1

Matter in Our Surroundings

In the Chapter

Matter is composed up of small particles.

- The matter around us exists in three states—liquid, solid and gas.
- The forces of attraction between the particles are maximum in case of solids, intermediate in liquids and minimum in gases.
- The arrangement of particles is most ordered in the case of solids, in the case of liquids, layers of particles can slip and slide over each other while for gases, there is no order, particles just move about randomly.
- The spaces in between the constituent particles and kinetic energy of the particles are minimum in solids, intermediate in liquids and maximum in gases.
- The states of matter are inter-convertible. The state of matter can be changed by changing pressure or temperature.
- Boiling is a bulk phenomenon. Particles from the bulk (whole) of the liquid change into vapour state.
- Sublimation is the change of gaseous state directly to solid state without going through liquid state, and vice versa.
- Evaporation is a surface phenomenon. Particles from the surface obtain enough energy to overcome the forces of attraction present in the liquid and convert into the vapour state.
- The rate of evaporation mainly depends upon the surface area exposed to the atmosphere, the temperature, the humidity and the wind speed.
- Latent heat of vaporisation is the heat energy required to change 1 kg of a liquid to gas at atmospheric pressure at its boiling point.
- Evaporation causes cooling.
- Latent heat of fusion is the amount of heat energy required to change 1 kg of solid into liquid at its melting point.

Intext Exercises

Page No. 3

1. Which of the following are matter? Chair, air, love, smell, hate, almonds, thought, cold, colddrink, smell of perfume.

Matter	Not Matter
Chair, air	Love, smell, hate
almonds, cold drink	thought, cold smell of perfume

2. Give reasons 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. The particles of hot sizzling food mixes with the particles of air and reaches us several metres away. In case of cold food the food particles do not mix with the particles of air easily. The temperature increases the rate of diffusion. Hence we have to go close to it to get the smell.

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

Ans. This shows that liquids are compressible. The intermolecular space between the particles of liquids is greater as compared to the solids. Hence when the diver dives into water the particles of water get compressed.

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

Ans. (i) Particles of matter are continuously moving, that is, they possess kinetic energy.
(ii) Particles of matter intermix on their own with each other. They do so by getting into the spaces between the particles.

Page No. 6

1. 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 chemnies, water, honey, cotton, chalk, iron.

2. (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.

Ans.

S.No.	Property	Solid	Liquid	Gas
1.	Shape	They have a definite shape.	They do not have a definite shape.	They do not have a definite shape.
2.	Volume	They have a fixed volume.	They have a fixed volume.	They do not have a fixed volume.
3.	Density	They have densities.	They generally have lower densities as compared to solids.	They have almost negligible densities as compared to solids and liquids.
4.	Rigidity	They are rigid.	They are not rigid.	They are not rigid.

5.	Fluidity	They are not fluid.	They are fluid.	They are fluid.
6.	Com-pressibility	They are incompressible.	They are more compressible as compared to the solids.	They have compressibility.
7.	Filling the container	They do not fill their container completely.	They fill their container completely.	They fill their container completely.
8.	Kinetic energy	The solid particles have mini kinetic energy.	The liquid particles have more kinetic energy than solid.	The gaseous particles have max. kinetic energy.

3. Give reasons

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

Ans. A gas fills completely the vessel in which it is kept due to large intermolecular space between the gaseous particles and high kinetic energy of the particles. Moreover the gas is fluid.

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

Ans. The kinetic energy of the particles in gaseous state is the maximum. Particles move about randomly at high speed. Due to random movement the particles hit each other and also the walls of the container. The pressure exerted by the gas is because of this force exerted by gas particles per unit area of the container.

(c) A wooden table should be called a solid.

Ans. A wooden table should be called a solid because it has a definite shape, distinct boundary and fixed volume.

(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. The particles of air have weak intermolecular force of attraction. They also have a large intermolecular space between them. As a result we can easily move our hand in air. In case of a solid block of wood or brick, the particles are closely packed having a strong intermolecular force of attraction and very less intermolecular space. Hence, it is difficult to move our hand through it.

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

Ans. Ice has greater volume. Hence, it has less density as compared to water. Thus, it floats on water.

Page No. 9

1. Convert the following temperature to celsius scale:

a. 300 K **b. 573 K.**

Ans. a. 300 K

$= (300 - 273)°C$

$= 27°C$

b. 573 K

$= (573 - 273)°C$
$= 300°C$

2. What is the physical state of water at:
a. 250°C b. 100°C ?

Ans. a. At 250°C the physical state of water is gas.
b. At 100°C the physical state of water changes from liquid to vapour.

3. For any substance, why does the temperature remain constant during the change of state?

Ans. The temperature remains constant during the change of state because the heat gets used up in changing the state by overcoming the forces of attraction between the particles. The excess heat is absorbed by the particles in the form of latent heat.

4. Suggest a method to liquefy atmospheric gases.

Ans. The air is compressed by increasing the pressure and is then cooled by decreasing the temperature to get liquid air.

Page No. 10

1. Why does a desert cooler cool better on a hot dry day?

Ans. A cooler cools better on a hot dry day because the rate of evaporation is directly proportional to the temperature and inversely proportional to humidity. Air around us cannot hold more than a definite amount of water vapour at a given temperature. On a hot dry day, the rate of evaporation increases (air can hold more water vapour) thus causing a cooling effect.

2. How does the water kept in an earthen pot (matka) become cool during summer?

Ans. An earthen pot has a large number of extremely small pores. Water seeps out through them and evaporates from the surface of the pot, thereby cooling the whole system. The latent heat required for evaporation is taken from the water in the pot. As a result water becomes cool.

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

Ans. (i) When we put acetone on our palm the particles gain energy from the palm or surroundings and leave. The vapour present in the air on coming in contact with the cold beaker of ice loses energy and gets the surface of the palm giving a cooling feeling.
(ii) When we put acetoneon on our palm, the particles gain energy from the palm or surroundings and leave the surface of the palm giving a cool feeling.

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

Ans. We are able to sip hot teat faster from a saucer rather than a cup because a saucer has a greater surface area. As a result rate of evaporation increases and cools the tea.

5. What type of clothes should we wear in summer?

Ans. We should wear cotton clothes during summer season. During summer we perspire more because of the mechanism of our body to keep us cool. During evaporation the particles at the surface of the liquid gain energy from the surroundings and change into vapour. The heat energy equal to the latent heat of vaporization is absorbed from the body leaving the body cool. Cotton being a good absorber of water helps in absorbing the sweat and exposing it to the atmosphere for easy evaporation.

Exercise

1. Convert the following temperatures to the Celsius scale.
(a) 300 K (b) 573 K.

Ans. a. 300 K
$= (300 - 273)°C$
$= 27°C$

b. 573 K

= (573 – 273)°C = 300°C

2. Convert the following temperatures to the Kelvin scale.
(a) 25°C (b) 373°C.

Ans. a. 25°C

= (25 + 273) K = 298 K

b. 373°C

= (373 + 273) K = 646 K

3. Give reason for the following observations.

(a) Naphthalene balls disappear with time without leaving any solid.

Ans. Naphthalene balls disappear with time without leaving any solid because they undergo sublimation i.e., they directly change into vapour without passing through the liquid state.

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

Ans. The particles of perfume mix on their own with the particles of air around us and spread out. Due to this spreading of the particles we can get the smell of perfume sitting at a distance.

4. Arrange the following substances in increasing order of forces of attraction between the particles— water, sugar, oxygen.

Ans. The intermolecular force of attraction is least in gas, followed by liquid and maximum in gas. Therefore, it is least in oxygen followed by water and maximum in sugar.

5. What is the physical state of water at—
(a) 25°C (b) 0°C (c) 100°C ?

Ans. (a) 25°C – Liquid
(b) 0°C – Solid
(c) 100°C – liquid to vapour

6. Give two reasons to justify—

(a) water at room temperature is a liquid.

Ans. Water at room temperature is a liquid because it does not have a fixed shape. It takes the shape of the container where it is poured. Secondly, it can flow easily, hence it is not rigid but a fluid.

(b) An iron almirah is a solid at room temperature.

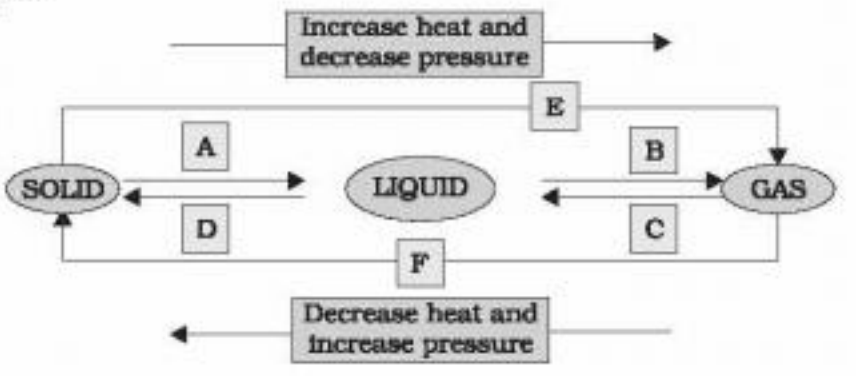
Ans. An iron almirah is a solid because it has a definite shape and a fixed volume. It does not flow, hence it is rigid.

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

Ans. The particles in ice at 273K have less energy as compared to the particles of water at 273K. Hence ice takes more heat energy from the surroundings and thus cause more cooling than water at the same temperature.

8. What produces more severe burns, boiling water or steam?

Ans. The particles in steam at 373K have more energy than water at the same temperature. This is because particles in steam have absorbed extra energy in the form of latent heat of vaporisation. So, when steam comes in contact with skin, it releases more heat than the boiling water would do at the same temperature. As a result, steam at 373K causes more severe burns than boiling water at the same temperature.



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

Ans. A – Fusion
B – Vaporisation
C – Condensation
D – Solidification
E – Sublimation
F – Sublimation

Additional Questions

1. Osmosis is a special kind of diffusion. Comment.

Ans. Yes, this is true. In both the phenomenon, there is movement of particles from region of higher concentration to that of lower concentration. However in the case of osmosis, the movement of solvent is through a semi-permeable membrane, which is permeable only to water molecules.

2. Water as ice has a cooling effect, whereas water as steam may cause severe burns. Explain these observations.

Ans. In case of ice the water molecules have low energy while in the case of steam the water molecules have high energy. The high energy of water molecules in steam is transformed as heat and may cause burns. On the other hand, in case of ice, the water molecules take energy from the body and thus give a cooling effect.

3. Alka was making tea in a kettle. Suddenly she felt intense heat from the puff of steam gushing out of the spout of the kettle. She wondered whether the temperature of the steam was higher than that of the water boiling in the kettle. Comment.

Ans. The temperature of both boiling water and steam is 100°C. But steam has more energy because of latent heat of vapourisation.

4. It is a hot summer day. Priyanshi and Ali was wearing cotton and nylon clothes, respectively. Who do you think would be more comfortable and why?

Ans. Cotton being a better absorber of water than nylon helps in absorption of sweat followed by evaporation which leads to cooling. So Priyanshi is more comfortable, whereas Ali is not so comfortable.

5. A substance upon heating directly changes into gaseous state. What is this changed called?

Ans. It is known as sublimation.

6. Arrange the following in the increasing order of force of attraction between their particles : oxygen, salt, milk.

Ans. Oxygen, Milk and Salt.

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

Ans. A sponge has minute holes in it, in which air is trapped. When we press it, the air is expelled out and therefore we are able to compress it.

8. What happens when you open a bottle of perfume?

Ans. The particles of perfume mix with particles of air and spread out eventually and reach to us even at a distance. This is due to diffusion of perfume particles into particles of air.

9. Name two substances which sublime on heating?

Ans. 1. Iodine, 2. Ammonium Chloride.

10. How does the pressure help in the liquefication of a gas.

Ans. The particles or molecules of a gas come closer and closer as the pressure is being increased

gradually. They ultimately condense and as a result, the gas liquefies or changes into the liquid state.

11. State the characteristics of gas used in supplying oxygen cylinders to hospitals.

Ans. Gases have high compressibility.

12. Ice and water are essentially the same substance. Mention any two differences in their properties.

Ans. (i) Ice has a fixed shape and a fixed volume. Water has a fixed volume but no fixed shape.
(ii) Ice do not flow but water flows easily.

13. Why dry ice does not wet the surface on which it is kept?

Ans. Dry ice sublimes to form carbon dioxide gas.

14. Why does evaporation cause cooling?

Ans. During evaporation, heat is absorbed from the nearest surrounding particles, descreasing their kinetic energy and thus causes cooling.

15. Name the phenomenon in which particles of two or more substances intermix on their own.

Ans. Diffusion.

16. Give one example to show that gases diffuse in liquids.

Ans. The carbon dioxide gas and oxygen gas present in air diffuse into water of ponds, lakes, rivers and sea, and dissolve in it.

17. Why is solid carbon dioxide known as dry ice?

Ans. Since solid carbon dioxide directly changes into carbon dioxide gas (or sublimes) and does not melt to produce a liquid, it is called dry ice.

18. Why does the level of water not change when salt is dissolved in it?

Ans. Because there are spaces between the particles of water.

19. What is the difference between a gas and a vapour?

Ans. A gas is that state of matter which has no definite shape and no definite volume. A vapour is a gaseous state of a substance which exists as a liquid at room temperature.

20. When we pour some acetone or perfumes on our palm, we get cooling sensation. Assign reason.

Ans. Both acetone and perfume are low boiling liquids. When any of them is poured on the palm, it readily changes into vapours of evaporates. For this it needs some energy which is taken from the palm. The temperature of the palm gets lowered and we get a cooling sensation.

21. Ice-cream appears colder to the mouth than water at 0°C. Why?

Ans. Ice-cream appears colder to the mouth than water at 0°C due to its high latent heat of fusion. Every gram of ice-cream absorbs 336 Joules of heat energy from mouth.

22. Solids are generally very heavy while gases are light. Explain.

Ans. In the solids, the particles are very closely packed. As a result, the number of particles per unit volume is quite large. Therefore, the solids are normally quite heavy. In the gases, the particles are loosely packed. The number of particles per unit volume is comparatively small. Therefore, gases are light.

23. Water as ice has a cooling effect. Where as, water as steam may cause severe burns. Explain these observations.

Ans. In case of ice the water molecules have low energy while in the case of steam the water molecules have high energy. The high energy of water molecules in steam is transformed as heat and may cause burns. On the other hand, in case of ice, the water molecules take energy from the body and thus give a cooling effect.

24. Explain the diffusion of copper sulphate solution into water.

Ans. Copper sulphate crystals are blue in colour. When a few crystals of copper sulphate are placed at the bottom of a beaker containing water, then the water slowly turns blue. This is due to the diffusion of blue coloured copper sulphate solution into water.
The copper sulphate crystals dissolve slowly and form a layer of blue solution at the bottom of the beaker. This blue copper sulphate solution diffuses upwards into clear water, and clear water diffuses downwards into blue solution. This diffusion goes on until the whole water turns blue. So the spreading of blue colour is due to the diffusion of blue copper sulphate solution and water into each other.

25. Benzene is a liquid. At 80°C, liquid benzene is in euqilibrium with its vapours. It is found that particles of benzene vapours are more energetic than particles of liquid benzene. Explain the observation.

Ans. Particles of benzene vapours are more energetic because these have absorbed extra energy in the form of latent heat of vaporisation.

26. How does our body maintain its temperature during summer?

Ans. During summer, water from the body gets evaporated. In the process water takes heat energy equal to latent heat of vaporization from the body leaving the body cool.

Multiple Choice Questions

1. During evaporation, particles of a liquid change to vapours only:
(a) from the surface
(b) from the bulk
(c) from both surface and bulk
(d) neither from surface nor from bulk

Ans. (a) Evaporation of a liquid takes place from the surface only since evaporation is a surface phenomenon.

2. In summer, we prefer wearing
(a) dark nylon clothes
(b) white cotton clothes
(c) white silk clothes
(d) dark silk clothes

Ans. (b) White cotton clothes are maximum porous. The sweat from the pores of the body during the summer can easily pass through these pores and evaporate. Since cooling is caused during evaporation, these clothes provide maximum relief in summer.

3. Which of the following is not a matter?
(a) Air
(b) Feeling of cold
(c) Dust
(d) Humidity

Ans. (c) Feeling of cold is simply a sensation. It is not a matter.

4. Solids cannot be compressed because:
(a) constituent particles are very closely packed
(b) inter particle attractive forces are weak
(c) movement of constituent particles is restricted
(d) constituent particles diffuse very slowly.

Ans. (a) Constituents particles are very closely packed.

5. Which of the following will not undergo sublimation?
(a) Camphor
(b) Ammonium Chloride

(c) Iodine
(d) Sodium Chloride

Ans. (d) Sodium Chloride does not sublime.

6. The interparticle forces are the strongest in :
(a) Ammonia
(b) Ethyl alcohol
(c) Carbondioxide
(d) Sodium bromide

Ans. (d) Sodium bromide is a crystalline solid and interparticle forces are the strongest.

7. In the sublimation process:
(a) solid changes directly to the vapour state
(b) solid initially melts and then changes to vapour state
(c) liquid changes to vapour state
(d) none of the above

Ans. (a) solid changes directly to the vapour state

8. Which one of the following sets of phenomena would increase on raising the temperature?
(a) Diffusion, evaporation, compression of gases
(b) Evaporation, compression of gases, solubility
(c) Evaporation, diffusion, expansion of gases
(d) Evaporation, solubility, diffusion, compression of gases

Ans. (c) On raising the temperature, random motion of the particles of matter increases. Thus the rate of evaporation, diffusion and expansion of gases increases.

9. During summer, water kept in an earthen pot becomes cool because of the phenomenon of
(a) diffusion (b) transpiration
(c) osmosis (d) evaporation

Ans. (d) Water evaporates taking heat from the rest of the water in the pot. Thus the temperature of water in the earthen pot falls and the water gets cooled.

10. A few substances are arranged in the increasing order of forces of attraction between their particles. Which one of the following represents a correct arrangement ?
(a) water, air, wind,
(b) oxygen, water, sugar
(c) air, sugar, oil
(d) salt, juice, air

Ans. (b) oxygen, water, sugar

11. Which condition out of the following increase the evaporation of water?
(a) Increase in temperature of water
(b) Decrease in temperature of water
(c) Adding common salt to water
(d) Less exposed surface area of water

Ans. (a) Increase in temperature of water