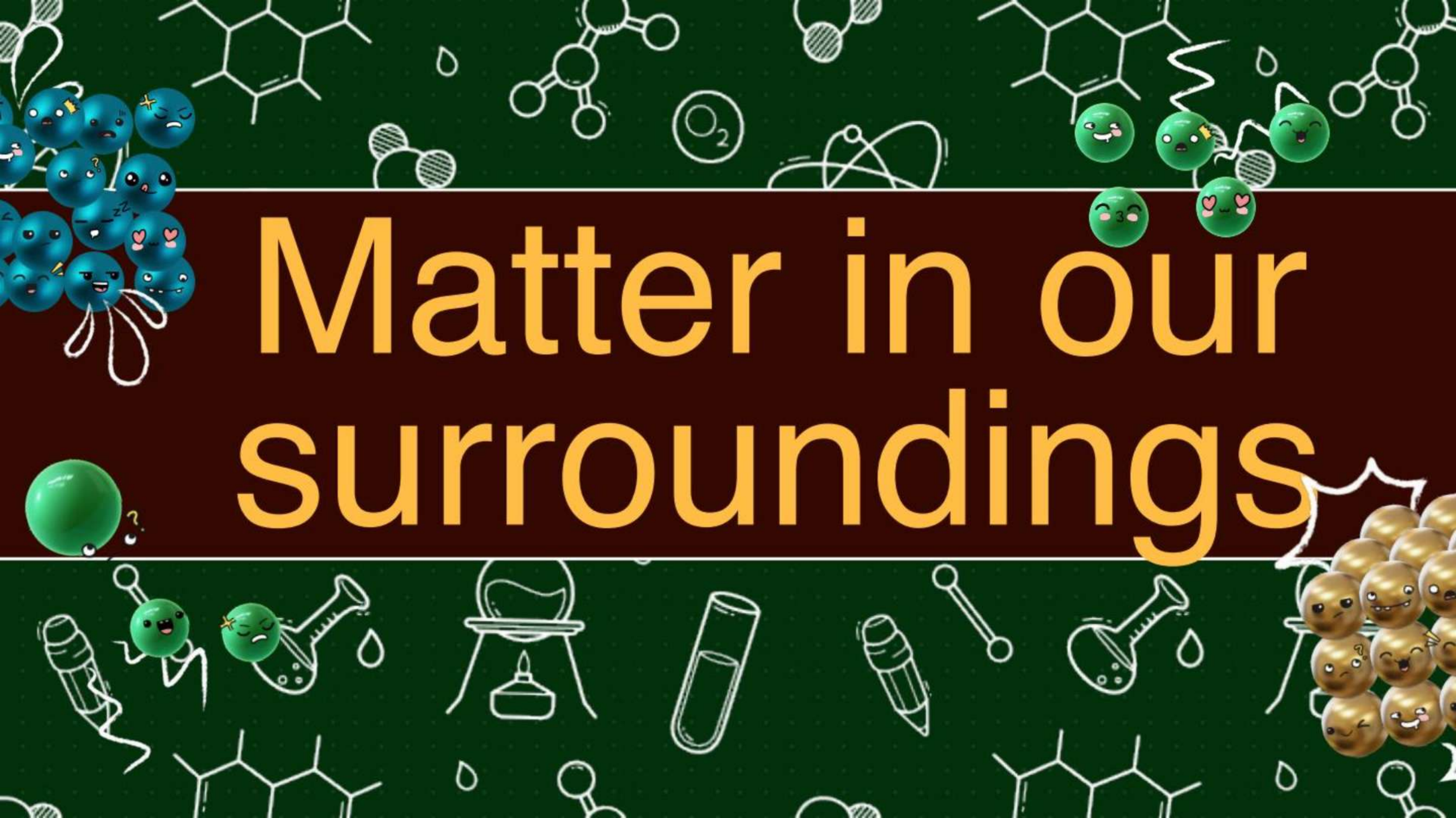

Matter in our surroundings

Matter

What is Matter ?

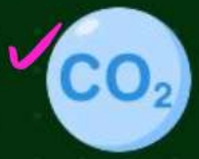
Matter is anything that :

- Has Mass (weighs something)

- Occupies space (takes up some volume)

	Matter
Chair & table	✓
Tree	✓
Water	✓
Air	✓
Love	✗
Almond	✓
Friendship	✗
Lemon water	✓
Hate	✗
Sand	✓
Thought/idea	✗
Smoke	✓

Matter

Examples of Matter	Examples
Solids	 Stone  Books  Metals  Wood  Human body
Liquids	 Water  milk  juice  oil  blood
Gases	 Air  oxygen  carbon dioxide  steam  smoke

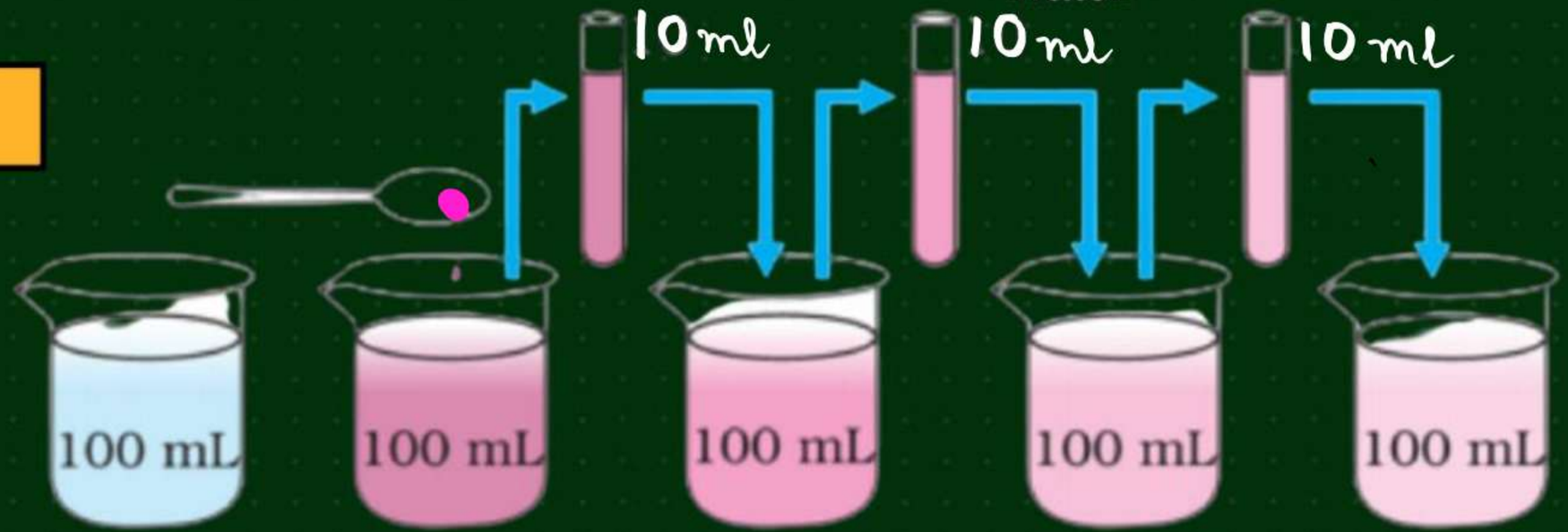
Matter is made up of particles

Atoms

Particles of matter are very small in size

- Particles are very tiny; millions can exist in a small crystal or drop.
- Examples : A few crystals of potassium permanganate can colour large amounts of water.

Activity 1.2

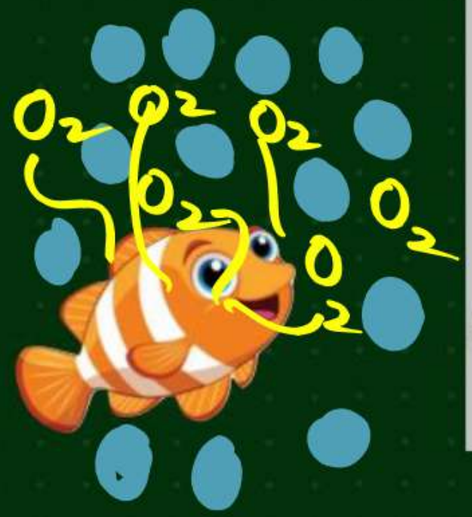


Characteristics of Particles of Matter

Particles of matter have space between them

- There is space between particles, which allows mixing or dissolving.
- Example : Salt or sugar dissolves in water.

Activity 1.1



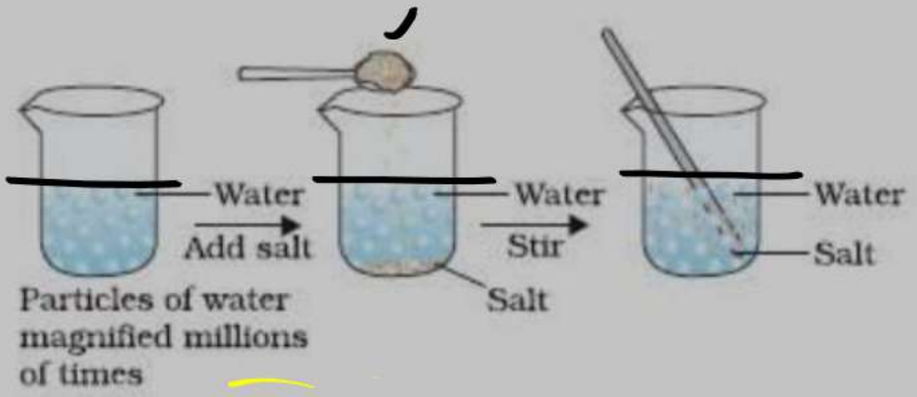


Fig. 1.1: When we dissolve salt in water, the particles of salt get into the spaces between particles of water.

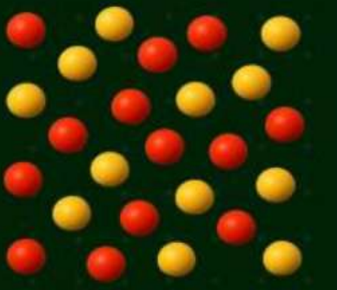
- Solids

Least inter particle space

↳ closely packed

- Liquids

More inter particle space than solids



- Gases

Large inter particle space

Characteristics of Particles of Matter

Particles of matter are continuously moving

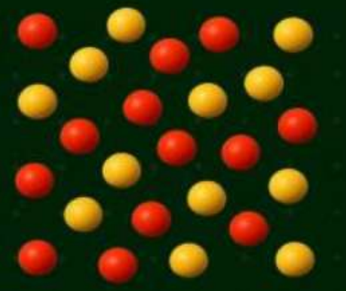
- Particles are always moving, and they move faster on heating. This causes diffusion.
- Example: Smell of perfume spreads in a room.

- Solids

Particles vibrate at fixed position

- Liquids

Particles can move over each other

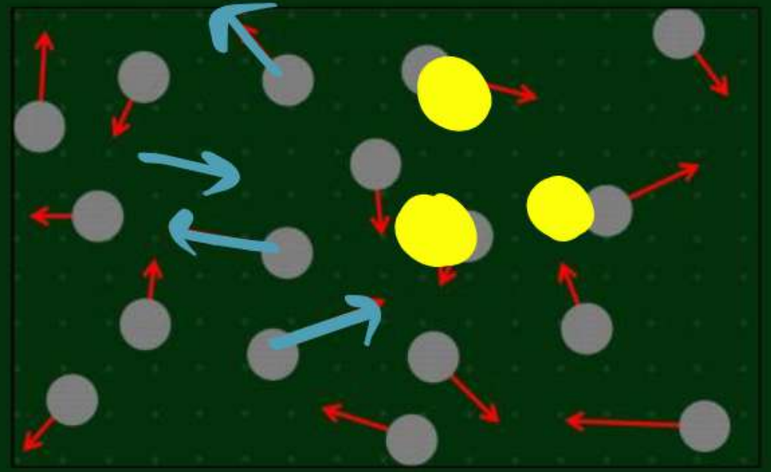


- Gases

Particles move freely and rapidly in all directions

Diffusion

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

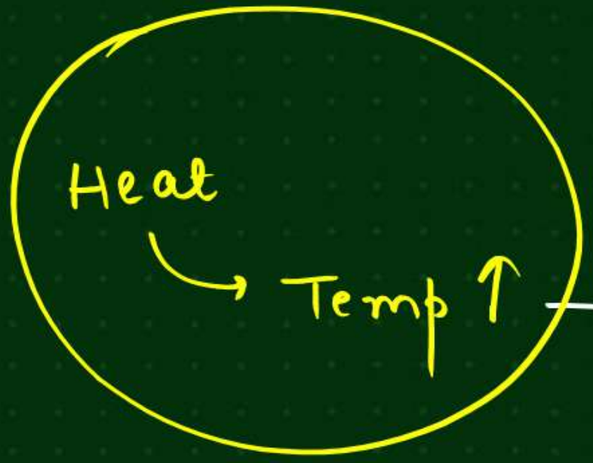


- Moving particle posses 'kinetic energy'
- Increase in temperature increases kinetic energy of particle

Activity 1.5

High temp
particles move at faster rate

Low temp
particles move at slower rate



→ Movement of particles Will be more → More Kinetic Energy → More diffusion

Temperature & Movement of Particles

High Temperature

- Particles move (diffuse) at faster rate ; movement of particles increases

Low Temperature

- Particles move (diffuse) at slow rate ; movement of particles decreases

Kinetic Energy

- If a particle is moving at higher speed; it will posses more kinetic Energy

More temperature ; more movement of particles; particles have more kinetic energy

Characteristics of Particles of Matter

Particles of matter attract each other

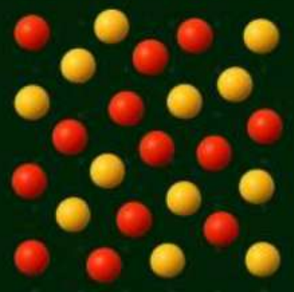
- There is a force of attraction between particles

- Solids

High inter particle force of attraction

- Liquids

Medium inter particle force of attraction



- Gases

Least inter particle force of attraction

Activity 1.7

- Chalk
- Wooden pencil
- Iron nail

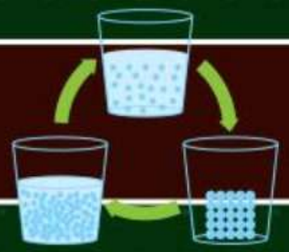
$f_{OA} < f_{OA} < f_{OA}$

Activity 1.8

Moving hand through water

Moving hand through air

f_{OA} Water $>$ f_{OA} air



States of Matter

Solid

Liquid

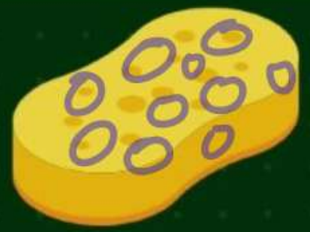
Gas

Examples	Ice, Iron, Wood, Brick	Water, Milk, Oil, Juice	Air, Oxygen, Carbon dioxide

Property	Solids	Liquids	Gas
Shape	Fixed Shape	No Fixed shape, take shape of container	No Fixed shape, fill entire container
Volume	Fixed volume	Fixed volume	No Fixed volume, spread to occupy full space
Compressibility	Incompressible	Slightly compressible	Highly compressible
Flow	Do not flow	Can Flow	Flow very easily
Density	High density	Moderate density	Low density
Particle Motion (Diffusion)	Vibrate in fixed position	Slide over each other	Move freely and rapidly in all directions
Kinetic energy	Very low	Higher than solids	Maximum
Force of Attraction	Very strong	Moderate	Very weak

Sponge is a Solid, yet we are able to compress it. Why ?

Ans. A sponge has tiny holes. Air is trapped in these tiny holes. When we press sponge, this air is expelled (released out) and we are able to compress it.

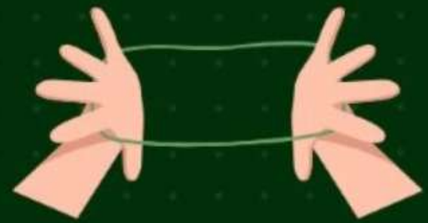


Sugar & Salt takes the shape of jars they are kept in. Are they Solid?

Ans. Yes, they are solid. The smal sugar or salt crystals have a fixed shape.

Rubber band can change its shape on stretching. is it a solid ?

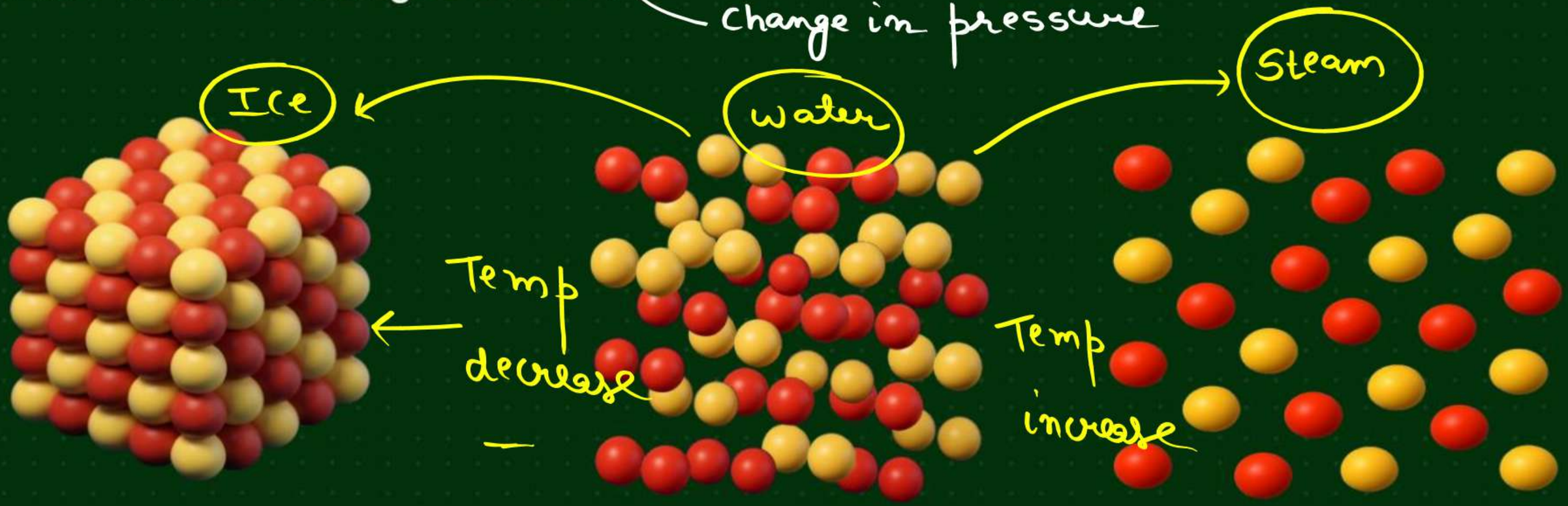
Ans. Yes, it is an elastic solid. On applying force the shape changes but it returns to same shape when force is removed. On applying larger force it can break.

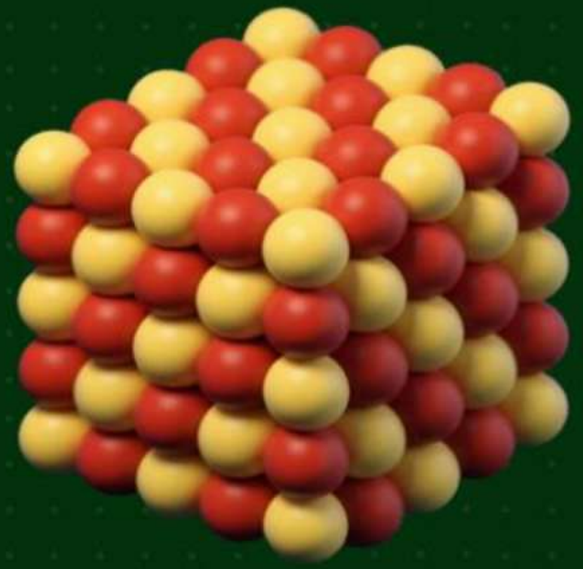


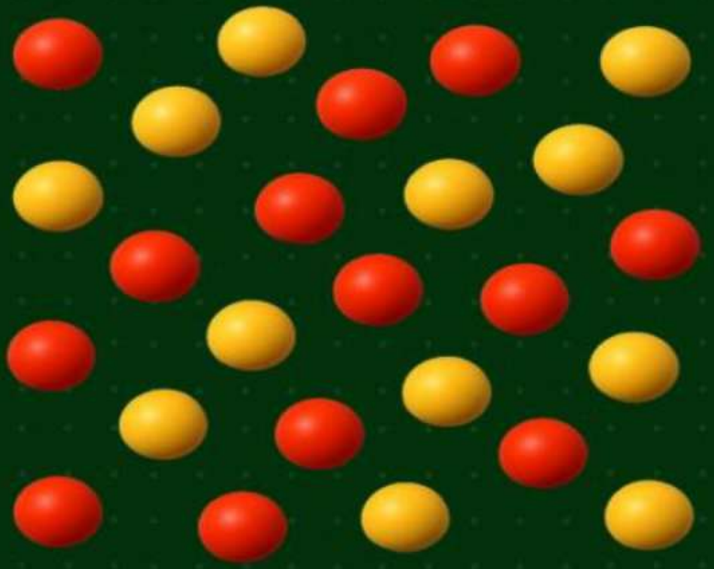
Can matter change its State

State of matter changes due to :

- Change in temperature
- Change in pressure



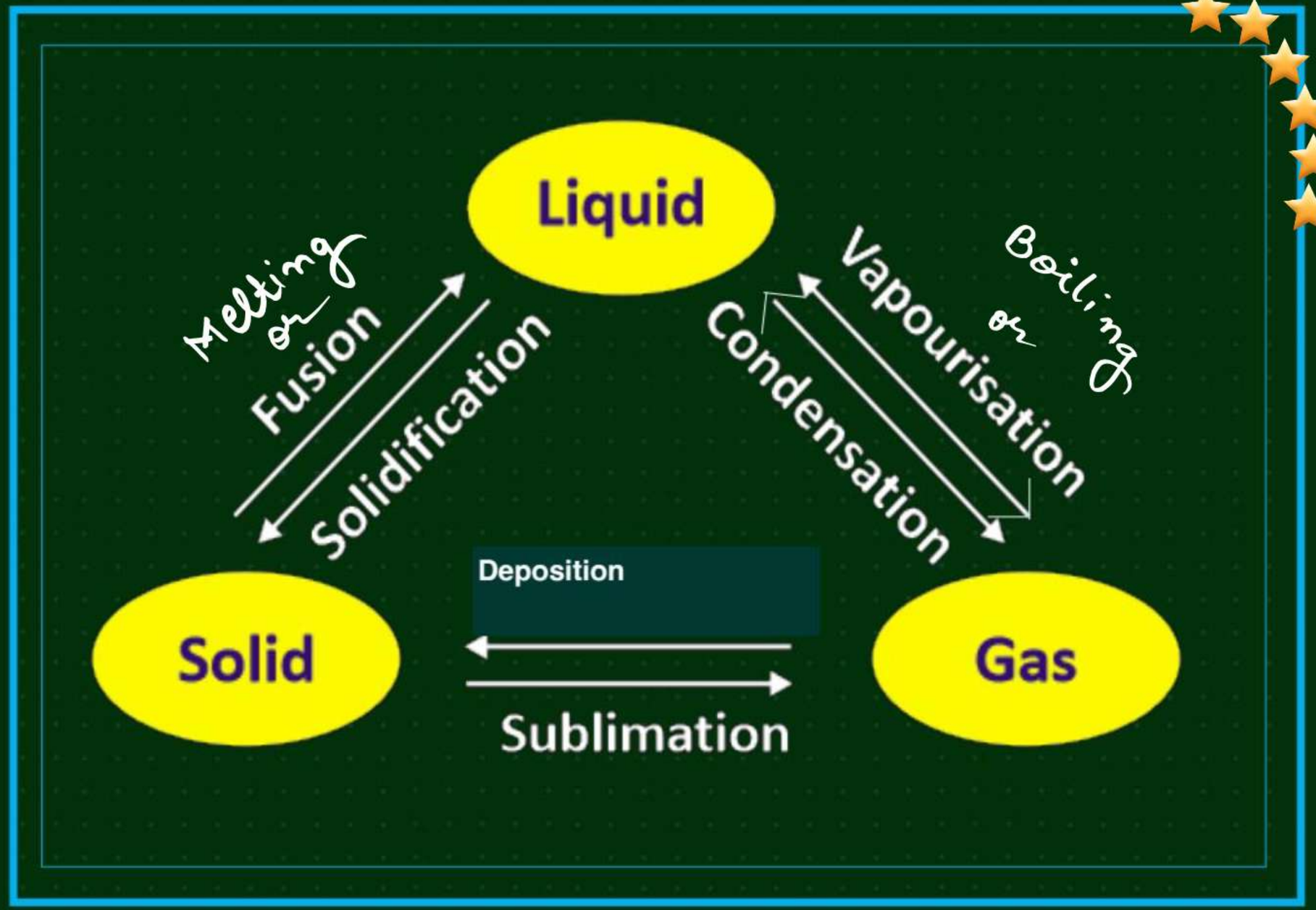




Solid
(Ice)

Liquid
(Water)

Gas
(Water Vapour/Steam)


Liquid
Melting or Fusion
Solidification
Vapourisation or Boiling
Condensation
Deposition
Solid
Gas
Sublimation

Heating

Temp Increase → Kinetic Energy increase → force of Altraction decrease → Inter-particle Space increase

Units of Temperature

- S.I unit of temperature : Kelvin (K)
- Other unit of temperature : °C , °F

Conversion of units of temperature

Conversion from Celsius to Kelvin

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

Conversion from kelvin to celsius

$$^{\circ}C = K - 273$$

Questions

$°C = K - 273$

A Convert the following temperature to celsius scale :

300K and 573K

(a) 300K

$\Rightarrow °C = 300 - 273$

$°C = 27°C$

(b) 573 K

$°C = 573 - 273$

$°C = 300°C$

B Convert the following temperature to kelvin scale :

100C and 37C

$K = °C + 273\,K$

(a) 100°C

$\Rightarrow K = 100 + 273$

$K = 373\,K$

(b) 37°C

$\Rightarrow K = 37 + 273$

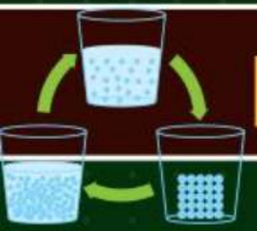
$K = 310K$

Melting/fusion

Solid to Liquid Change : Melting / Fusion

➢ The process of conversion of solid into liquid on heating is called Melting / Fusion.

Solid $\xrightarrow{H}$ Liquid



Boiling/ Vapourisation

Liquid $\xrightarrow{H}$ gas

Liquid to Gas Change : Boiling / Vaporization

➢ The process of conversion of liquid into gas on heating is called Boiling / Vaporization.

Melting Point :

- The melting point is the temperature at which a solid changes into a liquid.
- Example: Ice melts at 0°C or 273 K.

Boiling Point :

- The boiling point is the temperature at which a liquid changes into a gas.
- Example: Water boils at 100°C or 373 K.

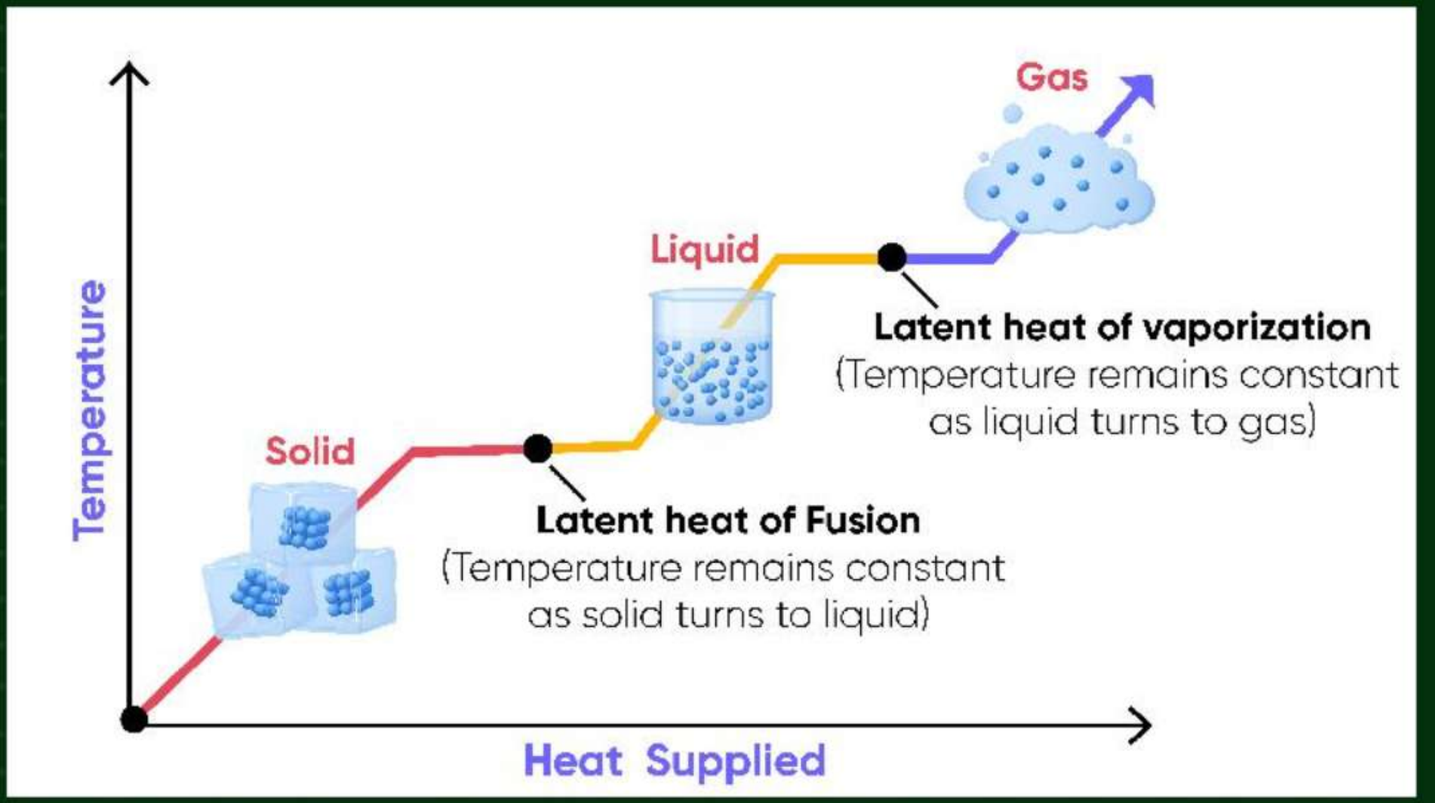
Concept of Latent Heat

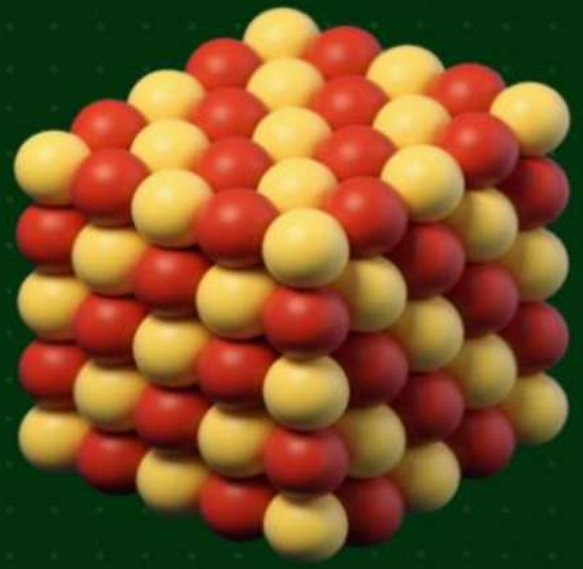
Latent Heat of Fusion :

- The amount of heat required by 1Kg of solid to get converted to liquid at atmospheric pressure at its melting point

Latent Heat of Vaporization :

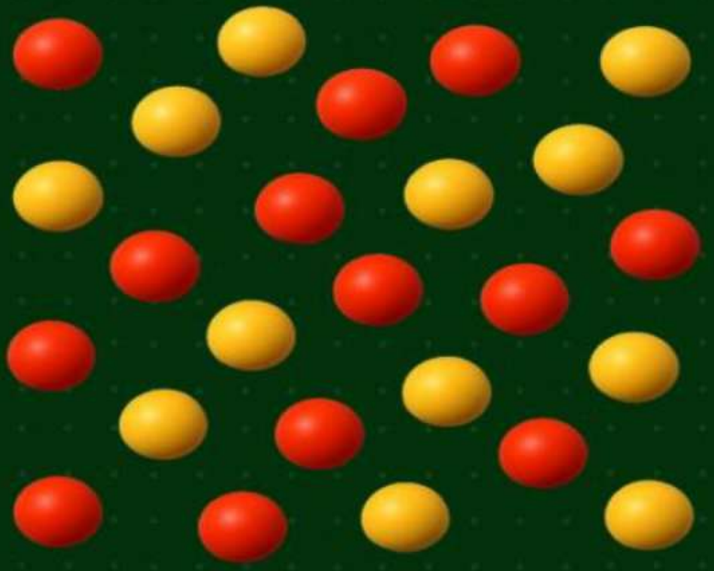
- The amount of heat required by 1Kg of liquid to get converted to gas at atmospheric pressure at its boiling point





Solid

Liquid



Gas

Concept of Latent Heat

Latent Heat of Fusion :

1kg Solid

(H) Latent heat of fusion

Liquid

Ice

(H)

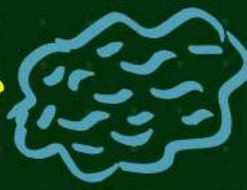
Ice

(H)

Melting Stand

(H)

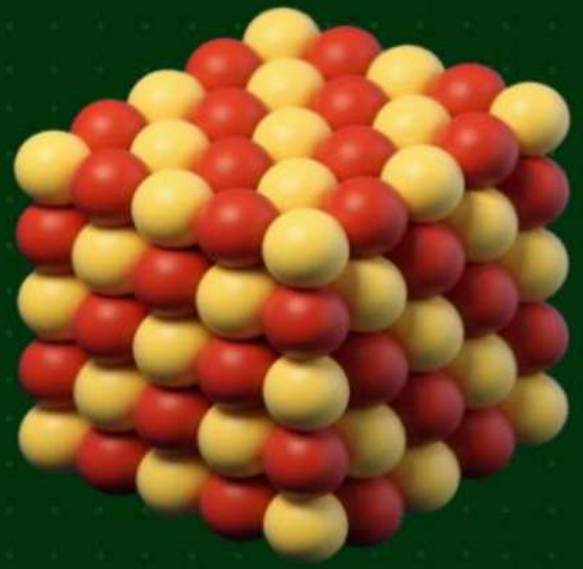
(H)



Water

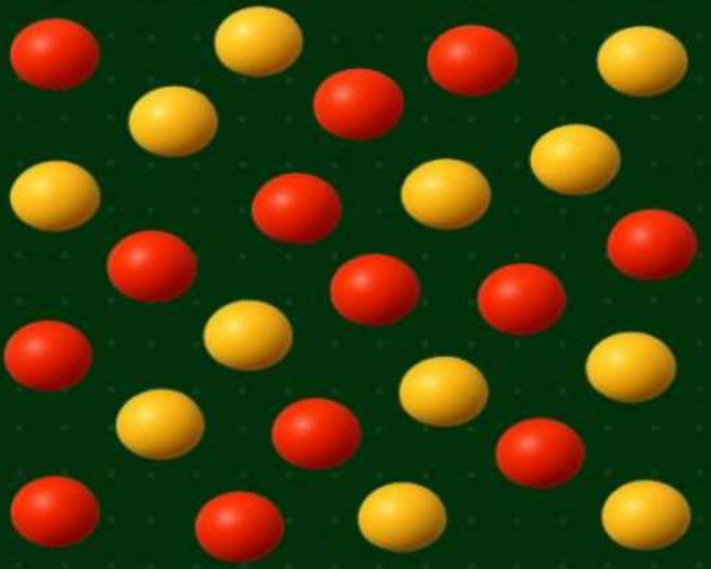
$-10^{\circ}C$ $-2^{\circ}C$ $0^{\circ}C$ $0^{\circ}C$ $20^{\circ}C$

Temp Constant



Solid

Liquid



Gas

Solid State ⇄ Liquid State ⇄ Gaseous State

Heat (Solid State → Liquid State)

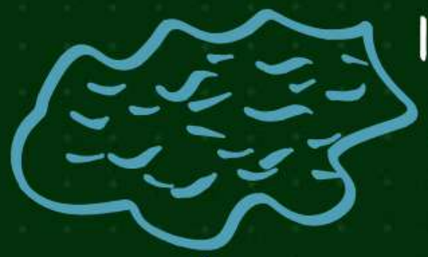
Cool (Liquid State → Solid State)

Heat (Liquid State → Gaseous State)

Cool (Gaseous State → Liquid State)

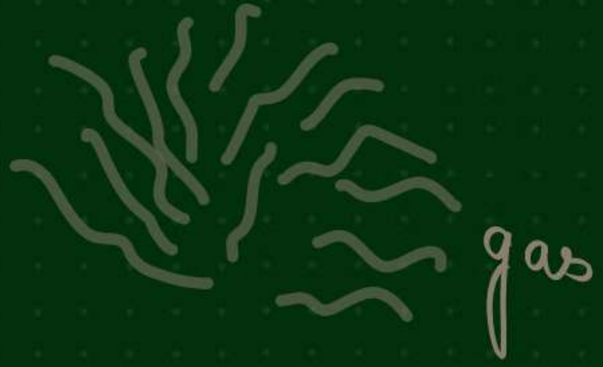
Concept of Latent Heat

Latent Heat of vaporisation



1Kg of Liquid

Latent heat of Vapourisation



gas

30°C → 100°C → 100°C → 110°C

Constant Temperature

Condensation

Gas to Liquid Change : Condensation

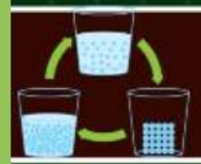
- The process of conversion of gas into liquid on cooling is called Condensation.

gas ⟶ Liquid

Water vapour

(gas)

Cold



Freezing/solidification

Liquid to Solid Change : Freezing / Solidification

- The process of conversion of liquid into solid on cooling is called Freezing / Solidification.

Liquid ⟶ Solid

Sublimation

Solid to Gas Change : Sublimation

- The process of conversion of solid into gas without coming to liquid state is called Sublimation.

Solid ⟶ gas

Deposition

Gas to Solid Change : Deposition

- The process of conversion of gas into solid without coming to liquid state is called Deposition.

gas ⟶ solid

Camphor

Napthalene Balls

Dry ice (Solid CO_2)

Effect of Pressure

- Pressure also effects the state of matter, especially gases.
- By increasing pressure and reducing temperature, gases can be converted into liquids.

Examples :

gas $\xrightarrow[\text{High pressure}]{\text{cool}}$ liquid

(Compress)

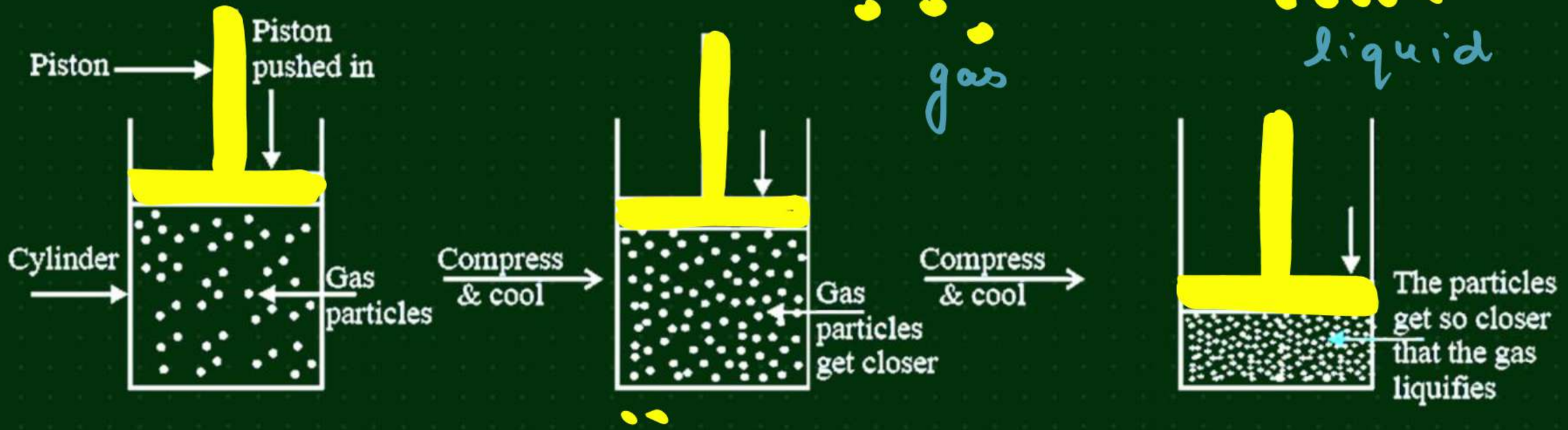
LPG (Liquefied Petroleum Gas)

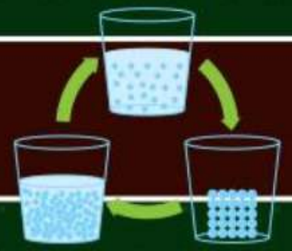
Stored in liquid form in gas cylinder under high pressure.

CNG (Compressed Natural Gas)

Methane gas stored under very high pressure for use as vehicle fuel.

Effect of Pressure





Summary

Process	Change of State
Melting ✓	Solid → Liquid
Boiling / Vaporization ✓	Liquid → Gas
Condensation ✓	Gas → Liquid
Freezing ✓	Liquid → Solid
Sublimation ✓	Solid → Gas
Deposition ✓	Gas → Solid

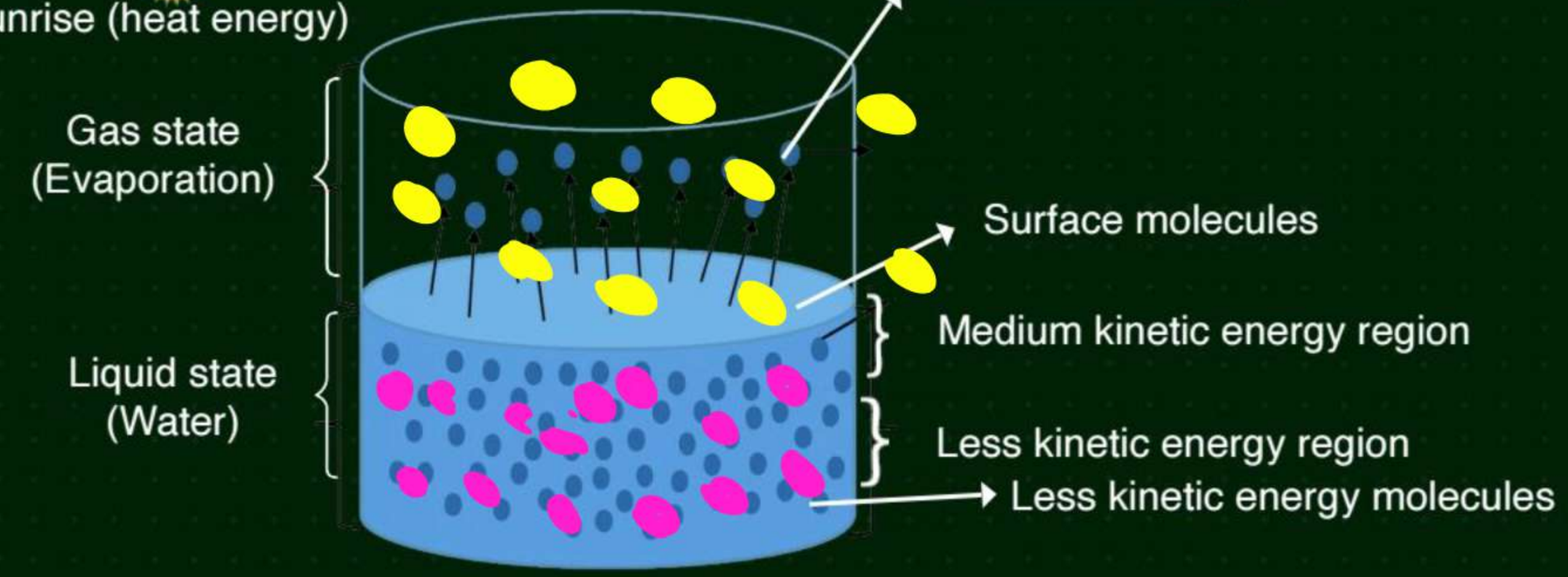
Evaporation

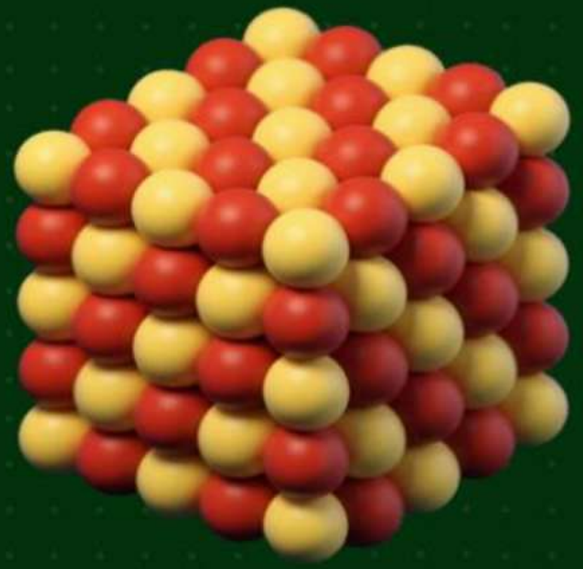
Liquid → (H) gas

- Process in which liquid particles at the surface escape into vapor.
- Happens only at the surface, unlike boiling.
- Can occur at any temperature below boiling point.
- It is a slow process.

40°C

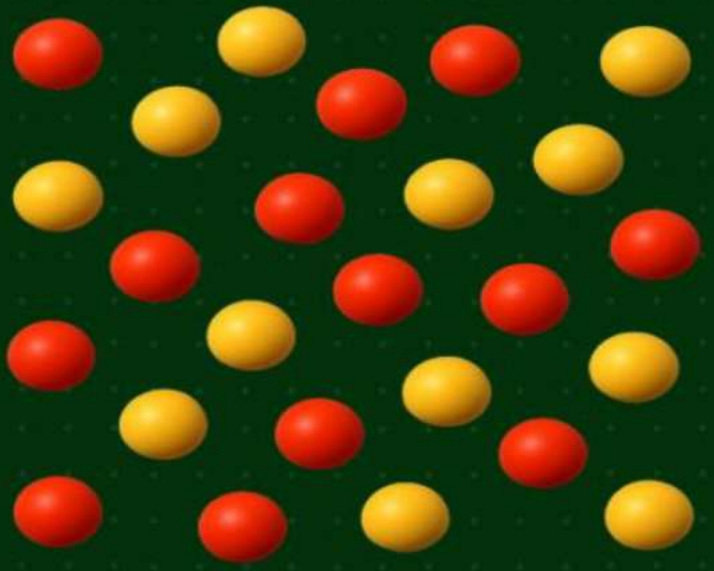
Sunrise (heat energy)





Solid

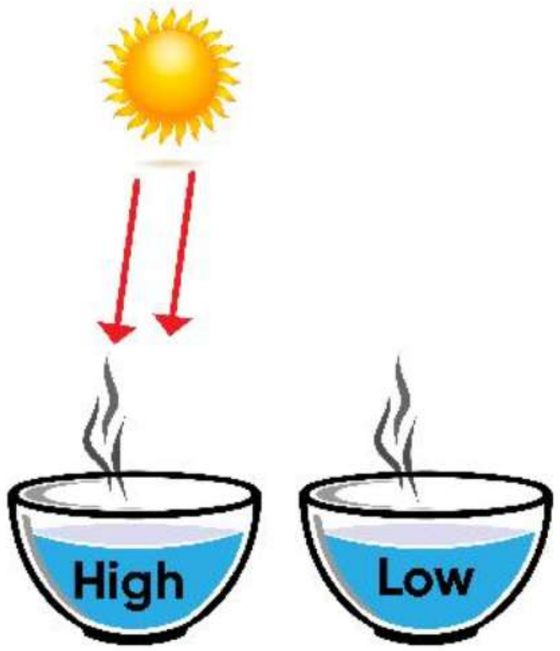
Liquid



Gas

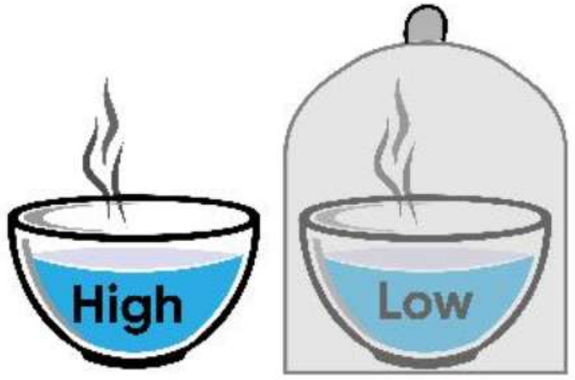
DIFFERENT FACTORS AFFECTING EVAPORATION

Temperature $\propto E$

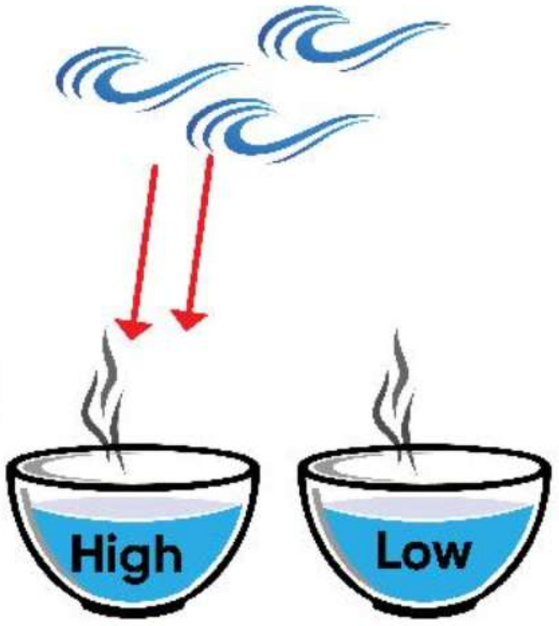


Surface area $\propto E$

Humidity $\propto \frac{1}{E}$



Wind speed $\propto E$



Factors Affecting Evaporation

Surface Area

- Larger the surface area, the faster the evaporation.
- Because more particles are exposed to air and can escape easily.
- Examples : Clothes dry faster when spread out than when folded.

Temperature

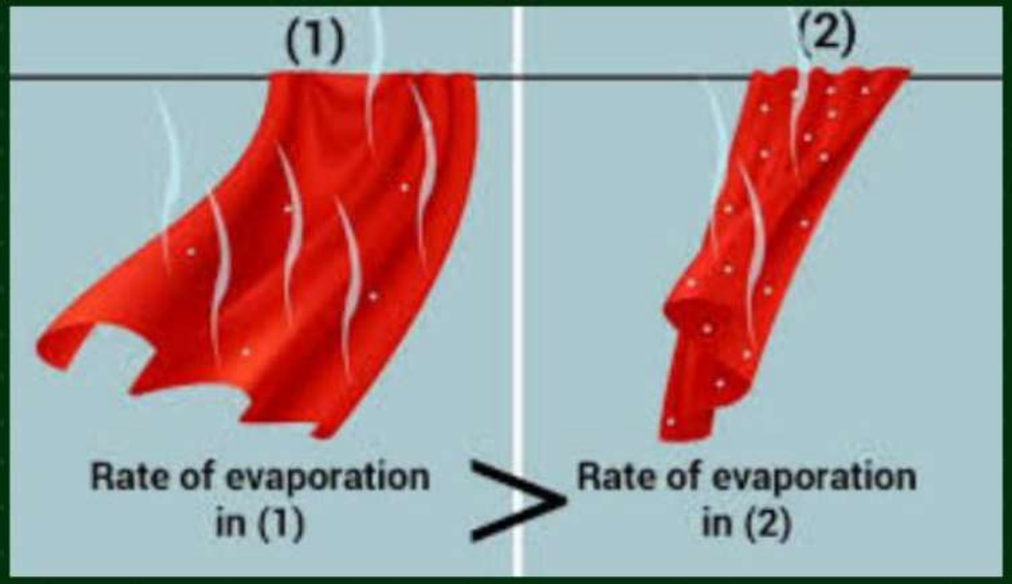
- Higher temperature increases the rate of evaporation.
- Because particles gain more kinetic energy and can leave the surface faster.
- Example : Clothes dry faster in the sun than in the shade.

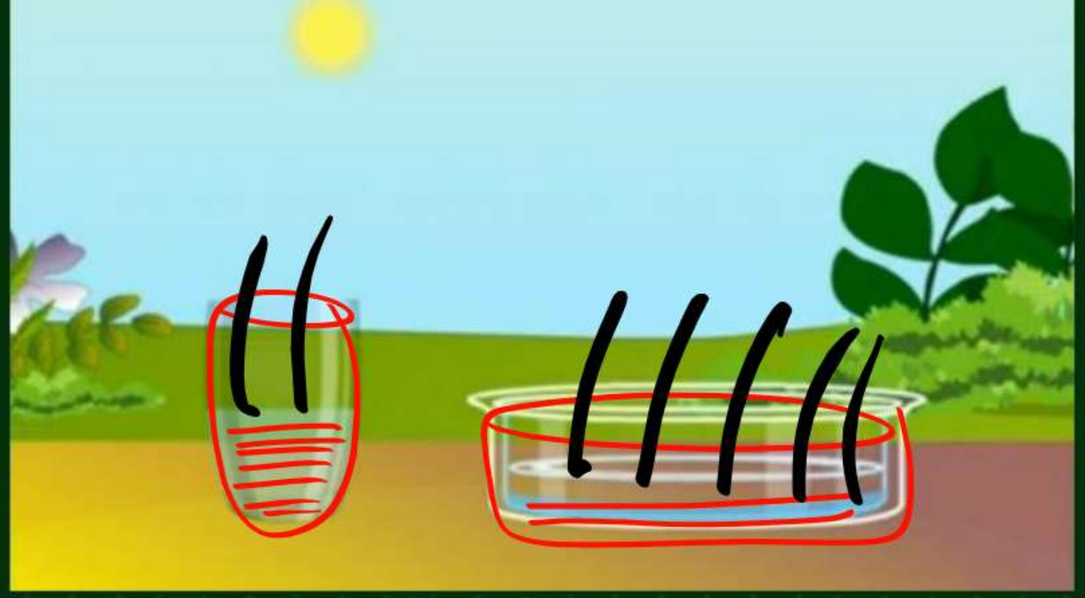
Humidity

- Lower humidity = Faster evaporation
- If the air is dry, it can take in more vapour from the liquid.
- Example : Clothes dry slower on a humid (rainy) day than on a dry, sunny day.

Wind Speed

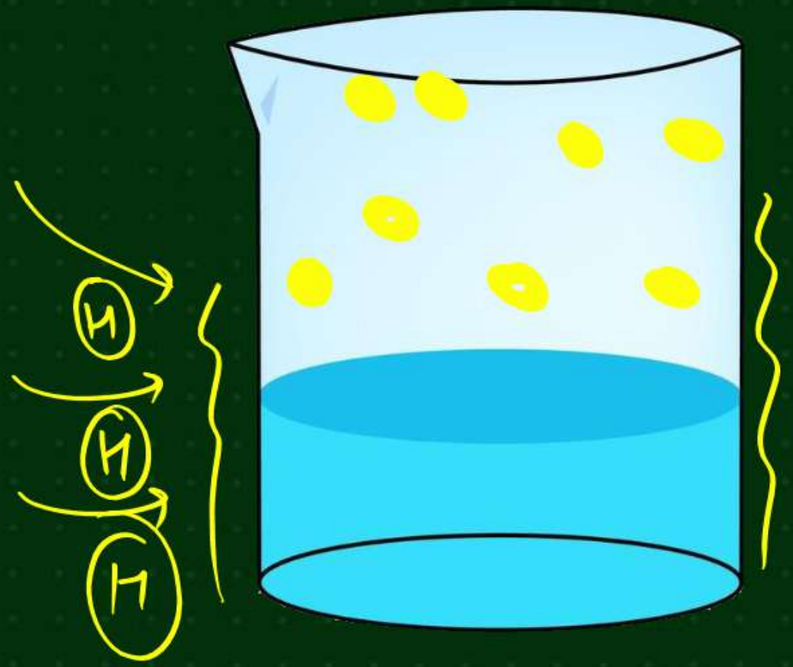
- Higher wind speed increases evaporation
- Wind carries away water vapour, allowing more evaporation.
- Example : Clothes dry faster on windy day.


(1)
(2)
Rate of evaporation in (1)
>
Rate of evaporation in (2)



Evaporation Causes Cooling

- Evaporation is not just a physical change — it also produces a cooling effect.
- When particles evaporate, they absorb heat from their surroundings to gain enough energy to escape as gas.
- As a result, the surrounding surface loses heat and becomes cooler.



Evaporation (Liquid $\xrightarrow{H}$ gas)

↓

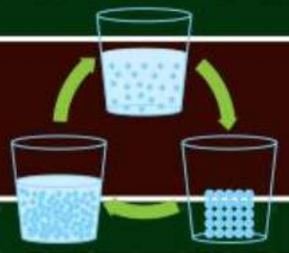
Heat absorb

↓

Surrounding (Heat decrease)

↓

Cooling effect.



Examples of Cooling by Evaporation

Sweating cools the Body

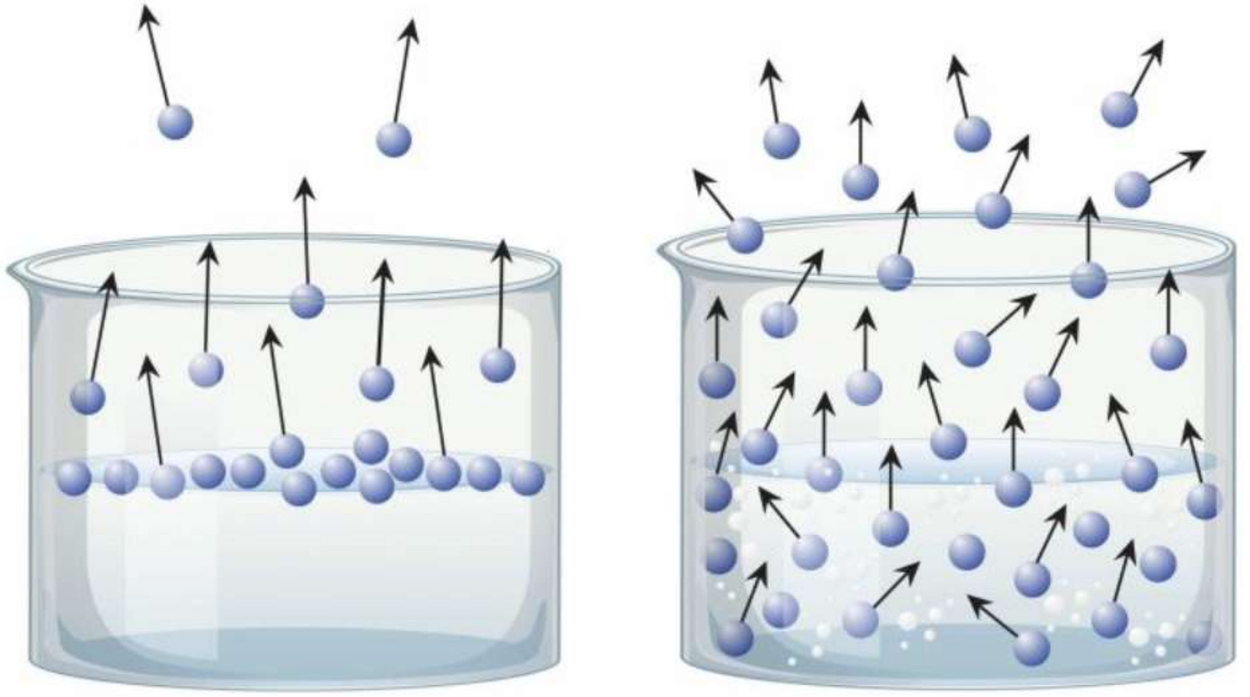
When sweat evaporates from the skin, it absorbs body heat, keeping us cool in hot weather.

Water cools Surfaces

People sprinkle water on floors and rooftops in summer to cool them. As water evaporates, it carries away heat.

Nail polish remover cold on skin

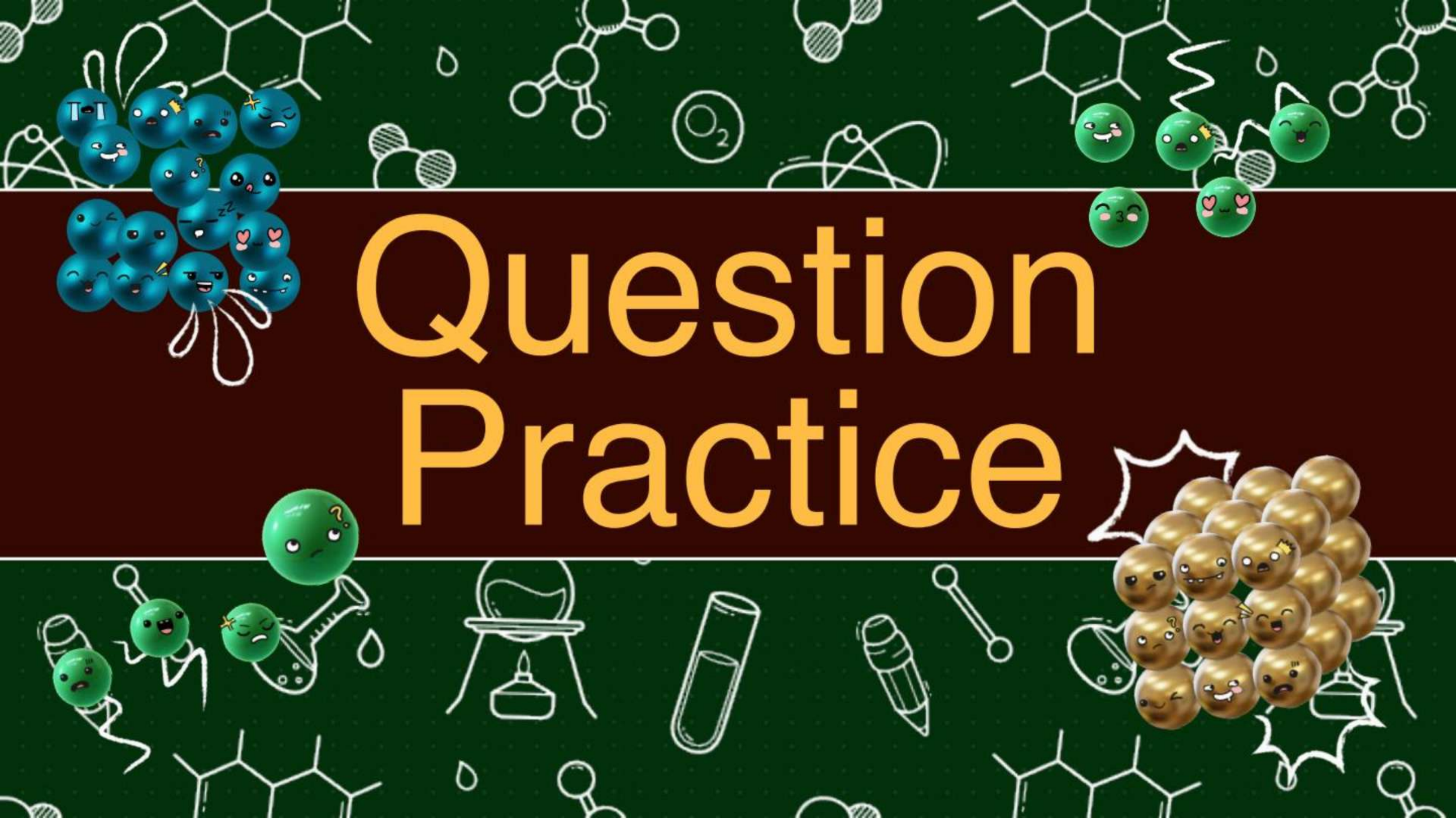
These liquids evaporates quickly, taking heat from the skin and creating a cool.



Evaporation

Boiling

Evaporation	Boiling
i) It takes place at all temperature.	i. It takes place only at boiling point.
ii) It causes cooling.	i. It does not cause cooling.
iii) It is surface phenomenon, i.e., starts from the surface.	i. It is bulk phenomenon


Question
Practice

Which of the following phenomena increases with increase in temperature?

A Density ✗

B Force of attraction between particles ✗

C Kinetic energy of particles ✓

D Number of particles

The best explanation for why “gases can be compressed easily” is:

A Gases have high kinetic energy

B Gases have large intermolecular forces

C Gases have large intermolecular spaces ✓

D Gases do not have fixed mass

Which of the following substances shows “sublimation” ?

s → g

A Ice

B Water

C Camphor ✓

D Milk

Which of the following “ does NOT affect the rate of evaporation ” ?

A Surface area

B Temperature

C Humidity

D Pressure of the liquid

Which state of matter has “no fixed shape and no fixed volume” ?

A Solid ✗

B Liquid ✗

C Gas ✓

D Plasma ✗

During evaporation, the particles of liquid:

Chocolate Questions

A Absorb energy from surroundings

B Lose energy to surroundings

C Become more closely packed

D Stop moving completely

Questions

A. Why can you smell hot food from a distance more easily than cold food?

B. When you add a drop of ink to a beaker of water, why does the ink spread throughout the water even without stirring?

C. Why do camphor tablets gradually disappear when left exposed to air?

D. Why does ice cream melt more quickly when it is hot outside?

E. We can easily move our hands in air but to do the same through a solid block of wood we need a karate expert. Explain.

Solutions

A The smell of hot food spreads more quickly than cold food because the particles in hot food have more kinetic energy. This increased movement allows the aroma particles to diffuse faster through the air, making the smell detectable from a greater distance.

B The ink spreads in water due to the process of diffusion. The ink particles move from an area of higher concentration (where the ink is added) to an area of lower concentration (the rest of the water) until they are evenly distributed. This happens because the particles of ink and water are in constant motion.

C Camphor tablets disappear over time due to sublimation in which a solid changes directly into a gas without passing through the liquid state.

D Ice cream melts faster on a hot day because the higher temperature provides more heat energy to the ice cream which results in the
increase in the kinetic energy of its particles. This causes the solid ice cream to change into liquid at a faster rate.

Solutions

E

We can easily move our hands in air because air is a gas. The particles of air are loosely packed, so they show large intermolecular spaces and weak intermolecular force of attraction

On the other hand, a block of wood is a solid. Its particles are tightly packed so they show have very small intermolecular spaces and strong intermolecular force of attraction

To move our hand through wood, we would need to apply a large force to break it.

Questions

A. Convert the following temperature to celsius scale :
300K and 573K

B. What is the physical state of water at (a) 250°C (b) 100°C

gaseous ← 250°C

100°C → liquid & gaseous

C. Why does temperature remains constant during melting of ice ?

D. What happens to intermolecular spaces when solid melts ?

E. Why steam at 100°C is better for heating purpose than water at 100°C ?

Solutions

A **300K** **573K**

B (a) At 250°C, water exists in the gaseous state as the given temperature is beyond its boiling point.
(b) At 100°C, water exist in both liquid and gaseous state.

C The temperature remains constant during the melting of ice because all the heat energy supplied is used to break the bondsbetween the ice (solid) particles, not to increase the temperature.This heat energy is called latent heat of fusion. It helps change the state of ice from solid to liquid (water) at 0°C, but the temperature stays the same until all the ice has melted.

Solutions

D When a solid melts, it changes into a liquid. During this process, the intermolecular spaces increase.

In a solid, the particles are tightly packed. When it melts, heat energy weakens the forces holding the particles together, so they move slightly apart. This creates more space between the particles, which is why liquids have more intermolecular space than solids.

E Steam at 100°C is better for heating purposes than water at 100°C because steam contains latent heat of vaporization in addition to the heat it already has at 100°C. When steam condenses on any surface, it releases this extra hidden heat, thereby giving out more heat energy than boiling water at the same temperature.

Questions

A. Why does the water in an earthen pot (matka) remain cool?

B. Why do wet clothes dry faster on a windy day compared to rainy day?

C. Why do we sprinkle water on the ground during summer?

D. How evaporation differs from vaporization?

E. Why is evaporation called a surface phenomenon?

Solutions

A. An earthen pot has tiny pores through which water seeps out and spreads over the surface of the pot. When this water evaporates, it absorbs heat from the water inside the pot, thereby cooling it.

B. Wind increases the rate of evaporation by removing the water vapour that forms near the surface of the wet clothes. This reduction in humidity around the clothes allows more water to evaporate. As a result, the clothes dry faster on a windy day than on a calm day.

C. Sprinkling water on the ground during summer helps cool the surroundings. As the water evaporates, it absorbs heat from the ground and the air, which reduces the temperature. This is a common practice in many hot regions to create a cooler environment.

D.
- Evaporation: It is a surface phenomenon that occurs at all temperatures and only at the surface of a liquid.
- Vaporization (Boiling): It is a bulk phenomenon that occurs throughout the liquid at a fixed temperature called the boiling point.

Solutions

E

Evaporation is called a surface phenomenon because it takes place only at the surface of the liquid. The particles at the surface gain enough kinetic energy to overcome the forces of attraction and escape into the air as vapor, while the particles inside the liquid remain unaffected.

Questions

A. What are the characteristics of the particles of matter?

B. Suggest a method to liquefy atmospheric gases.

C. State the difference between solid, liquid and gases on the basis of:
(a) Volume (b) Shape (c) Kinetic energy

D. Can a rubber band change its shape on stretching? Is it a solid ?

E. Why do gases exert more pressure on the walls of the container than solids?

Solutions

A

1. Particles of matter continuously move.
2. Particles of matter attract each other.

B

The atmospheric gases can be liquefied either by decreasing temperature or by increasing pressure.

C

	Solid	Liquids	Gases
(a) Volume	Definite volume	Definite volume	No definite volume
(b) Shape	Definite shape	No definite shape	No definite shape
(c) Kinetic energy	Lowest kinetic energy	Moderate kinetic energy	Highest kinetic energy

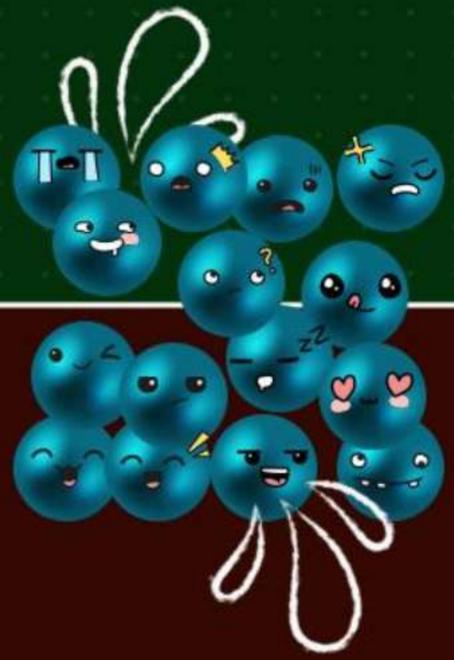
Solutions

D Yes, a rubber band can change its shape when stretched, but it regains its original shape when the force is removed. It is considered a solid because it has a definite shape and volume, though it is elastic in nature.

E Gases exert more pressure because their particles are free to move randomly with high speed and collide with the container walls frequently. In solids, particles vibrate about fixed positions, so they do not exert significant pressure on the container walls.

GIVEAWAY WINNERS

SANKALP SRIVASTAVA	SHREYAS WAGHMARE	UTKARSH BHAII	PRATEEK YADAV	TANISHK KHUBCHANDANI
ISHAN	ADITYA RAGHAV	AZIM NUMAN	ANANYA RAI	PALAK PATHAK
SEHER MUBARAK	ANKIT GUPTA	TANYA RAJ	ARADHANA GUPTA	PRAKHAR SRIVASTAV
SADIA CHOUDHARY	SHOURYA CHAUHAN	ANVESHA TIWARI	SUMIT SINGH	SAURABH MISHRA
AKSHARA AMIT YADAV	GOURAV VERMA	SHRISTI SAHARAN	AARUSH DUBEY	GEET RANI
SIDDHI SAUMYA	ADITYA TANWAR	ANANYA MANGA	RAJATA CHAKRABORTY	ASTHA PANDEY
PRINCE RAO	ANGEL	DIYA	YADAV JI	VISHAKHA
DEBANSH BISWAL	GAURAV GITTE	SANTHOSH KUMAR	VINIT KUMAR	MUHAMMAD SINAN
DARITI	REYANSH MODI	POORVI	ADITI PAL	ANSHULI KUMARI
ANUJ TIWARI	MANIK GOYAL	VIKHYAT YADAV	KRITIKA SINGH	YUVRAJ TYAGI



THANK YOU