

CHAPTER-1

MATTER IN OUR SURROUNDINGS

SUMMARY

Matter - Everything is made up of matter.
Early Indian philosophers classification of matter : Air, Earth, fire, sky and water.
Modern scientists have evolved two types of matter based on their physical and chemical nature.

Physical Nature of Matter

- Matter is made up of particles
- These particles are called atoms.

Size of Particles of Matter

- These particles of matter are too small so they cannot be seen by naked eyes or simple microscope.

Characteristics of Particles of Matter

- i. Particles of matter have space between them.
 - ii. Particles of matter are continuously moving.
 - iii. Particles of matter attract each other.
- Diffusion - Due to Brownian movement
- intermixing of particles of matter.

Different states of matter

- The solid state
- The liquid state
- The gaseous state

Change of State of matter

Matter can change its state

- Solid to liquid → Melting or fusion
- Liquid to Gas → Vapourisation
- Liquid to solid → Solidification or freezing
- Solid to Gas → Sublimation
- Gas to liquid → Condensation
- Liquid to Gas in any temperature → Evaporation

Effect of temperature

- Melting point, Boiling point, Latent heat, Latent heat of fusion and Latent heat of vapourisation.

Effect of Pressure

Applying pressure and reducing temperature can liquefy gases.

Evaporation

- factors affecting evaporation
 - Increase of Surface area
 - Increase of temperature
 - Decrease in humidity
 - Increase in wind speed.
- evaporation gives cooling effect.

CHAPTER - 1

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Some Important Terms:

- i. Matter: Anything that occupies space and has mass is called matter.
- ii. Volume: The amount of space occupied by an object is called volume.
- iii. Diffusion: The intermixing of particles of two different types of matter on their own is called diffusion.
- iv. Intermolecular force of attraction: The force of attraction between the particles of matter is called intermolecular force of attraction.
- v. Intermolecular space: The space between the particles of matter is called intermolecular space.
- vi. fluid: A substance which can flow easily.
- vii. Density: The mass per unit volume of a substance is called density.
- viii. Vapourisation: The process of boiling, i.e., change of liquid state into gaseous state is known as vapourisation.
- ix. Evaporation: The phenomenon of change of liquid into gas at any temperature below its boiling point is called evaporation. It is surface phenomenon.

X. Latent heat of fusion: The amount of heat energy required to change 1kg of a solid into liquid at atmospheric pressure without any change of temperature at its melting point is known as latent heat of vaporisation.

XI. Latent heat of vaporisation: The amount of heat energy required to change 1kg of a liquid into gas at atmospheric pressure without any change of temperature at its boiling point is known as latent heat of vaporisation.

Exercise

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Q1: Which of the following are matter:

Matter	Not matter
Chair, air, almonds, water, cold drink	love, smell, hate, thought, cold.
Smell of perfume.	

Q2: Give reason for the following observation:

"The smell of hot sizzling food reaches you several metres away, but to get the smell from cold food, you have to go close"

Ans: The rate of diffusion is very high in case of gases. And as the temperature increases the rate of diffusion increases. So, the particles of hot sizzling food mix with the particles of air and reach us several metres away and in case of cold food, the food particles do not mix with the particles of air easily. Hence, we have to go close to it to get the smell of cold food.

Q3: A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?

Ans: This observation shows the particulate property of matter. As the person swims, his/her body displaces the particles of water and thus cuts through stream.

Q4: What are the characteristics of the particles of matter?

Ans:

Three characteristics of particles of matter are:

- i. Particles of matter have space between them.
- ii. Particles of matter attract each other.
- iii. Particles of matter are continuously moving.

Exercise

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Q1:

The mass per unit volume of a substance is called density.

(density = mass/volume)

Arrange the following in order of increasing density - air, exhaust from chimneys, honey, water, chalk, cotton and iron.

Ans:

Air, exhaust from chimneys, cotton, water, honey, chalk, iron.

Q2:

a) Tabulate the differences in the characteristics of states of matter

b) Comment upon the following:

rigidity, compressibility, fluidity, filling a gas container, shape, Kinetic energy and density.

a)

Characteristics	Solid	Liquid	Gas
1. Shape	fixed shape	no fixed shape	no fixed shape
2. Volume	fixed volume	fixed volume	no fixed volume
3. Rigidity	Rigid, can't flow	not rigid, can flow	not rigid, can flow
4. Inter-molecular force	maximum	less than solid	Very less
5. Inter-molecular space	Very less	more than solid	maximum
6. Compressibility	negligible	compressible	highly compressible

b) i) Rigidity: The tendency of a substance to retain/maintain their shape when subjected to outside force.

ii) Compressibility: The matter has inter-molecular space. The external force applied on the matter can bring these particles closer. This property is called compressibility. Gases and liquid are compressible.

iii) Fluidity: The tendency of particles to flow is called fluidity. Liquids and gases flow.

iv) filling of a gas container: Gases have particles which vibrate randomly in all the directions. The gas can fill the container.

v) Shape: Solids have maximum intermolecular force and definite shape. Whereas liquids and gases takes the shape of container.

vi) Kinetic energy: The energy possessed by particles due to their motion is called Kinetic energy. Molecules of gases vibrate randomly as they have maximum kinetic energy.

v) Density: It is defined as mass per unit volume, the solids have highest density.

Q3: Give reasons:

a) A gas fills completely the vessel in which it is kept,

Ans: The molecules of gas have high kinetic energy due to which they keep moving in all directions and hence fill the vessel completely in which they are kept.

b) A gas exerts pressure on the walls of the container.

Ans:- A gas exerts pressure on the walls of the container because the molecules of the gas are in constant random motion due to high kinetic energy. These molecules constantly vibrate, move and hit the walls of the container thereby exerting pressure on it.

c) A wooden table should be called a solid.

Ans:- The molecules of wooden table are tightly packed with each other, there is no intermolecular space, it cannot be compressed, it cannot flow, all these characteristics are of solid. So, wooden table should be called a solid.

d) We can easily move our hand in air but to do the same through a solid block of wood we need a Karate expert.

Ans:- We can easily move our hand in air but to do the same through a solid block of wood we need a karate expert. It is because the molecules of air has less force of attraction between them and a very small external force can separate them and pass through it. But in case

solids, the molecules have maximum force of attraction, the particles are tightly bound due to this force. Hence large amount of external force is required to pass through solid.

Q4:- Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Find out why.

Ans:- Ice is a solid but its density is lower than water due to its structure. The molecules in ice make a cage like structure with lot of vacant spaces, this makes ice float on water.

Exercise

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Q1:- Convert the following temperature to Celsius scale:

a) 300 K

$$300 - 273 = 27^{\circ}\text{C}$$

b) 573 K

$$573 - 273 = 300^{\circ}\text{C}$$

Q2:- What is the physical state of water at:

a) 25°C = gas

b) 100°C = liquid as well as gas

Q3:- For any substance, why does the temperature remain constant during the change of state?

Ans: It is due to the latent heat as the heat supplied to increase the temperature of the substance is used up to transform the state of matter of the substance hence the temperature stays constant.

Q4:- Suggest a method to liquefy atmospheric gases.

Ans: It can be achieved by either increasing the pressure or decreasing the temperature which ultimately leads to the reduction of spaces between molecules.

Exercise

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Q1:- Why does a desert cooler cool better on a hot dry day?

Ans: It is because the temperature is high and it is less humid on a hot dry day which enables better evaporation. High levels of this evaporation provide better cooling effects.

Q2: How does the water kept in an earthen pot (matka) become cool during Summer?

Ans: The earthen pot is porous with lot of pores on it, the water oozes out through these pores and the water gets evaporated at the surface of the pot thereby causing cooling effect. This makes the pot cold and the water inside the pot cools by this process.

Q3: Why does our palm feel cold when we put some acetone or petrol or perfume on it?

Ans: Acetone, petrol or perfume evaporate when they come into contact with our skin. The evaporation causes cooling sensation in our hands.

Q4: Why are we able to sip hot tea or milk faster from a saucer rather than a cup?

Ans: Tea in a saucer has larger surface area than a cup. The rate of evaporation is faster with increased surface area. The cooling of tea in saucer takes place sooner than in a cup. Hence we are able to sip hot tea or milk faster from a saucer rather than a cup.

Q5: What type of clothes should we wear in summer?

Ans: We should wear light coloured cotton clothes in summer. Light colours because it reflects heat. Cotton clothes because it has pores in it, which absorbs sweat and allows the sweat to evaporate faster thereby giving cooling effect.

Exercise

Q1: Convert the following temperature to the celsius scale.

a) 293K

$$293 - 273 = 20^\circ\text{C}$$

b) 470K.

$$470 - 273 = 197^\circ\text{C}$$

Q2: Convert the following temperature to the Kelvin scale.

a) 25°C

$$25 + 273 = 298\text{K}$$

b) 373°C

$$373 + 273 = 646\text{K}$$

Q3: Give reason for the following observations

a) Napthalene balls disappear with time without leaving any solid.

Ans: Napthalene balls disappear with time without leaving any solid, because napthalene balls sublime in nature and directly changes into vapour state without leaving any solid.

b) We can get the smell of perfume sitting several metres away.

Ans: We can get the smell of perfume sitting several metres away because perfume contain volatile solvent and diffuse faster and can reach people sitting several metres away.

Q4: Arrange the following substances in increasing order of attraction between the particles - water, sugar, oxygen.

Ans:

Oxygen > water > sugar
(gas) (liquid) (solid)

Q5: What is the physical state of water at -

- a) 25°C b) 0°C c) 100°C

25°C is liquid

0°C is solid or liquid (transition phase)

100°C is liquid and gas (transition phase)

Q6: Give two reasons to justify

- a) Water at room temperature is a liquid
b) an iron almirah is a solid at room temperature.

- a) Water at room temperature is a liquid because its freezing point is 0°C and boiling point is 100°C .
- b) An iron almirah is a solid at room temperature because melting point of iron is higher than room temperature.

Q7: Why is ice at 273K more effective in cooling than water at the same temperature?

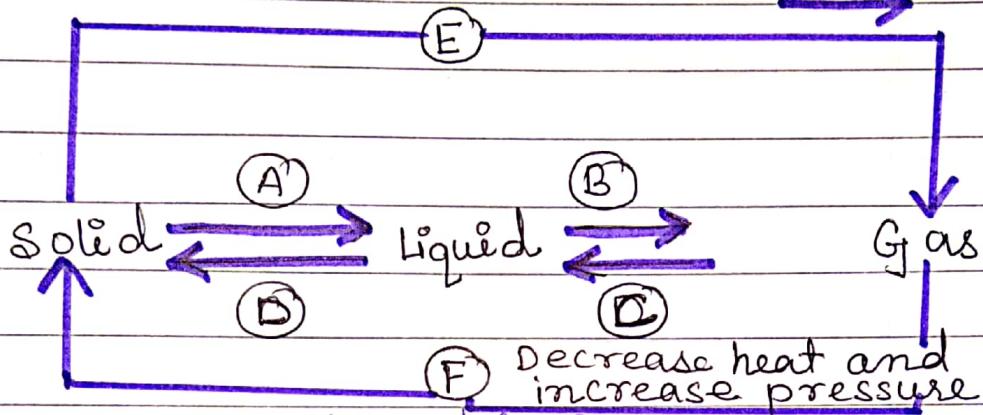
Ans: Ice at 273K will absorb heat energy or latent heat from the medium to overcome the fusion to become water. Hence the cooling effect of ice is more than the water at same temperature because water does not absorb this extra heat from the medium.

Q8: What produces more severe burns, boiling water or steam?

Ans: Steam at 100°C will produce more severe burns as extra heat is hidden in it called latent heat whereas the boiling water does not have this hidden heat.

Q9: Name A, B, C, D, E and F in the following diagram showing change in its state

- Increase heat and decrease pressure



A - melting / fusion

B - Vapourisation/ evaporation

C - Condensation

D - Solidification

E - Sublimation

F - Sublimation