



**Natural Sciences: NATS4**  
**NOTES AND ACTIVITY – US 7509**

**LESSION ONE**

**THEME:** Matter and Materials

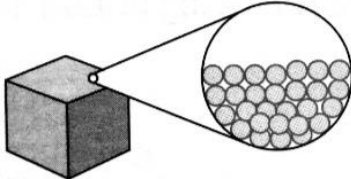
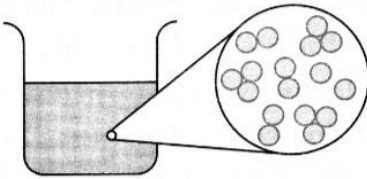
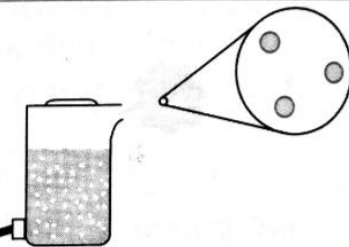
**TOPIC:** Phases of matter and Phase change of matter

At the end of this unit, you should be able to:

1. Define what is matter and various processes of phase change.
2. Describe and distinguish between the three phases of matter.
3. Understand the effect of temperature and heat (energy) on phase change of matter.

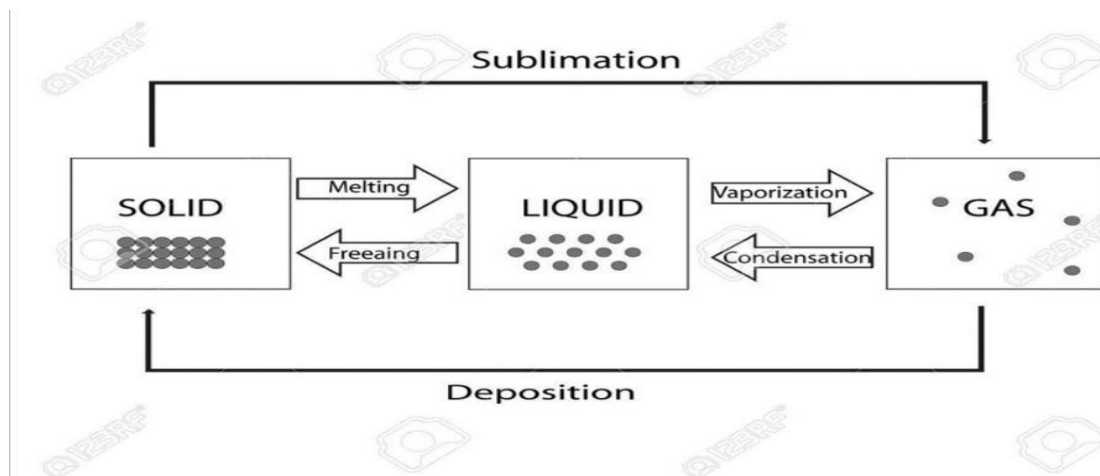
**A. PHASES OF MATTER**

1. Matter is anything that occupies space and has mass
2. Matter occurs in three different phases or states (i.e. **solid, liquid and gas**).
3. The three phases/states of matter have their particular characteristics and behave in particular ways because the particles that make them up move in different ways.

<b>solid</b>	$\begin{matrix} \text{melting} \\ \rightleftharpoons \\ \text{freezing} \end{matrix}$	<b>liquid</b>	$\begin{matrix} \text{boiling} \\ \rightleftharpoons \\ \text{condensing} \end{matrix}$	<b>gas</b>
 <p>The particles in a solid are:</p> <ul style="list-style-type: none"><li>• very close together</li><li>• arranged in regular rows</li><li>• held together very tightly</li><li>• not moving from their position but vibrating</li></ul>	 <p>The particles in a liquid are:</p> <ul style="list-style-type: none"><li>• touching but further apart</li><li>• not regularly arranged</li><li>• held together loosely</li><li>• moving by sliding past each other</li></ul>	 <p>The particles in a gas are:</p> <ul style="list-style-type: none"><li>• very far apart</li><li>• randomly arranged</li><li>• free to move (diffuse)</li><li>• moving in all directions, occasionally colliding</li></ul>		

## B. PHASE CHANGES OF MATTER

1. Phase change occurs when a substance changes from one physical state (solid, liquid or gas) to another.
2. A phase change takes place when there is a change in the arrangement of the particles due to the absorption or release of energy.

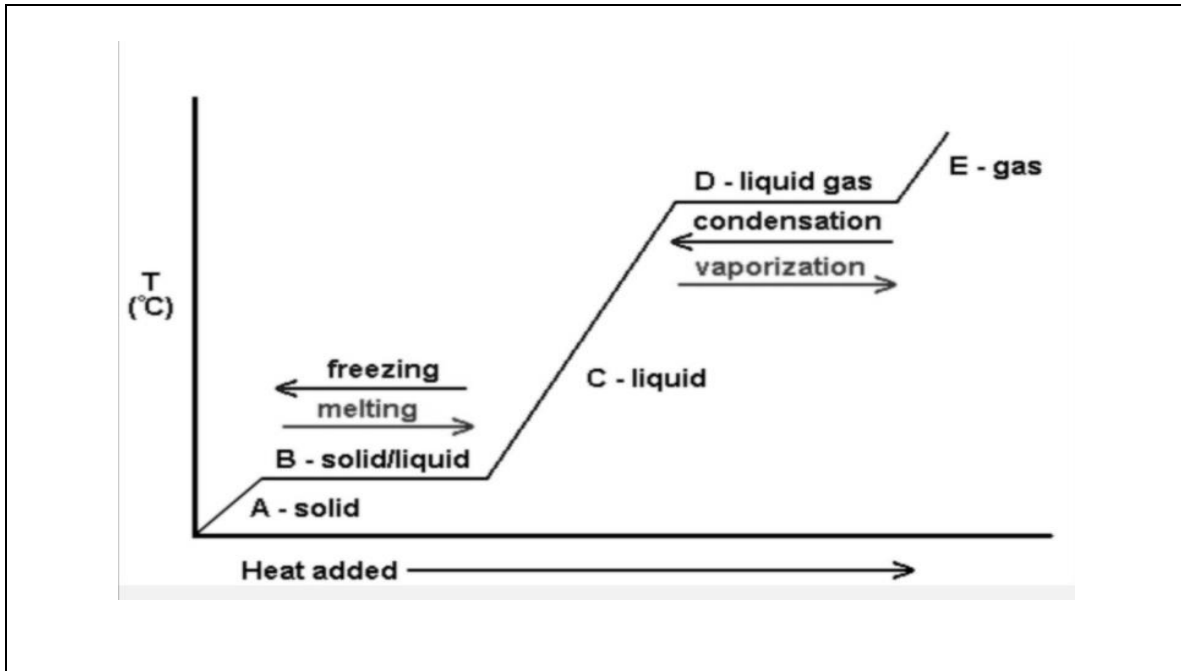


## C. PROCESSES OF PHASE CHANGES OF MATTER

PROCESS	PHASE CHANGE	EXAMPLE
Melting	Solid to liquid	A bar of chocolate left in the sun melts
Freezing	Liquid to solid	Cool drink left too long in fridge freezes to ice
Evaporation	Liquid to gas (vapour)	Wet clothes hanging to dry on a washing line
Condensation	Gas to liquid	Steam changes to droplets on the lid of the pot
Sublimation	Solid to gas	Dry ice or steam ice used by mobile ice cream sellers
Deposition	Gas to solid	Thin layer of ice forming on windows during winter

**N.B:** **BOILING** – Is the process at which a liquid change to a gas when it reaches its *boiling* point.

## D. PHASE CHANGE GRAPHS



The Phase Change diagram above shows various processes of how phases of matter (solid, liquid and gas) transform to another for TWO scenarios, i.e. FORWARD phase change wherein a rise in temperature increases heat and vice versa for the REVERSE phase change.

The following explanation is for the forward phase change

- At point A, we have a substance in a solid state that absorbs energy in the form of heat through an endothermic reaction. Note the gradual temperature rise.
- At B, the substance experiences a phase change as it turns from solid to liquid at an increased heat and constant temperature.
- As the heat keeps rising, the solid substance is now completely liquid at point C and the temperature of the liquid also increases for quite some time.
- At point D, the liquid substance turns to gas, another phase change, at a constant temperature and increasing heat.
- As the temperature reaches its maximum, the substance is completely turned to a gaseous phase.

### ACTIVITY

1. Matter is defined as “*anything that occupies space and has mass*”.

Is AIR an example of matter? Justify your answer in terms of it occupying space and having mass.

2. Name ONE of the three phases of matter. Describe the strength of force of attraction between its particles.
3. Briefly explain why ice as a solid floats in water as a liquid.
4. Which phase of matter (solid, liquid or gas) transmits sound the quickest? Justify your answer.

***For Question 6 to 9, refer to the Phase Change Graph in the notes:***

5. Explain why the temperature does not change at points B and D.
  6. At which point (from A to E) does the temperature reading is 100°C. What do we call this process?
  7. What physical phenomenon is indicated by opposite arrows in point B?
  8. Does the graph illustrate a physical or chemical change?
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