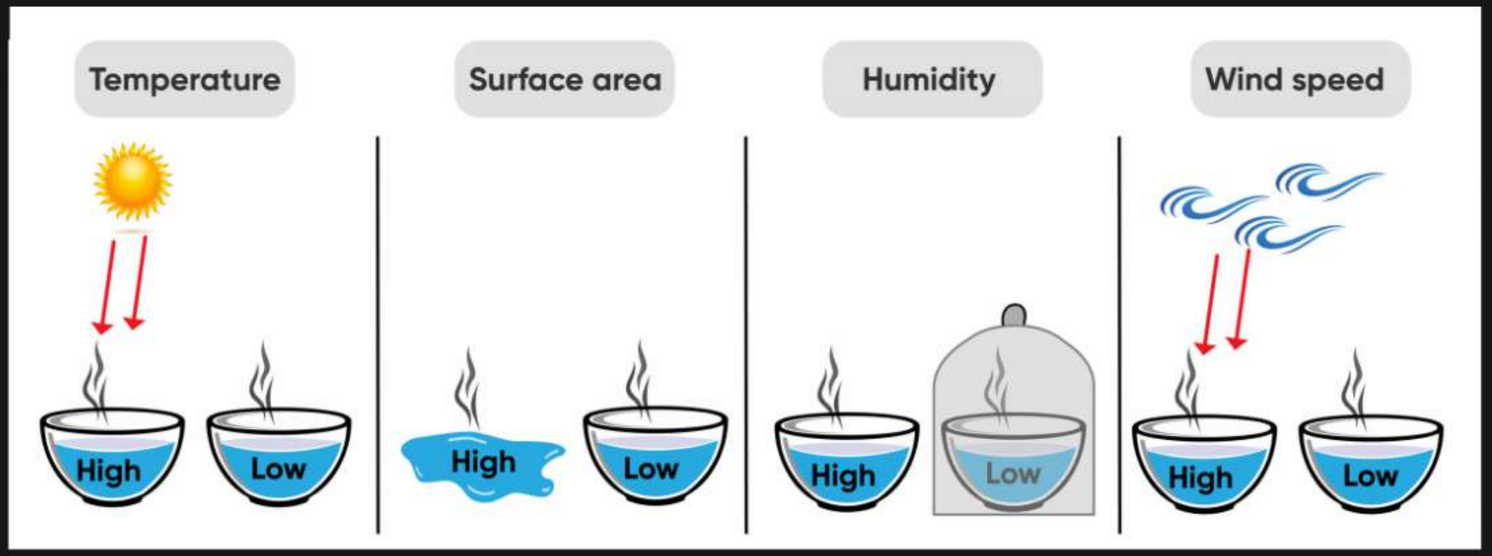
Factors Affecting Evaporation:

Temperature: As the temperature rises, the rate of evaporation becomes faster.

Surface Area: A larger surface area results in a higher rate of evaporation.

Humidity: Higher humidity reduces the rate of evaporation.

Wind Speed: Faster wind speeds lead to an increased rate of evaporation.



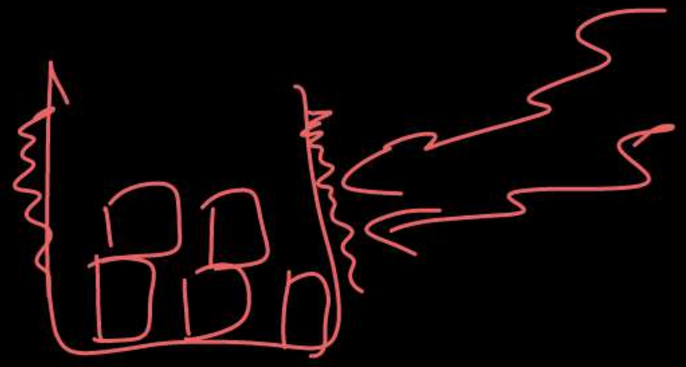
Cooling Due To Evaporation:

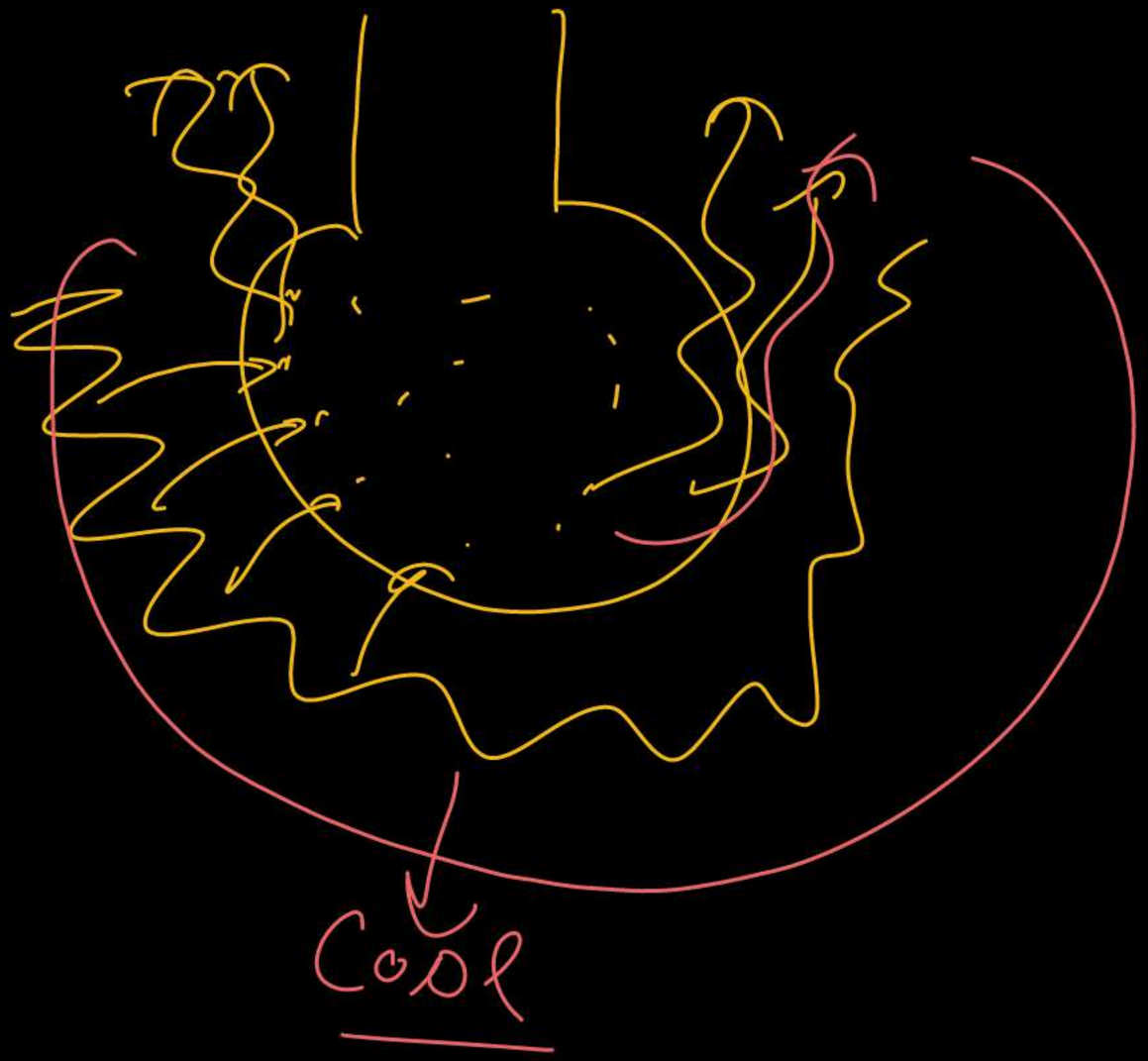
अभय

During evaporation, the particles of a liquid absorb energy from the surroundings to overcome the inter-particle forces of attraction and undergo phase change. The absorption of heat from the surrounding makes the surroundings cool.

Q. Why do evaporation and condensation cause cooling and the formation of water droplets in various situations, such as sweating, cooling in earthen pots, wearing cotton clothes, and water droplets on cold surfaces?

- Sweat evaporates, taking heat away and cooling the body.
- Water in earthen pots cools as it evaporates through the porous walls.
- Cotton clothes absorb sweat, aiding evaporation and keeping the body cool.
- Water droplets form on cold glass surfaces due to condensation of water vapor.




Cool

अभय

Evaporation	Boiling
Occurs at any temperature.	Happens only at the boiling point.
A slow and gradual phenomenon.	A fast and intense process.
Takes place only at the surface of the liquid.	Occurs throughout the entire liquid.
Results in cooling.	Does not lead to cooling.

Same matt Samajhna!


LET'S DO THIS!

Abhay Premier League

अभय

1.What is the physical state of matter in which particles have the least kinetic energy?

A) Solid
B) Liquid
C) Gas
D) Plasma

Abhay Premier League

अभय

2. Which of the following substances does not show the property of sublimation?

A) Dry ice
B) Camphor
C) Naphthalene
D) Sugar

Let's do this!

Abhay Premier League

अभय

3. The boiling points of diethyl ether, acetone and n-butyl alcohol are 35°C, 56°C and 118°C respectively. Which one of the following correctly represents their boiling points in Kelvin scale?

(a) 306 K, 329 K, 391 K

(b) 308 K, 329 K, 392 K

(c) 308 K, 329 K, 391 K

(d) 329 K, 392 K, 308 K

$35+273=308\ K$

$56+273=329$

$118+273=391$

Let's do this!

Abhay Premier League

अभय

4. Which of the following causes the temperature of a substance to remain constant while it is undergoing a change in its state?

(a) Latent heat
(b) Lattice energy
(c) Loss of heat
(d) None of these

Let's do this!

Abhay Premier League

अभय

5.‘A small volume of water in a kettle can fill a kitchen with steam’. Explain why.

Answer:

The liquid form of water converts into gaseous form in steam.

Its particles move very rapidly in all the directions and fill the kitchen as gases completely fills the vessel.

Let’s do this!

Abhay Premier League

अभय

6. Why does the temperature of a substance remain constant during its melting point or boiling point?

Answer:

The temperature of a substance remains constant during its melting and boiling point because the change in any state of matter, as solid to liquid or liquid to gas, involves crossing the latent heat of fusion which causes a difference in the intermolecular spacing of the molecules in the substance.

Let's do this!

Abhay Premier League

7. Comment on the following statements:

(a) Evaporation produces cooling.

(b) The rate of evaporation of an aqueous solution decreases with an increase in humidity.

(c) Sponge though compressible is solid.

Answer:

(a) Evaporation produces cooling because the liquid that gets evaporated draws the latent heat of vaporisation from the other particle in contact with it.

(b) The rate of evaporation of an aqueous solution decreases with an increase in humidity because when the humidity is high, it is observed that the air possesses more water vapours. Due to this, it will not draw more water vapours. Therefore, it decreases with the increase in humidity.

(c) Sponge is considered as solid because it has a defined volume and shape. It is compressible because of tiny holes where the air is trapped.

Abhay Premier League

अभय

8.We observe no change in volume of water when we dissolve a specific amount of salt/sugar into a given volume. This observation illustrates which characteristic of matter?

Answer: The characteristics of matter as described by the observation are as follows:

(i) Matter is composed of tiny particles.

(iii) Matter particles have spaces between them.

When salt or sugar is dissolved in water, it enters the spaces between water particles. This is why the volume of water does not change.

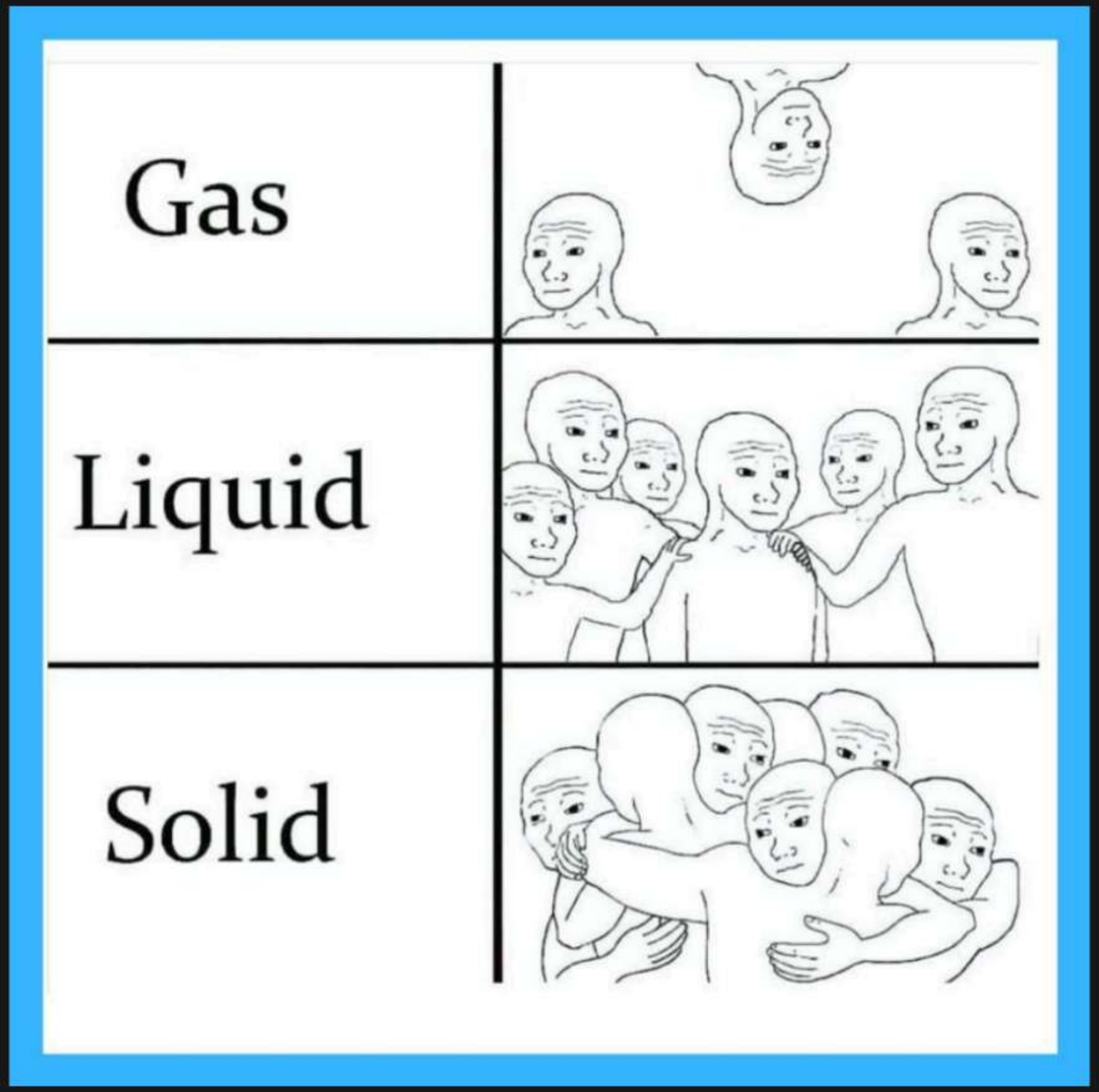
Let's do this!

Abhay Premier League

अभय

9.What is the latent heat of vaporization?

The heat energy required to change 1 kg of a liquid into a gas at its boiling point without a temperature change.


Gas
Liquid
Solid