

CHAPTER 1

Matter in Our Surroundings

1. NCERT INTEXT QUESTIONS

1. Which of the following are matter?

Chair, air, love, smell, hate, almond, thought, cold, lemon water, smell of perfume.

Ans :

Anything that occupies space and has mass is called matter. Matter can exist in three physical states—solid, liquid and gaseous. Chair and almond are forms of matter in solid state. Cold drink is a liquid state of matter. Air and smell of perfume, are gaseous states of matter. Love, smell, cold are not matter, as they are feelings that do not have mass and don't occupy space.

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 smell of hot sizzling food reaches us several metres away because food particles diffuse faster in air when temperature is high and we can smell it earlier, whereas cold food particles take time to diffuse so we have to go close to smell it.

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

Ans :

This observation shows that the intermolecular space is high in liquid so the diver can easily pass through it.

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4. What are the characteristics of particles of matter?

Ans :

The characteristics of particles of matter are :

- Particles of matter have spaces between them.
- Particles of matter are continuously moving.
- Particles of matter attract each other.

5. 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 chimney, honey, water, chalk, cotton, and iron.

Ans :

Air, exhaust from chimney, cotton, water, honey, chalk, and iron.

(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 :

- (a) Differences in the characteristics of states of matter :

Property	Solid	Liquid	Gas
Rigidity	Rigid and cannot be compressed	Not rigid and can be compressed to a little extent.	Not rigid and can be easily compressed
Shape	Definite shape	Shape of container	No definite shape
Volume	Definite volume	Definite volume	No definite volume
Fluidity	Cannot flow	Can flow from higher to lower level	Flow in all direction
Diffusion	Almost nil	Diffuse slowly	Diffuse easily
Storage	Can be stored without container	Open/ closed container is needed.	Only closed container can store
Inter-molecular space	Least	Greater than solid but lesser than gases	Maximum
Arrangement of molecules	Regular, close to each other	Random or irregular close to each other	Random and wide apart
Movement of molecules	Very little movement in the form of vibrations	Molecules can move around each other	Quick movement in random direction
Strength of bond between molecules	Strong bond	Weak bond	Very loose bonding
Examples	A rock	Water	Water vapour

(b)

- Rigidity** : It is the property of matter to counter the change of its shape.
- Compressibility** : It is the property of matter in which its volume is decreased by applying force.
- Fluidity** : It is the ability of matter to flow.
- Filling a gas container** : On filling a gas or liquid, it takes the shape of the container.
- Shape** : A shape is the form of an object or its external boundary.
- Kinetic energy** : The kinetic energy of an object is the energy that is due to its motion.
- Density** : Density of a substance is its mass per unit volume.

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6. Give reasons :
- A gas fills completely the vessel in which it is kept.
 - A gas exerts pressure on the walls of the container.
 - A wooden table should be called a solid.
 - 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 force of attraction between particles of gas is negligible. Thus, the particles of gas can move in all directions and fills the vessel completely in which it is kept.
- Particles of gas move randomly in all directions with high speed. Therefore, the particles collide with each other and also with the walls of the container with a force. Therefore, gas exerts pressure on the walls of the container.
- A wooden table has fixed shape and fixed volume, which are the main characteristics of solid. Thus, a wooden table should be called a solid.
- Particles of air have large spaces between them. On the other hand, wood has little space between its particles. Also, it is rigid. For this reason, we can easily move our hands in air, but to do the same through a solid block of wood, we need a karate expert.

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

Ans :

Ice which is a solid has vacant spaces between water molecules, thus making ice lighter than water. Thus, ice floats on water.

8. Convert the following temperature to Celsius scale :
- 300 K
 - 573 K

Ans :

- $300\text{ K} = (300 - 273)^{\circ}\text{C} = 27^{\circ}\text{C}$
- $573\text{ K} = (573 - 273)^{\circ}\text{C} = 300^{\circ}\text{C}$

9. What is the physical state of water at :
- 250°C
 - 100°C

Ans :

- Gaseous state at 250°C .
- Equilibrium state between liquid and vapour (100°C). At this temperature, after getting the heat equal to the latent heat of vaporization, water starts changing from liquid state to gaseous state.

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

Ans :

During the change of state the temperature of any substance remains constant. Because heat supplied or released is utilized in changing the state by overcoming the forces of attraction between the particles. Therefore, this heat does not contribute in increasing or decreasing the temperature of the substance. Such heat is called latent heat.

11. Suggest a method to liquify atmospheric gases.

Ans :

The gases can be converted into liquid if high pressure is applied at low temperature.

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

Ans :

There is high temperature and low humidity in day time in desert. These factors increase evaporation, and cooler works well because of faster evaporation. This also means that desert cooler cool better on a hot dry day.

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

Ans :

The liquid inside the pot evaporates through the pores in an earthen pot. This evaporation makes the water inside the pot cool. Thus, water kept in an earthen pot becomes cool during summers.

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

Ans :

Acetone, petrol, and perfume evaporate at low temperatures. When some acetone, petrol, or perfume is dropped on the palm, it takes heat from the palm and evaporates, so making the palm cooler.

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

Ans :

Increase in surface area increases evaporation rate and cools faster in a saucer than in a cup. A liquid has a larger surface area in a saucer than in a cup. Thus, we are able to sip hot tea or milk faster from a saucer than a cup.

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

Ans :

We should wear cotton clothes in summer as cotton is a good water (sweat) absorber. Sweat is absorbed by the cotton and it exposes water to the atmosphere for evaporation to make the body cool.

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2. NCERT EXERCISE QUESTIONS

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

Ans :

(a) $300\text{ K} = (300 - 273)^{\circ}\text{C} = 27^{\circ}\text{C}$
(b) $573\text{ K} = (573 - 273)^{\circ}\text{C} = 300^{\circ}\text{C}$

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

Ans :

(a) $25^{\circ}\text{C} = (25 + 273)\text{ K} = 298\text{ K}$
(b) $373^{\circ}\text{C} = (373 + 273)\text{ K} = 646\text{ K}$

3. Give reason for the following observations :
(a) Naphthalene balls disappear with time without leaving any solid.
(b) We can get the smell of perfume sitting several metres away.

Ans :

(a) Naphthalene balls disappear with time without leaving any solid because they undergoes sublimation easily, i.e. the change of state of naphthalene from solid to gas takes place easily.
(b) Perfumes have high degree of vaporization and its vapour diffuse into air easily. Therefore, we can get the smell of perfume sitting several metres away.

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

Ans :

Oxygen, water, sugar.

5. What is the physical state of water at :

(a) 25°C
(b) 0°C
(c) 100°C

Ans :

(a) Liquid state
(b) At 0°C , water can exists as both solid and liquid. At this temperature, after getting the heat equal to the latent heat of fusion, the solid form of water, i.e. ice starts changing into its liquid form, i.e. water.
(c) At 100°C , water can exist as both liquid and gas. At this temperature, after getting the heat equal to the latent heat of vaporization, water starts

changing from its liquid state to its gaseous state, i.e. water vapours.

6. Give two reasons to justify—
(a) Water at room temperature is a liquid.
(b) An iron almirah is a solid at room temperature.

Ans :

(a) (i) Intermolecular forces are less.
(ii) Intermolecular spaces and kinetic energy is more.

Thus, the molecules of water can interchange their spaces and hence water is in liquid state at room temperature.

(b) (i) Intermolecular forces are very strong.
(ii) Intermolecular spaces, as well as, kinetic energy are very small.

Thus, the molecules are held very very tightly, with the result, the iron almirah has a definite shape and definite volume, and hence, is a solid.

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

Ans :

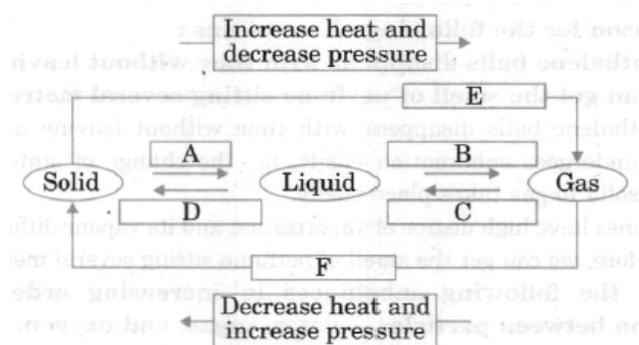
Ice at 273 K has less energy than water (although both are at the same temperature). Water has the additional latent heat of fusion. Hence, at 273 K , ice is more effective in cooling than water.

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

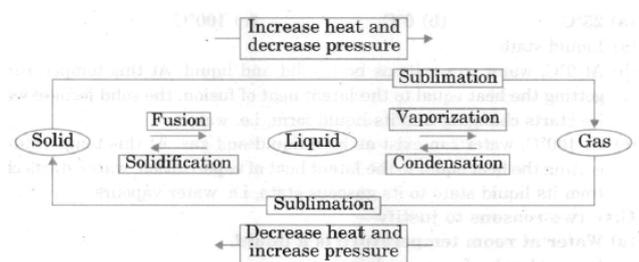
Ans :

Steam will produce more severe burns than boiling water. As steam has 2260 J of heat energy (latent heat of vaporization) as compared to water. Thus, steam produces more severe burns.

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



Ans :



3. NCERT EXEMPLAR

Objective Type Questions

1. Which one of the following sets of phenomena would increase on raising the temperature?
- Diffusion, evaporation, compression of gases
 - Evaporation, compression of gases, solubility
 - Evaporation, diffusion, expansion of gas
 - Evaporation, solubility, diffusion, compression of gases

Ans : (c) Evaporation, diffusion, expansion of gas

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 :
- Low temperature, low pressure
 - High temperature, low pressure
 - Low temperature, high pressure
 - High temperature, high pressure

Ans : (c) Low temperature, high pressure

3. The property to flow is unique to fluids. Which one of the following statements is correct?
- Only gases behave like fluids
 - Gases and solids behave like fluids
 - Gases and liquids behave like fluids
 - Only liquids are fluids

Ans : (c) Gases and liquids behave like fluids

4. During summer, water kept in an earthen pot becomes cool because of the phenomenon of :
- diffusion
 - transpiration
 - osmosis
 - evaporation

Ans : (d) evaporation

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?
- Water, air, wind
 - Air, sugar, oil
 - Oxygen, water, sugar
 - Salt, juice, air

Ans : (c) Oxygen, water, sugar

6. On converting 25°C , 38°C and 66°C to Kelvin scale, the correct sequence of temperature will be :
- 298 K, 311 K and 339 K
 - 298 K, 300 K and 338 K
 - 273 K, 278 K and 543 K
 - 298 K, 310 K and 338 K

Ans : (a) 298 K, 311 K and 339 K

7. Choose the correct statement of the following :
- Conversion of solid into vapours without passing through the liquid state is called vaporization.
 - Conversion of vapours into solid without passing through the liquid state is called sublimation.

- Conversion of vapours into solid without passing through the liquid state is called freezing.
- Conversion of solid into liquid is called sublimation.

Ans : (b) Conversion of vapours into solid without passing through the liquid state is called sublimation.

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?
- 306 K, 329 K, 391 K
 - 308 K, 329 K, 392 K
 - 308 K, 329 K, 391 K
 - 329 K, 392 K, 308 K

Ans : (c) 308 K, 329 K, 391 K

9. Which condition out of the following will increase the evaporation of water?
- Increase in temperature of water
 - Decrease in temperature of water
 - Less exposed surface area of water
 - Adding common salt to water

Ans : (a) Increase in temperature of water

10. In which of the following conditions, the distance between the molecules of hydrogen gas would increase?
- Increasing pressure on hydrogen contained in a closed container.
 - Some hydrogen gas leaking out of the container.
 - Increasing the volume of the container of hydrogen gas.
 - Adding more hydrogen gas to the container without increasing the volume of the container.
- (i) and (iii)
 - (i) and (iv)
 - (ii) and (iii)
 - (ii) and (iv)

Ans : (c) (ii) and (iii)

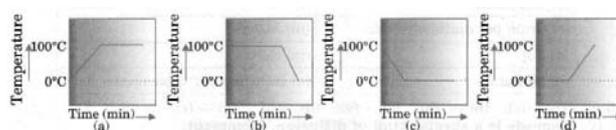
Short Answer Questions

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.

Ans :

No, because it is not pure water. Its freezing point will be below 0°C due to the presence of a non-volatile impurity in it.

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 figure would correctly represent the result? Justify your choice.



Ans :

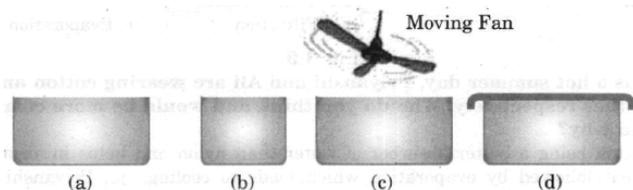
The correct option is (d). Since ice and water are in equilibrium, the temperature would be zero. When we heat the mixture, energy supplied is utilized in

Ans :

Fig. (a).

The temperature of water falls to 0°C first. Then, it will be constant till all water turn into ice, then it will decrease.

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



Ans :

Fig. (c).

The rate of evaporation increases with the increase in surface area and wind speed. The surface areas of vessel c, a and d are similar but the wind speed is greater above the vessel c because of fan, hence the rate of evaporation will be highest in the vessel c.

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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?

Ans :

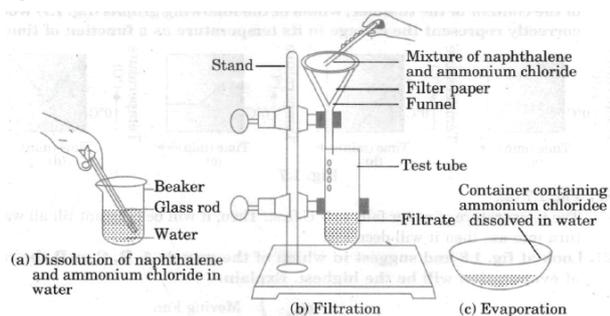
- (a) The conversion of vapour to solid without changing into liquid or vice versa is known as 'sublimation'. This process is also known as 'deposition'.
 (b) Latent heat of fusion is the heat required to melt the solid state to liquid state without only increase in temperature.

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.

Ans :

Naphthalene is insoluble in water but soluble in ether (an organic solvent). It is volatile at room temperature. Ammonium chloride is soluble in water and volatile at higher temperature. It decomposes on heating to dryness.



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

Ans :

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

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?

Ans :

Conditions that can increase the rate of evaporation of water are :

- (a) an increase of surface area by spreading the shirt.
 (b) an increase in temperature by putting the shirt under the Sun.
 (c) increase the wind speed by spreading it under the fan.

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.

Ans :

- (a) Evaporation produces cooling as the particles at the surface of the liquid gain energy from the surroundings and change into vapour thereby producing a cooling effect.
 (b) Air around us cannot hold more than a definite amount of water vapour at a given temperature which is known as humidity. So, if the air is already rich in water vapour, it will not take up more water, therefore, rate of evaporation of water will decrease.
 (c) A sponge has minute holes in which air is trapped. Also the material is not rigid. When we press it, the air is expelled out and we are able to compress it.

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

Ans :

The temperature of a substance remains constant at its melting and boiling points until all the substance melts or boils because the heat supplied is continuously used up in changing the state of the substance by overcoming the forces of attraction between the particles. This heat energy absorbed without showing any rise in temperature is given the name latent heat of fusion/latent heat of vaporization.

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Science IX

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