



STATES OF MATTER.

BY ELLY KENEDDY NALITSO

0708838163- 0779031329



1/7/2025

ELLY KENEDDY

LEARNING OUTCOMES



- **The learner should be able to:**
- understand that matter is anything which occupies space and has mass and can exist in a solid, liquid, gas, and plasma form (u)
- b. understand that solids, liquids, and gases have different properties including shape, pouring, and compressing (u, s)
- c. know the kinetic theory of matter and use it to explain particle arrangement, inter-particle forces, movement of particles and the properties of solids, liquids, and gases (k, u)
- d. understand that a change from one state to another involves either heat gain or heat loss (u, s)
- e. appreciate the cooling effect of evaporation and how this contributes to maintaining constant body temperature (k, u, s)



INTRODUCTION

- Matter is **anything that occupies space and has weight**.
- Matter is made up of tiny particles joined together by some forces. This is explained by the **particulate theory of matter**.
- **According to this theory**: matter is made up of extremely tiny particles. There are spaces between these particles.
 - ❑ The particles are always in a continuous state of motion
 - ❑ The particles attract one another
 - ❑ At higher temperature, these move at a faster speed
 - ❑ The states of matter are solids, liquids and gases

ACTIVITY.



How would you establish that matter is made up of tiny particles that cannot be seen by our naked eyes

Materials

- Hot water
- Beaker
- Sugar
- Stirring rod

Methodology

Put 2 spoons into a beaker of hot water and stir and observe what happens.

Explain what happens.

When sugar is stirred in water, the crystals breakdown into tiny particles that can not be seen. These fit in spaces between water molecules

SOLIDS

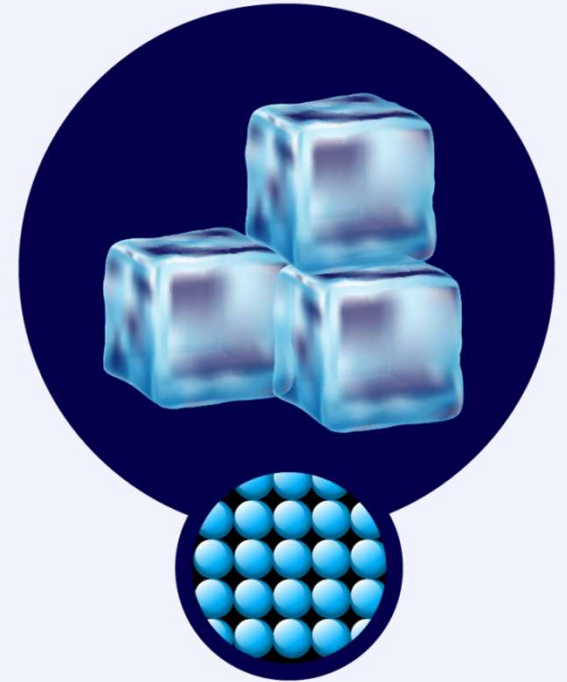
The characteristics of solids include:

- - Fixed volume
- - Fixed shape
- - Incompressible
- - Do not flow
- Have a definite shape

1/7/2025

ELLY KENEDDY

SOLID



Rigid

Fixed
Shape

Fixed
Volume

Cannot be
squashed



- The particles of solids are **closely** and **regularly** packed together
- They are held **together by strong forces** which attract particles to each other
- At a certain temperature the regular arrangement of particles in the solid state breaks down.
- At this point the solid melts and turns into liquid state. The temperature at solids change to liquid is called **melting point**.



LIQUIDS

The characteristics of liquids include:

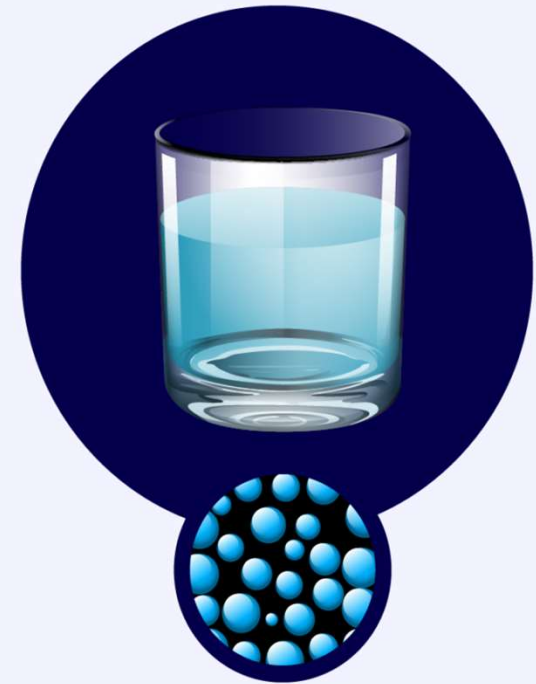
- Fixed volume
- No fixed shape
- Takes the shape of the container
- Incompressible
- Flow easily
- Have definite volume but no definite shape and take up the shapes of their containers e.g. water, milk. When liquids are heated their particles move faster and finally turn into gas.

The temperature at which a liquid changes into a gas is called the **boiling point** e.g. the boiling point for pure water is 100C.

1/7/2025

ELLY KENEDDY

LIQUID



Rigid

No Fixed
Shape

Fixed
Volume

Cannot be
squashed

GASES

The characteristics of gases include:

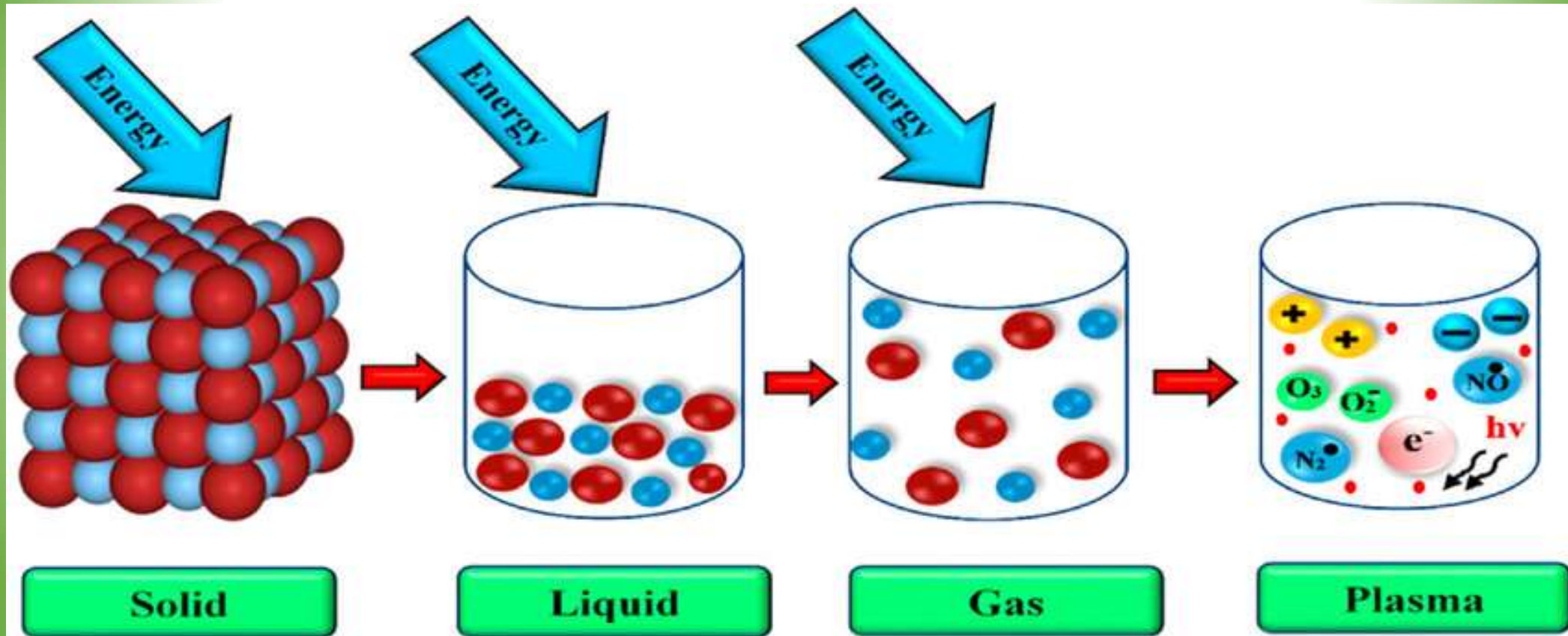
- No fixed volume
- No fixed shape
- Compressible
- Flow in all directions
- Do not have a definite shape and volume

The particles cannot attract each other and can be compressed e.g. air

- When gases are cooled, they turn into liquids and the process is called **condensation**.
- The behaviour of particles in solids, liquids and gases is governed by the principle of **kinetic theory of matter**.



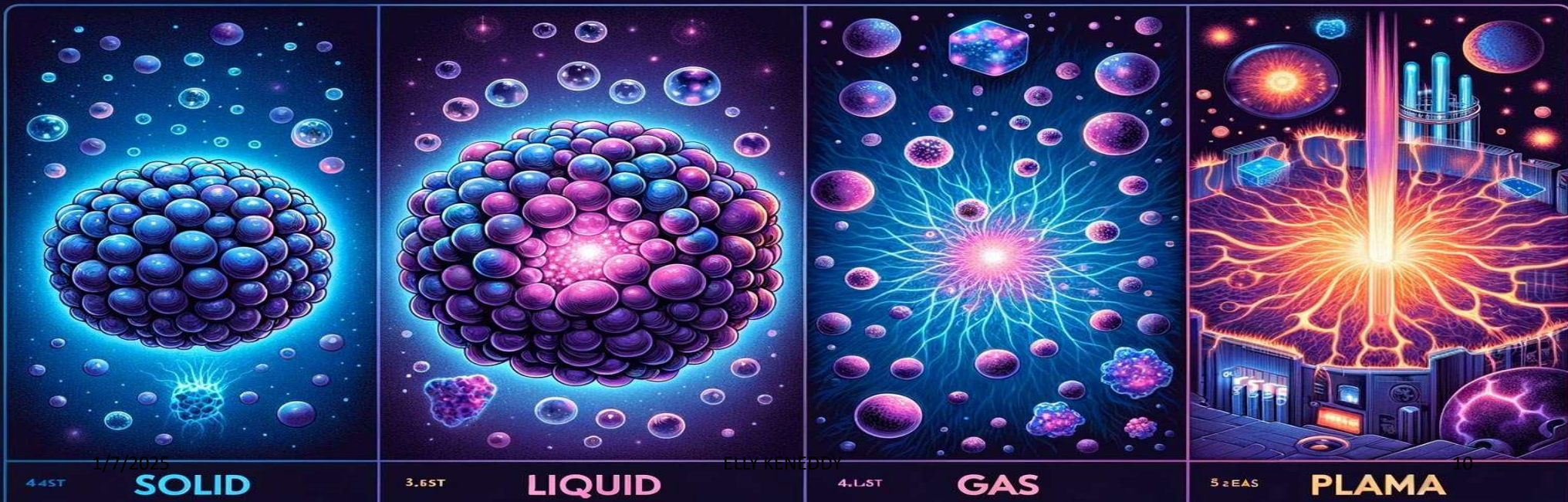
ARRANGEMENT OF PARTICLES



PLASMA



- Plasma is regarded as the fourth state of matter.
- It is observed in situations such as when a metal is melted at high temperatures consisting of an **ionized** material and **electrons**.
- It is also the state present in the **sun**, most **stars** and in **fusion reactors**



THE KINETIC PARTICLE THEORY OF MATTER



Kinetic theory assumes that

- ☐ Particles are too small to be seen directly
- ☐ There are spaces between particles of matter; the amount of space varies between each states
- ☐ The particles constantly move; each state moves in different speed.
- ☐ The kinetic theory of matter states that matter is made up of a large number of tiny particles that are in a continuous random motion. These can be atoms or molecules.

EXPERIMENT

Aim : to observe that particles in gases are in a continuous state of motion

Materials

Source of bromine vapour

2 empty gas jars

Cover plate

Methodology

- Bromine is filled into a gas jar and covered. Another jar full of air is placed on top of jar with bromine, separated with cover plate.
- Cover is removed and both ends are left open.

1/7/2025

ELLY KENEDDY



12

CONT.....



Observation

- After sometime, the brown colour of bromine is evenly distributed between the 2 jars. Bromine evaporates, filling both jars with dense reddish-brown bromine vapour.

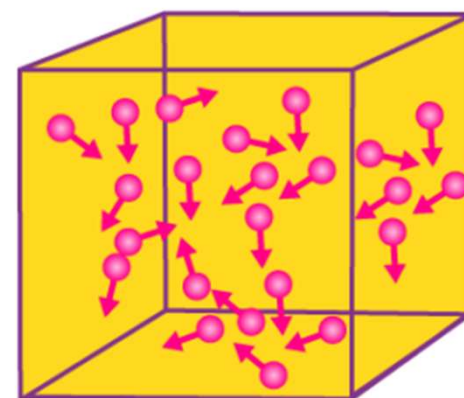
Explanation:

- Bromine particles move from lower jar into spaces between air particles in upper jar.
- At the same time, air particles move down from upper jar to mix with bromine particles in lower jar which shows gas particles are always in motion
- The movement of molecules from a region of higher concentration to that of low concentration is called diffusion.

BROWNIAN MOTION.



- The movement of small particles making up matter is best studied by the smoke cell experiment.
- The smoke is sucked into the cell and illuminated. The movement of the smoke particles is then observed through a microscope.
- Observation.
- The smoke particles are seen in continuous rapid random movement. This type of movement is called Brownian motion.



Brownian Movement

OTHER EXAMPLES OF KINETIC THEORY OF MATTER.



- **Drying clothes:** Water molecules in wet clothes gain enough energy to escape into the air as vapor, leaving the fabric dry.
- **Dust in sunlight:** Particles of dust floating in the air move randomly due to collisions with air molecules in constant motion.
- **Steam from a kettle:** Water molecules gain kinetic energy and escape into the air as steam when heated.
- **Car tires heating up:** The motion of gas molecules inside a tire increases as the temperature rises, increasing pressure.
- **Boiling water:** Water molecules move faster as they are heated, eventually overcoming intermolecular forces to turn into vapor.
- **Diffusion of food coloring:** When a drop of food coloring is added to water, the particles spread out due to their constant motion.

AN EXPERIMENT TO INVESTIGATE DIFFUSION IN GASES.

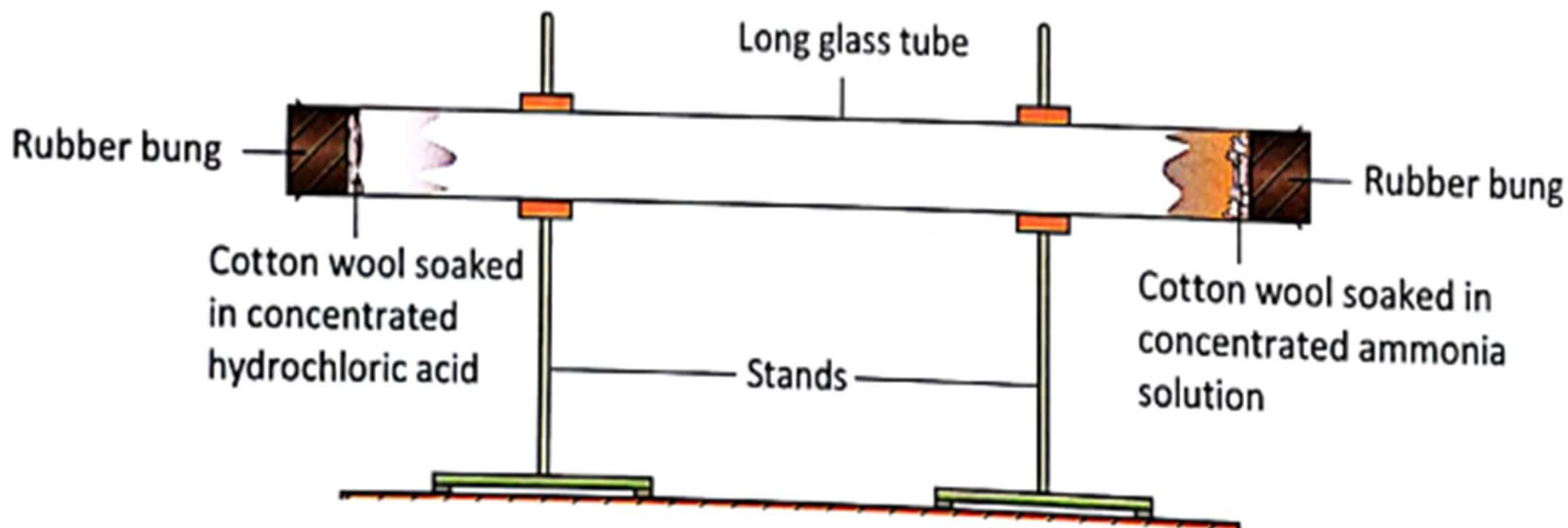


Aim : to investigate diffusion of gases

Materials

- Glass tube
- Retort stands
- Cotton wool
- Concentrated ammonia and hydrochloric acid
- Rubber bang

- Cotton wool soaked in aqueous ammonia and another soaked in hydrochloric acid are placed on opposite sides of the tube.
- Place the 2 bungs of cotton wool each at different end as shown below and record your observation





OBSERVATION

- A white solid is formed ring is formed in the glass tube.
- It is formed near hydrochloric acid because HCl is denser than ammonia and so , it diffuses faster than ammonia.

FACTORS AFFECTING RATE OF DIFFUSION



- **Temperature**

The higher the temperature, the more particles of matter absorb energy making them move faster, the higher the rate of diffusion; the lower the temperature, the slower the rate of diffusion

- **Mass of particles**

Greater mass, the slower it diffuses; smaller mass, the faster it diffuses

- Cotton wool soaked in aqueous ammonia and another soaked in hydrochloric acid are placed on opposite sides of the tube.
- Ammonium hydroxide (NH_4OH) vapor and hydrogen chloride (HCl) vapor diffuses in the tube and a compound is produced inside the tube closer to HCl soaked cotton as the particles are heavier. The greater the mass, the slower particles diffuse and the smaller the mass, the faster particles diffuse.

ITEMS.



- Mr. Katabula a physics teacher applied perfume as he was coming for lessons on Monday. When he entered the school gate, the students who were sitting at the door smelt the perfume as he passed by. Explain how this was possible.



Sample response

- The perfume molecule moved from his shirt where they are more concentrated into the air where they are less concentrated. These were taken in and detected by the nose.

1/7/2025

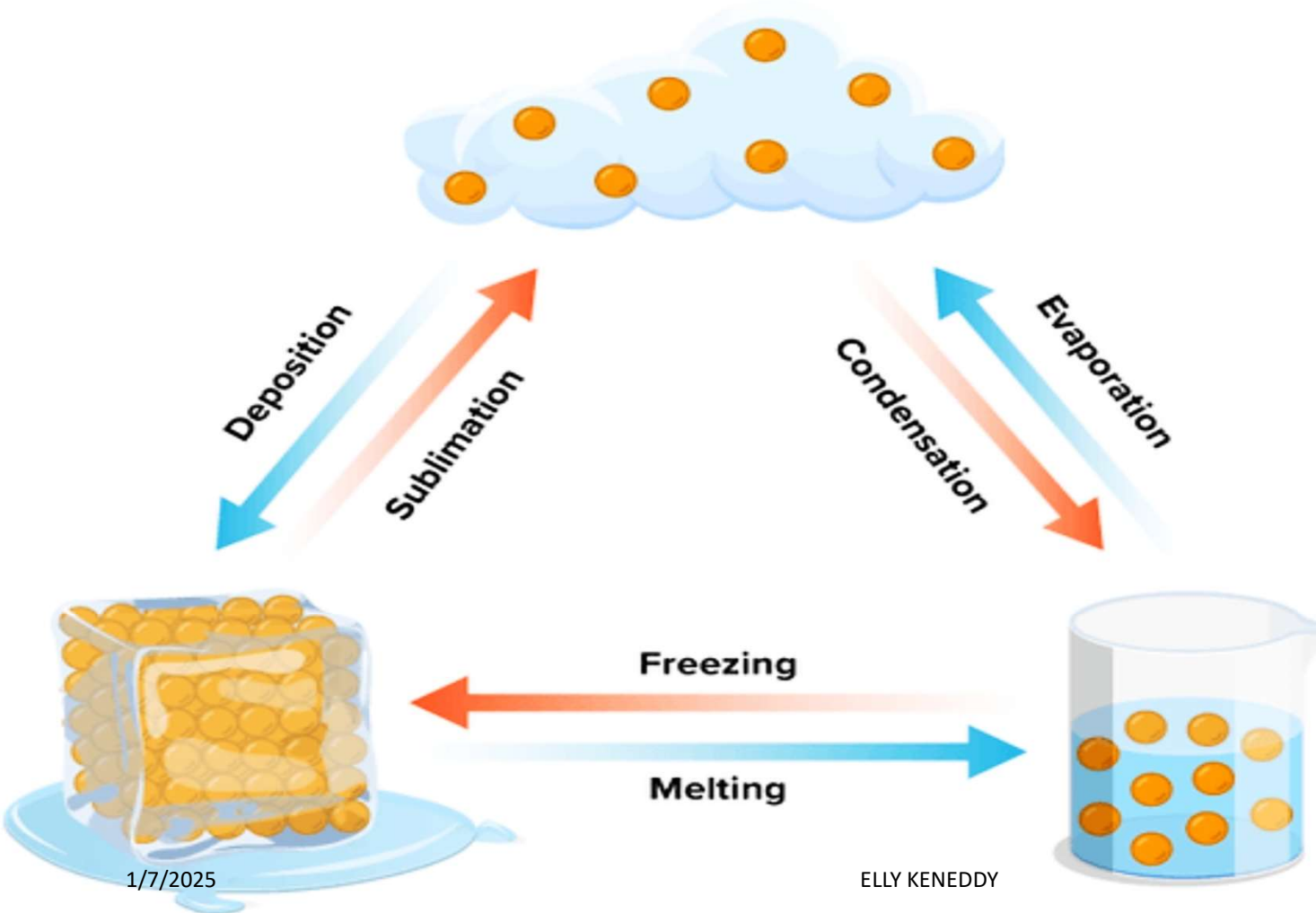
- S.1 class is situated 5m away from the girls toilet however during noon hours, the students complain about the much bad smell present. **Explain to the learners how the bad smell is able to reach them and why its much in the afternoon.**



When a tea bag was dropped in a cup of hot and cold milk, the colour of milk changed to brown. **Explain why the colour of milk changed**

- Which of the 2 cups of milk changes colour faster? Explain your answer.

CHANGES OF STATES OF MATTER





- **Melting** : is change from solid to liquid by absorbing heat to break force of attraction holding particles together. The temperature at which solid melts is melting point.
- **Freezing** : is the change of liquid to solid by cooling down of liquid. Freezing point is the temperature at which liquid freezes.
- **Boiling** : is the change of liquid to gas by absorbing heat to break the forces holding them together. Boiling point is the temperature at which liquid boils.
- **Condensation** : is the change of gas to liquid. Heat energy is given out as gas particles slow down and move closer to one another to form liquid.
- **Sublimation** is the change of solid to gas without melting. Heat is absorbed.
- **Evaporation** is change of liquid to gas without boiling, occurs below boiling point on water surface. It gives **cooling effect** – heat energy absorbed from surroundings.

CHANGES OF STATE



- The state of a substance depends on the temperature. A change in temperature can change the state of a substance.
- Condensation is the change of state from gas to liquid due to **cooling**.
- When the **temperature of a liquid is reduced**, the **kinetic energy of the molecules decreases**, then the **forces of attraction become stronger** and liquid changes to solid.
- When a **solid is heated**, **the molecules acquire more kinetic energy** to **overcome the attractive forces** hence the solid changes to liquid in a process called melting.



• APPLICATIONS OF CHANGES OF STATE

Discuss how the changes in states of matter are useful in our daily life





1/7/2025

ELLY KENEDDY

26



ACTIVITY

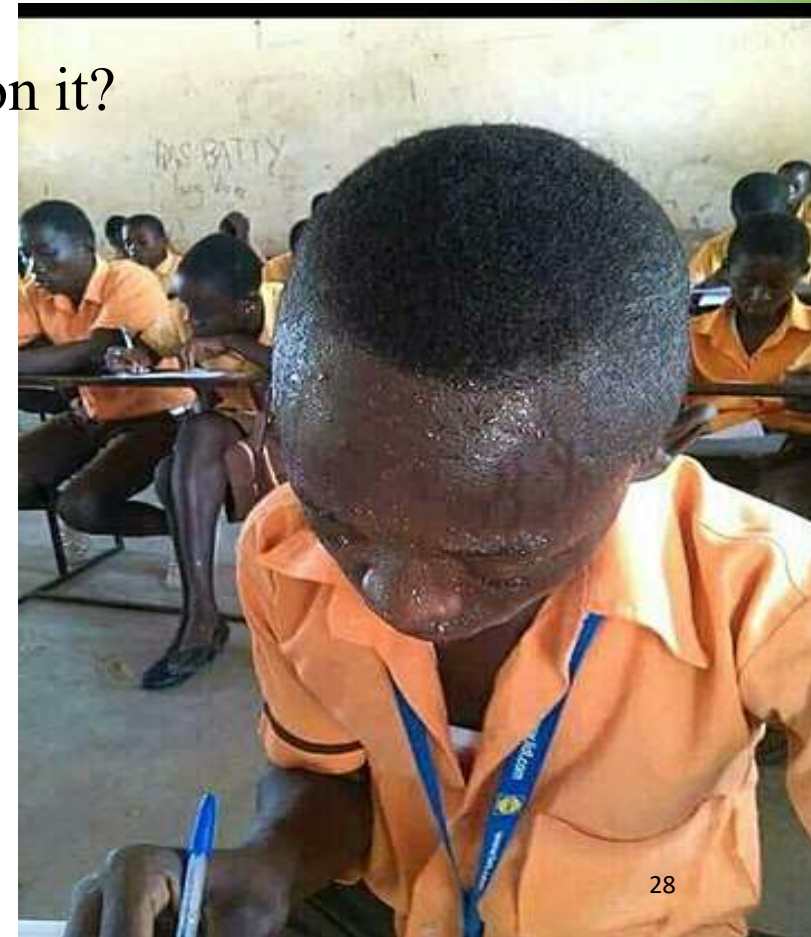
- ☐ Which of the above changes occur with gain of heat?
- ☐ Which of the above changes proceed with loss of heat ?

THE COOLING EFFECT OF EVAPORATION ON MAINTAINING A CONSTANT BODY TEMPERATURE.



QUESTION

- Why does the skin feel cold after pouring spirit on it?
- Why do you feel after sweating?



EXPLANATION



❑ **Sweat Production** or **application of spirit**

When the body overheats, sweat glands release moisture (sweat) onto the skin's surface. Sweat is mostly water and contains some salts.

❑ **Energy Transfer:**

For water molecules or spirit in sweat to evaporate, they **must absorb heat energy from the skin**. This **energy provides the molecules enough kinetic energy to overcome intermolecular forces and escape into the air as vapor**.

❑ **Cooling Effect:**

As high-energy (hotter) water molecules evaporate, **they remove heat from the skin**, leaving behind lower-energy (cooler) molecules. This process reduces the average kinetic energy of the skin and its surrounding sweat, resulting in a cooling sensation.

ALWAYS AIM FOR EXCELLENCE

BY ELLY KENEDDY NALITSO

0708838163- 0779031329

1/7/2025

ELLY KENEDDY

