

Chapter - 1

Matter in our surrounding

Multiple Choice Questions

1. 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

Soln:

Answer is c) Evaporation, diffusion and expansion of gases

Explanation:

Particles of matter are continuously moving as they possess kinetic energy. When temperature is raised particles of matter intermix with each other which is called diffusion.

Evaporation means conversion of liquid state into vapour state. When we increase temperature molecules move and vibrate so quickly that they escape into the atmosphere in the form of vapours.

Increase in temperature causes the molecules to move faster; this results in expansion of gases.

2. Seema visited a Natural Gas Compressing Unit and found that the gas can be liquefied under specific conditions of temperature and pressure. While sharing her experience with friends she got confused. Help her to identify the correct set of conditions

- (a) Low temperature, low pressure
- (b) High temperature, low pressure
- (c) Low temperature, high pressure
- (d) High temperature, high pressure

Soln:

Answer is c) Low temperature, high pressure

Explanation:

To compress gas into liquid, low temperature and high pressure is required. Between the particles of gas there is a lot of space. On applying pressure particles get closer and they start attracting each other to form a liquid. A lot of heat is generated when gas is compressed; hence it is necessary to cool it. Cooling lowers the temperature of compressed gas and helps in liquefying it.

3. The property to flow is unique to fluids. Which one of the following statements is correct?

- (a) Only gases behave like fluids
- (b) Gases and solids behave like fluids
- (c) Gases and liquids behave like fluids
- (d) Only liquids are fluids

Soln:

Answer is c) Gases and liquids behave like fluids

Explanation:

In gases and liquids intermolecular force of attraction between the particles is less and they facilitate flow of these states of matter.

4. During summer, water kept in an earthen pot becomes cool because of the phenomenon of

- (a) diffusion
- (b) transpiration
- (c) osmosis
- (d) evaporation

Soln:

Answer is d) evaporation

Explanation:

Evaporation of water through pores of earthen pot reduces temperature of immediate surroundings. This makes the water cool after some time.

Movement of water through plants and evaporation through its aerial parts is called transpiration.

Diffusion is the movement of a substance from an area of higher concentration to area of lower concentration

If molecules of a solvent tend to pass through a semipermeable membrane from a less concentrated solution into a more concentrated one it is called osmosis.

5. 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) Air, sugar, oil
- (c) Oxygen, water, sugar
- (d) Salt, juice, air

Soln:

Answer is c) Oxygen, water, sugar

Explanation:

Intermolecular force of attraction is less in gases than liquid and solid. Solids have higher intermolecular attraction compared to liquid. In the answer Oxygen is a gas which has lesser intermolecular attraction than water-a liquid and sugar- a crystalline solid.

6. On converting 25°C, 38°C and 66°C to kelvin scale, the correct sequence of temperature will be

- (a) 298 K, 311 K and 339 K
- (b) 298 K, 300 K and 338 K
- (c) 273 K, 278 K and 543 K
- (d) 298 K, 310 K and 338 K

Soln:

Answer is a) 298 K, 311 K and 339 K

Explanation:

Add 273 to respective temperature to get temperature in kelvin. 25°-298K, 38°-311K, 66°-339K

7. Choose the correct statement of the following

- (a) Conversion of solid into vapours without passing through the liquid state is called sublimation.
- (b) Conversion of vapours into solid without passing through the liquid state is called vaporisation.
- (c) Conversion of vapours into solid without passing through the liquid state is called freezing.
- (d) Conversion of solid into liquid is called sublimation.

Soln:

Answer is a) Conversion of solid into vapours without passing through the liquid state is called sublimation.

Explanation:

- Sublimations is a process in which a solid is converted into vapours without passing through liquid state.
- Vaporisation is a phase transition from liquid to vapours.
- Conversion of liquid to solid at substance's freezing temperature is called as freezing.

8. The boiling points of diethyl ether, acetone and n-butyl alcohol are 35°C, 56°C and 118°C respectively. Which one of the following correctly represents their boiling points in kelvin scale?

- (a) 306 K, 329 K, 391 K
- (b) 308 K, 329 K, 392 K
- (c) 308 K, 329 K, 391 K
- (d) 329 K, 392 K, 308 K

Soln:

Answer is c) 308 K, 329 K, 391 K

Explanation:

Temperature in Celsius can be converted into temperature in kelvin by adding 273 to the Celsius value. Boiling points of diethyl ether, acetone and n-butyl alcohol are 308 K, 329 K, and 391 K respectively.

9. Which condition out of the following will increase the evaporation of water?

- (a) Increase in temperature of water
- (b) Decrease in temperature of water
- (c) Less exposed surface area of water
- (d) Adding common salt to water

Soln:

Answer is a) Increase in temperature of water

Explanation:

Increase in temperature of water increase the kinetic energy of the water which will make more particles to attain enough energy to convert into vapour state. This is how increase in temperature favours evaporation.

On the other hand exposed surface is also responsible for the evaporation. Higher the exposed surface are higher will be the evaporation.

When common salt is added to water then surface is occupied by the solvent as well as non-volatile solute particles.

This make the escaping tendency of solvent particles decrease and thus the evaporation of water decreases. Hence options (b), (c) and (d) will decrease the evaporation of water.

10. In which of the following conditions, the distance between the molecules of hydrogen gas would increase?

- (i) Increasing pressure on hydrogen contained in a closed container
 - (ii) Some hydrogen gas leaking out of the container
 - (iii) Increasing the volume of the container of hydrogen gas
 - (iv) Adding more hydrogen gas to the container without increasing the volume of the container
- (a) (i) and (iii)
 - (b) (i) and (iv)
 - (c) (ii) and (iii)
 - (d) (ii) and (iv)

Soln:

Answer is c) ii and iii

Explanation

- To increase the intermolecular interaction either volume of Hydrogen gas should be reduced or container volume should be increase.
- By increasing the pressure or by adding Hydrogen without increasing container volume inter-molecular interaction would decrease.
- Water under study was found to boil at 102°C at normal temperature and pressure.

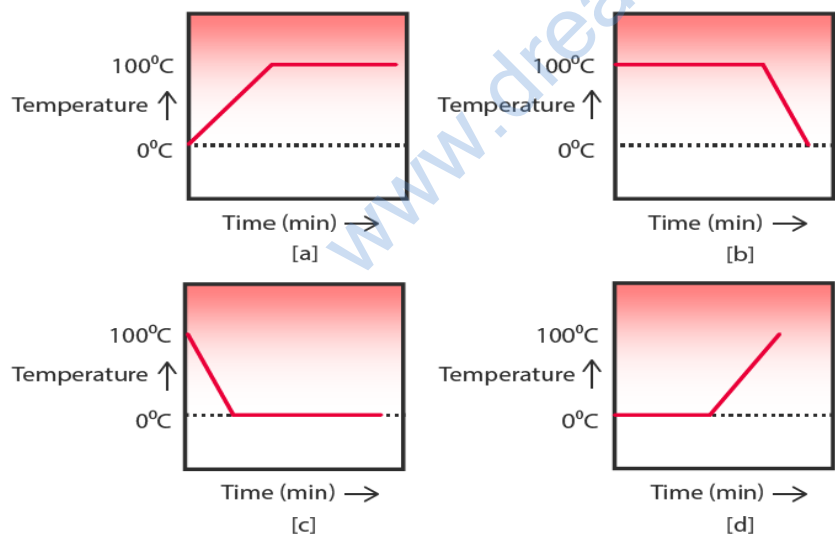
Short Answer Questions

11. A sample of water under study was found to boil at 102°C at normal temperature and pressure. Is the water pure? Will this water freeze at 0°C? Comment.

Soln:

Boiling point of pure water is 100 °C and melting point is 0°C at 1 atmospheric pressure. Here the water boils at 102 °C hence it is not a pure water and freezes at temperature below 0°C.

12. A student heats a beaker containing ice and water. He measures the temperature of the content of the beaker as a function of time. Which of the following (Fig. 1.1) would correctly represent the result? Justify your choice.



Soln:

Answer is d) because at the start of the experiment temperature of the mixture would be zero as water and ice will be in equilibrium. When students start heating initially latent heat will be utilised to melt the ice. Hence the temperature did not increase for certain amount of time. When students heat the mixture further the temperature of the water increases gradually.

13. Fill in the blanks:

(a) Evaporation of a liquid at room temperature leads to a ——— effect.

(b) At room temperature the forces of attraction between the particles of solid substances are ——— than those which exist in the gaseous state.

(c) The arrangement of particles is less ordered in the ——— state. However, there is no order in the ——— state.

(d) ——— is the change of solid state directly to vapour state without going through the ——— state.

(e) The phenomenon of change of a liquid into the gaseous state at any temperature below its boiling point is called ———.

Soln:

- a. Cooling
- b. Stronger
- c. Liquid, gaseous
- d. Sublimation, liquid
- e. Evaporation

14. Match the physical quantities given in column A to their S I units given in column B:

- | (A) | (B) |
|-----------------|------------------------------|
| (a) Pressure | (i) cubic metre |
| (b) Temperature | (ii) kilogram |
| (c) Density | (iii) pascal |
| (d) Mass | (iv) kelvin |
| (e) Volume | (v) kilogram per cubic metre |

Soln:

- (a) — (iii) The SI unit of pressure is pascal (denoted by P).
- (b) — (iv) The SI unit of temperature is "kelvin" (denoted by K).
- (c) — (v) The SI unit of density is kilogram per cubic metre (kg/m³).
- (d) — (ii) The SI unit of mass is kilogram (kg).
- (e) — (i) The SI unit of volume is m³.

15. The non S I and S I units of some physical quantities are given in column A and column B respectively. Match the units belonging to the same physical quantity:

(A)	(B)
(a) Degree Celsius	(i) kilogram
(b) Centimetre	(ii) Pascal
(c) Gram per centimetre cube	(iii) metre
(d) Bar	(IV) kelvin
(e) Milligram	(v) kilogram per metre cube

Soln:

- (a) — (iv) Degree Celsius and kelvin are the units of temperature.
- (b) — (iii) Centimetre and metre are the units of length.
- (c)—(v) Gram per centimetre cube and kilogram per metre cube are the units of density.
- (d) — (ii) Bar and pascal are the units of pressure.
- (e) - (i) Milligram and kilogram are the units of mass.

16. 'Osmosis is a special kind of diffusion'. Comment.

Soln:

Diffusion in liquids and gases is the movement of particles from low concentration to high concentration. Osmosis is the movement of particles from the low concentration to high concentration through the semi permeable membrane. This movement happens due to diffusion. Hence Osmosis is a special kind of diffusion.

17. Classify the following into osmosis/diffusion

- (a) Swelling up of a raisin on keeping in water.
- (b) Spreading of virus on sneezing.
- (c) Earthworm dying on coming in contact with common salt.
- (d) Shrinking of grapes kept in thick sugar syrup.
- (e) Preserving pickles in salt.
- (f) Spreading of smell of cake being baked throughout the house.
- (g) Aquatic animals using oxygen dissolved in water during respiration

Soln:

- a) Osmosis
- b) Diffusion
- c) Osmosis
- d) Osmosis
- e) Osmosis
- f) Diffusion
- g) Diffusion

Explanation:

a) Concentration of water will be more than water concentration in raisin. Hence there is a movement of water from higher concentration to lower concentration which will make the raisin swell up.

b) Microscopic virus get diffused in air.

c) Because of vary in concentration of water and solute. Water comes out of earthworm body making its cell to burst causing its death.

d) Thick sugar syrup has more solutes in it than grapes. Hence water moves out of the grapes from higher concentration to lower concentration hence grapes swell.

e) Salt helps to remove water from the cells and helps to preserve pickles. Pickling is intended to keep out oxygen. Pickling prevents oxidation of fruits and vegetables through the use of salt. Dry salt forms pickling brine and absorbs excess moisture from fruits and vegetables through the process of osmosis.

f) Particles containing smell diffuse into air to spread it throughout the house

g) When Aquatic animals breathe dissolved oxygen, oxygen diffuses directly into their blood without any membrane.

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

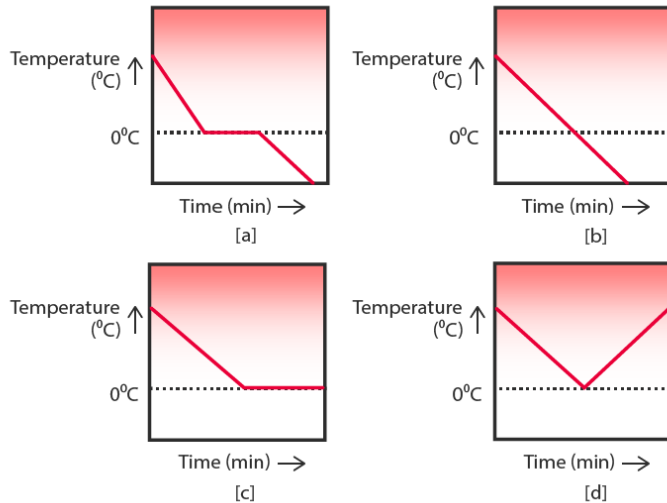
Soln:

Water as ice has less energy and water molecules absorb energy from our body to give cooling effect whereas steam has high energy and transfers high energy into our body which transforms as heat to cause burns.

19. 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.

Steam and the water temperature boiling in the kettle is the same. But the particles of steam have more energy in the form of latent heat of vaporisation than the particles of water. This energy is released when the steam condenses to water. Therefore, steam is hotter than the boiling water.

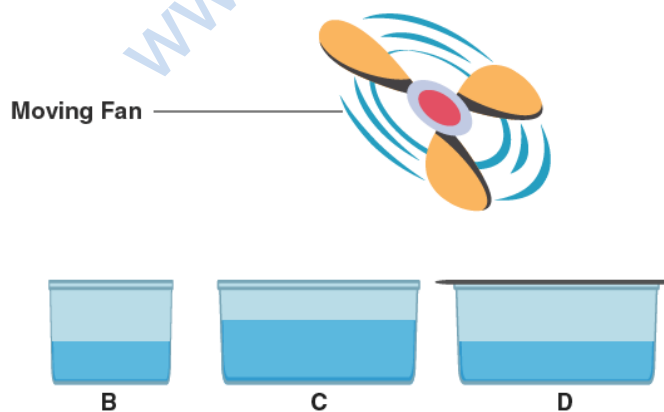
20. A glass tumbler containing hot water is kept in the freezer compartment of a refrigerator (temperature $< 0^{\circ}\text{C}$). If you could measure the temperature of the content of the tumbler, which of the following graphs (Fig.1.2) would correctly represent the change in its temperature as a function of time.



Soln:

Graph (a) is the right answer because water will cool initially till its temperature reaches 0°C . After reaching freezing point (0°C) temperature will remain constant till the water becomes ice. After that point temperature would decrease again.

21. Look at Fig. 1.3 and suggest in which of the vessels A, B, C or D the rate of evaporation will be the highest? Explain.



Soln:

Answer is C because evaporation increases with increase in the surface area. With increase in wind speed particles of water vapour will move away hence the rate of evaporation will be the highest.

22.

(a) Conversion of solid to vapour is called sublimation. Name the term used to denote the conversion of vapour to solid.

(b) Conversion of solid state to liquid state is called fusion; what is meant by latent heat of fusion? used to denote the conversion of vapour to solid.

Soln:

a) Sublimation is the term used to denote the conversion of vapour to solid.

b) The amount of heat energy released or absorbed when a solid changing to liquid at atmospheric pressure at its melting point is known as the latent heat of fusion.

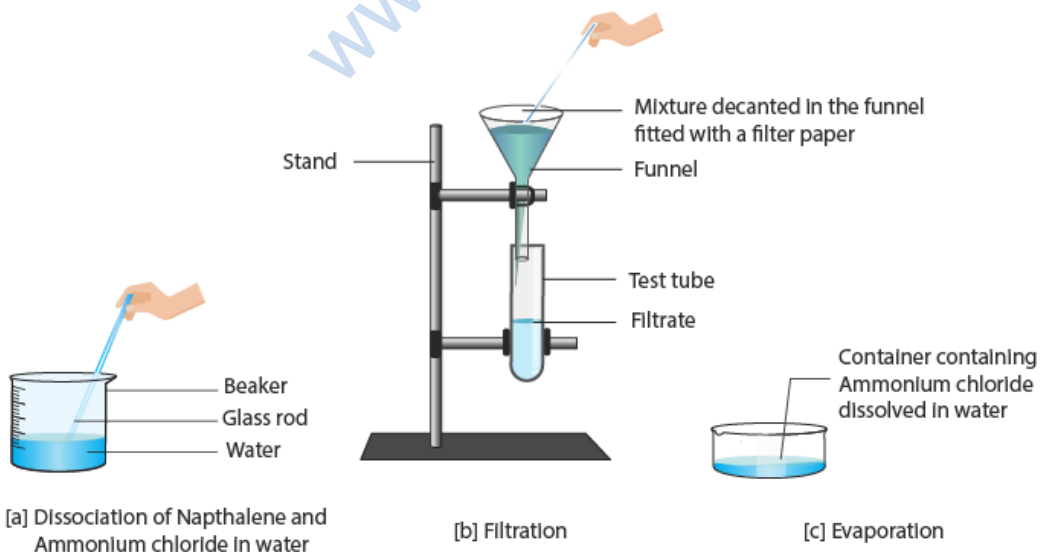
Long Answer Questions

23. You are provided with a mixture of naphthalene and ammonium chloride by your teacher. Suggest an activity to separate them with well labelled diagram.

Soln:

Naphthalene is a non-polar compound which will not dissolve in water. Similarly ammonium chloride is a polar compound which is soluble in water. Naphthalene is volatile in room temperature whereas ammonium chloride is volatile in high temperature.

The mixture of Naphthalene and ammonium chloride can be separated by decantation of aqueous mixture. Naphthalene remains undissolved in water and can be taken out in a funnel. The filtrate of ammonium chloride can be evaporated to obtain dry ammonium chloride.



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

Soln:

Hot summer leads to lot of sweating. Cotton absorbs lot of moisture whereas Nylon will not absorb the moisture as efficient as cotton. Hence cotton absorbs the sweat faster than Nylon does. Evaporation of moisture from the cotton cloth will give a cool feeling, especially when wind flows. Hence It can be concluded that Priyanshi will be more comfortable in summer days.

25. You want to wear your favourite shirt to a party, but the problem is that it is still wet after a wash. What steps would you take to dry it faster?

Soln:

Drying of clothes is due to process of evaporation hence following steps should be taken to dry the shirt faster.

1. Dry the shirt under fan with high speed. With increase in speed of fan water vapour move away with wind. This decreases water vapour in the surroundings which will increase the evaporation and the shirt gets dried faster.
2. Spread the shirt on a hanger which will increase surface area. Increase in surface area makes the shirt dry quickly.
3. Dry the shirt in sunlight. Because of high temperature more water vapour gets kinetic energy to get converted to vapour. This will fasten the process of evaporation and the shirt gets dried easily.
4. Iron the shirt. Heat increases the speed of vaporization and evaporation. This will make the shirt gets dried faster.

26. Comment on the following statements:

(a) Evaporation produces cooling.

(b) Rate of evaporation of an aqueous solution decreases with increase in humidity.

(c) Sponge though compressible is a solid.

Soln:

a) When liquid evaporates it takes latent heat from the object it touches. This will make the object gets cool. Hence evaporation causes cooling.

b) When there is increase in the humidity water vapours in the atmosphere will be more. Hence atmosphere will not take water vapours easily which decreases the process of evaporation.

c) Sponge is a solid because it has definite shape and volume which does not change until you press it. It has minute pores in which air is filled. When you press air passes out through pores this makes it a compressible solid.

27. Why does the temperature of a substance remain constant during its melting point or boiling point?

The temperature of a substance remains constant during melting and boiling points till the completion of melting and boiling because of latent heat of fusion used by the substances. Latent heat of fusion helps to overcome the force of attraction between particles of solid to change into liquid when they melt. Hence temperature remains constant.

In the same way during formation of vapours latent heat helps solid substance to convert into gaseous state. Hence temperature of a substance remains constant at boiling point.