Matter in Our Surroundings

Case Study Based Questions

Case Study 1

Every matter is made up of tiny particles. These particles are so tiny that they can't be seen with naked eyes.

The three characteristics shown by particles of matter are as follows:

(i) There are small voids between particles in a matter. This characteristic is the concept behind the solubility of a substance in other substances.

(ii) Particles of matter show continuous random movements, that is they possess kinetic energy. The spreading of ink in a beaker of glass, smell of agarbattis, etc. are few illustrations that show the movement of particles of a substance.

(iii) The particles of matter attract each other with a force called interparticle force of attraction.

Read the given passage carefully and give the answer of the following questions:

Q1. Spreading of fragrance of a burning incense stick in a room shows that:

a. particles of matter have spaces between them.

b. particles of matter attract each other.

c. particles of matter are constantly moving.

d. None of the above

Q2. What happens when we add sugar to water?

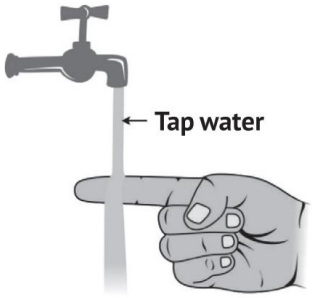
a. Volume of water doubles.

b. Volume of water decreases.

c. Volume of water remains the same.

d. None of the above

Q3. A stream of water cannot be cut by fingers. Which property of matter does this observation show?



a. Particles of matter attract each other.

b. Particles of matter have spaces between them.

c. Particles of matter are continuously moving.

d. None of the above

Q4. When we put some crystals of potassium permanganate in a beaker containing water, we observe that after sometime, the whole water turns pink. This intermixing of particles of two different types of matter on their own is called:

a. Brownian motion

b. melting

c. sublimation

d. diffusion

Q5. Why is the rate of diffusion of liquids higher than that of solids?

a. In the liquid state, particles are tightly packed as compared to solids.

b. In the liquid state, particles move freely as compared to solids.

c. In solid state, particles have least force of attraction between the particles.

d. In solid state, particles cannot be compressed easily.

Solutions

1. (c) particles of matter are constantly moving.

2. (c) Volume of water remains the same.

3. (a) Particles of matter attract each other.

4. (d) diffusion

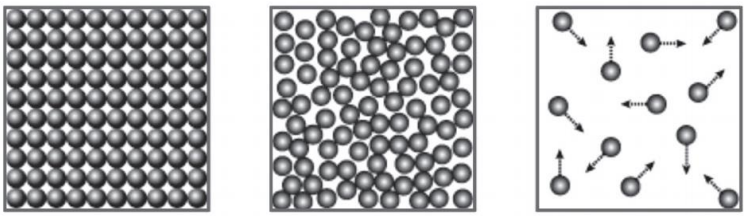
5. (b) In the liquid state, particles move freely as compared to solids.

Case Study 2

All the materials we see in our daily life are made up of matter. Matter can be classified into different states such as solid, liquid and gas on the basis of intermolecular forces and the arrangement of particles.

In a solid, particles are tightly packed together and have very low kinetic energy. They have a definite shape and a certain volume.

In a liquid, particles are loosely packed than in a solid and are able to flow around each other, giving the liquid an indefinite shape. In a gas, the particles have a great deal of space between them and have high kinetic energy. A gas has neither definite shape nor volume.



Solid Liquid Gas

Read the given passage carefully and give the answer of the following questions:

Q1. The forces of attraction between the particles of matter is maximum in:

a. iron rod b. kerosene oil

c. glycerine d. dry air

Q2. The substance with least interparticle space is:

a. methanol b. acetic acid

c. copper d. oxygen

Q3. Which of the following indicates the relative randomness of particles in the three states of matter?

a. Solid > Liquid >Gas b. Liquid < Solid < Gas

c. Liquid > Gas > Solid d. Gas > Liquid > Solid

Q4. Which of the following statements does not go with the liquid state?

a. Particles are loosely packed in the liquid state.

b. Fluidity is maximum in the liquid state.

c. Liquids cannot be compressed much.

d. Liquids take up the shape of any container in which they are placed.

Q5. The description of the particles of four substances

(i), (ii), (iii) and (iv) is shown in the table given below. Which of the following is a gas?

	Force of attraction between particles	Arrangement of particles	Position of particles
(i)	Strong	Fixed	Closely packed
(ii)	Strong	Not fixed	Close together
(iii)	Weak	Fixed	Far apart
(iv)	Weak	Not fixed	Far apart

a. I

b. ii

c. iii

d. iv

Solutions

1. (a) iron rod

In iron rod (solid), there is maximum force of attraction between the particles.

2. (c) copper

In solid, particles have least interparticle space between them.

3. (d) Gas > Liquid > Solid

Gas particles have the highest kinetic energy; hence the randomness is highest in gas.

The solid particles are very closely packed; hence the solids have least kinetic energy.

4. (b) Fluidity is maximum in the liquid state.

Fluidity is maximum in the gaseous state.

5. (d) iv

Case Study 3

The word 'matter' refers to everything in the universe that has mass and takes up space. States of matter are generally described on the basis of qualities that can be seen or felt. Three states of matter can be found in daily life: solid, liquid and gas.

Matter that feels hard and maintains a fixed shape is called a solid, matter that feels wet and maintains its volume but not its shape is called a liquid. Matter that can change both shape and volume is called a gas.

Read the given passage carefully and give the answer of the following questions:

Q1. In which form, do the water molecules have less kinetic energy?

a. Ice

b. Water

c. Steam

d. All of them have equal kinetic energy

Q2. Which of the following describes the liquid phase?

a. It has a definite shape and a definite volume.

b. It has a definite shape but not definite volume.

c. It has a definite volume but not a definite shape.

d. It has neither a definite shape nor a definite volume.

Q3. Which one of the following statements is wrong for gases?

a. Gases do not have a definite shape and volume.

b. Volume of the gas is equal to the volume of the container confining the gas.

c. Confined gas exerts uniform pressure on the walls of container in all directions.

d. Mass of the gas cannot be determined by weighing a container in which it is enclosed.

Q4. 'Gases are easily compressed but liquids cannot be compressed. What can be inferred from this statement?

a. The forces of attraction between gas particles are stronger than that between liquid particles.

b. The gas particles are spaced further apart than liquid particles.

c. The gas particles have less energy than liquid particles.

d. The gas particles move more rapidly than liquid particles.

Q5. As the solid melts to form liquid:

a. interparticle forces of attraction decrease

b. the kinetic energy of particles increases

c. compressibility increases

d. All of the above

Solutions

1. (a) Ice

Ice (solid) has less kinetic energy as compared to water (liquid) and steam (gas).

2. (c) It has a definite volume but not a definite shape.

3. (d) Mass of the gas cannot be determined by weighing a container in which it is enclosed.

The mass of a gas can be determined by weighing the empty container first, then filling it with gas and again weighing the container filled with gas.

The difference of two readings gives the mass of gas.

4. (b) The gas particles are spaced further apart than liquid particles.

The large space between the particles of gas allow the gas to be easily compressed when pressure is applied.

5. (d) All of the above

When a solid is heated, the interparticle force decreases and kinetic energy of the particles increases. Compressibility of liquids is slightly more than solids, hence increases.

Case Study 4

In an experimental activity, crushed ice was taken in a beaker. A thermometer is fitted in such a way that its bulb was thoroughly surrounded by ice. The beaker is now slowly heated and temperature was regularly noted. Temperature rises gradually as the heating is continued and becomes constant when ice starts changing into liquid.

Read the given passage carefully and give the answer of the following questions:

Q1. What name is associated with conversion of ice into water?

a. Evaporation b. Sublimation

c. Freezing d. Fusion

Q2. What specific name is given to the constant temperature?

a. Latent heat of fusion b. Boiling point

c. Melting point d. Condensation point

Q3. The heat added to the system at constant temperature is called:

a. specific heat b. latent heat

c. residual heat d. None of these

Q4. In this experiment, the ice melts because its particles:

a. change their size

b. gain heat energy and escape

c. gain heat energy and become closer

d. gain heat energy and move away from their fixed positions

Q5. Where does the heat energy go when the temperature does not rise?

a. It makes the molecular motion of the liquid faster.

b. It raises the temperature of the beaker only.

c. It is utilised for bringing out the complete change of state.

d. It slows down the molecular motion.

Solutions

1. (d) Fusion

The process of change of solid state into liquid state is known as fusion.

2. (c) Melting point

The minimum temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point.

3. (b) latent heat

4. (d) gain heat energy and move away from their fixed positions

5. (c) It is utilised for bringing out the complete change of state.

The heat energy is used up in changing the state of the solid substance by overcoming the force of attraction between its particles, so that they become somewhat loose and form liquid water.

Case Study 5

We know that particles of matter are always moving and are never at rest. At a given temperature in any gas, liquid or solid, there are particles with different amounts of kinetic energy.

In the case of liquids, a small fraction of particles at the surface, having higher kinetic energy, are able to break away from the forces of attraction of other particles and gets converted into vapour. This phenomenon of change of a liquid into vapours at any temperature below its boiling point is called evaporation.

The rate of evaporation increases with an increase in surface area of the liquid, an increase in temperature of the liquid and increase in wind speed. The rate of evaporation decreases with an increase in humidity.

Read the given passage carefully and give the answer of the following questions:

Q1. Which of the following statements about evaporation is incorrect?

(i) It is a bulk phenomenon.

(ii) It is a fast process.

(iii) It causes cooling.

a. (ii) and (iii) b. (i) and (ii)

c. (i) and (iii) d. (i), (ii) and (iii)

Q2. Evaporation is directly proportional to:

(i) humidity

(ii) surface area

(iii) temperature

(iv) wind speed

a. (i) and (iv)

b. (ii) and (iii)

c. (iii) and (iv)

d. (ii), (iii) and (iv)

Q3. The evaporation of a liquid can be best carried out in a:

a. measuring cylinder

b. china dish

c. test tube

d. flask

Q4. Evaporation of a liquid can take place:

a. at its boiling point

b. below its boiling point

c. above its boiling point

d. at fixed temperature

Q5. Which of the following does not involve evaporation?

a. During summer, we perspire more.

b. Sprinkling water on the roof in a hot sunny day.

c. Spreading of virus on sneezing.

d. Water kept in an earthen pot becomes cool during summer.

Solutions

1. (b) (i) and (ii)

Evaporation is a surface phenomenon and is a slow process.

2. (d) (ii), (iii) and (iv)

Rate of evaporation increases with increase in surface area, temperature and wind speed.

3. (b) china dish

China dish has the maximum surface area available for evaporation.

4. (b) below its boiling point

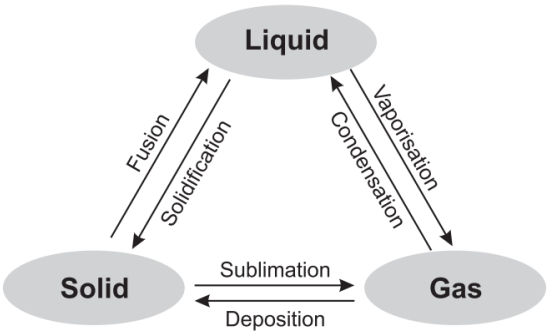
Evaporation is conversion of a liquid into vapours below its boiling point.

5. (c) Spreading of virus on sneezing.

Case Study 6

Changes of state are physical changes in matter. They are reversible changes that do not involve changes in matter's chemical properties. We can change the physical state of matter in two ways: (i) by changing temperature (heating or cooling) or (ii) by changing pressure (increasing or decreasing).

Latent heat is the heat energy which has to supplied to change the state of a substance. Latent heat does not increase the temperature of a substance. It can be of fusion or of vaporisation.



Applying pressure and reducing temperature can liquefy gases. Solid carbon dioxide gets converted directly to gaseous state on decrease of pressure to 1 atmosphere.

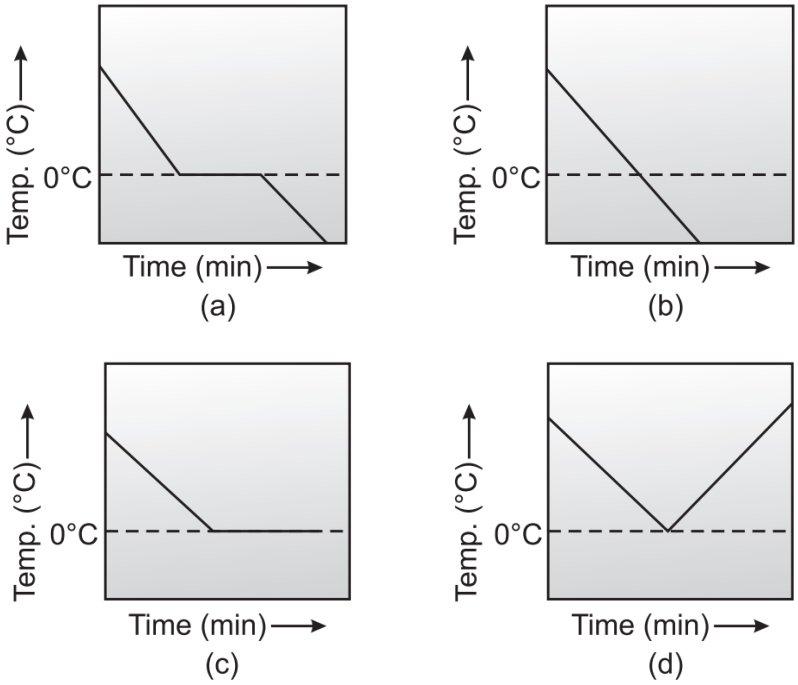
Read the given passage carefully and give the answer of the following questions:

Q1. What is meant by the word 'latent' in latent heat? Name the two types of latent heat.

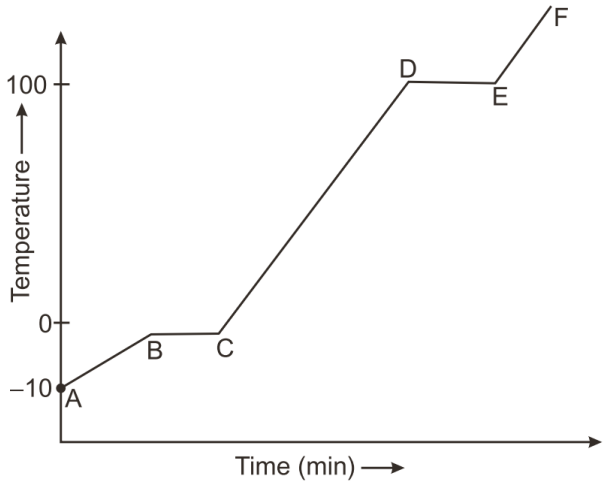
Q2. Give the temperature at which water exists in two different states.

Q3. What is the relation between pressure in atmosphere and pressure in pascal.

Q4. A glass tumbler containing hot water is kept in the freezer compartment of a refrigerator (temperature < 0°C). If you could measure the temperature of the contents of the tumbler, which of the following graphs would correctly represent the change in its temperature as a function of time.



Q5. Based on the data represented in the graph below, which region shows latent heat of vaporisation?



Solutions

1. The word latent means hidden.

Types: (i) Latent heat of fusion

(ii) Latent heat of vaporisation.

2. (i) At 0°C, water can be in solid or in liquid state.

(ii) At 100°C, water can be in liquid or in gaseous state.

3. 1 atmosphere = 1.01×10^5 Pascal.

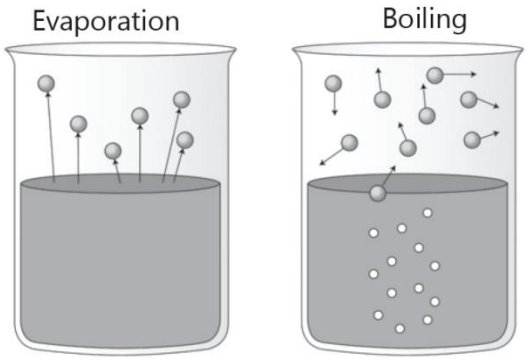
4. The temperature of hot water decreases to 0°C and remains constant due to latent heat of fusion and then decreases further.

So, graph (a) would correctly represent the change in its temperature as a function of time.

5. DE is the region that shows latent heat of vaporisation.

Case Study 7

The phenomenon of change of a liquid into vapours at any given temperature below its boiling point is called evaporation. Evaporation is different from boiling as boiling is a bulk phenomenon i.e., particles from the whole of the liquid change into vapour state whereas evaporation is a surface phenomenon i.e., only the particles from the surface gain enough energy to overcome the forces of attraction present in the liquid and change into vapour state.



The process of evaporation uses the energy of the liquid particles. This results in cooling of the surrounding area. The rate of evaporation depends upon the surface area exposed to the atmosphere, the temperature, the humidity and the wind speed.

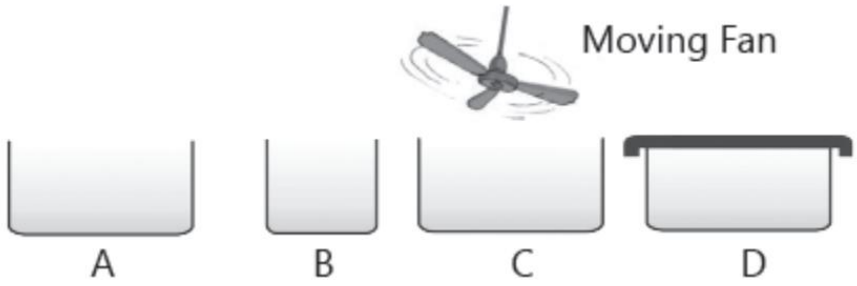
Read the given passage carefully and give the answer of the following questions:

Q1. Differentiate between evaporation and boiling. Give any two differences.

Q2. Which one among evaporation or boiling is known as a surface phenomenon. Why?

Q3. Which one among evaporation or boiling is a slow process?

Q4. Based on the figure given below, suggest in which of the vessels A, B, C or D, the rate of evaporation be the highest?



Q5. What is the effect of humidity on rate of evaporation?

Solutions

1. Difference between evaporation and boiling is as follows:

Basis of Difference	Evaporation	Boiling
Type	It is a surface phenomenon.	It is a bulk phenomenon.
Cause	It causes cooling.	It does not cause cooling.

2. In evaporation, the particles from the surface gain enough energy to overcome the forces of attraction present in the liquid and change into the vapour state, therefore it is called surface phenomenon.

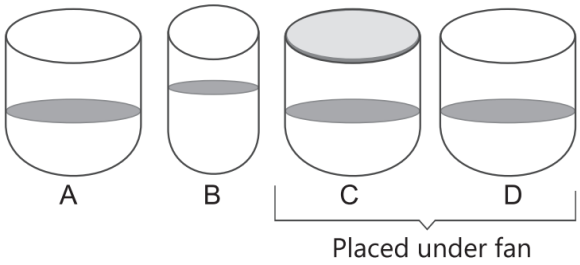
3. Evaporation

4. Greater the surface area and more the wind speed, higher will be the rate of evaporation. So, the rate of evaporation will be highest in the vessel C.

5. Lesser is the humidity in air, more is the rate of evaporation.

Case Study 8

100 mL of water was placed in four vessels A, B, C and D. Vessel A, C and D are of same size, B is smaller. Vessel C is covered and C and D are placed under the fan.



Read the given passage carefully and give the answer of the following questions:

Q1. In how many beakers, water will escape into atmosphere as vapours?

Q2. What name is given to the process of escaping of water from liquid to vapour state?

Q3. After one hour from the beginning of the experiment, the water level will fall to the maximum in which beaker?

Q4. What happens in beaker C?

Solutions

1. In three beakers, i.e., A, B and D, water will escape into atmosphere as vapours.

2. Evaporation

3. D, because it is placed under fan and has large surface area.

4. Evaporation will not occur and water level remains the same.