# 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.



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

**Ans :**

The characteristics of particles of matter are :
a. Particles of matter have spaces between them.
b. Particles of matter are continuously moving.
c. 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)

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



**6.** Give reasons :
(a) A gas fills completely the vessel in which it is kept.
(b) A gas exerts pressure on the walls of the container.
(c) A 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 :**

(a) 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.
(b) 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.
(c) 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.
(d) 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 :
(a) 300 K
(b) 573 K

**Ans :**

(a) 300 K = (300 – 273)°C = 27°C
(b) 573 K = (573 – 273)°C = 300°C

**9.** What is the physical state of water at :
(a) 250°C
(b) 100°C

**Ans :**

(a) Gaseous state at 250°C.
(b) 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.



## 2. NCERT EXERCISE QUESTIONS

**1.** Convert the following temperatures 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.** Convert the following temperatures to 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.
(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 exits 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 :**

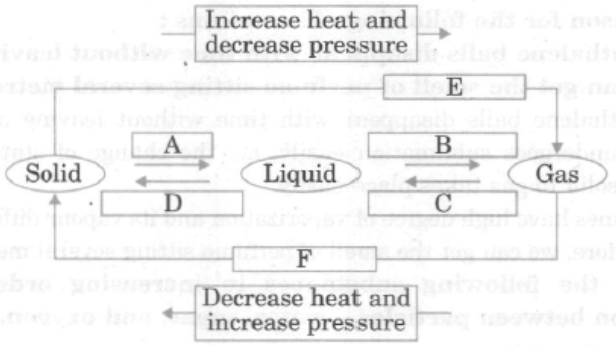
Ice at 273 K has less energy than water (although both are at the same temperature). Water has the additional latent heat of fusion. Hence, at 273 K, ice is more effective in cooling than water.

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

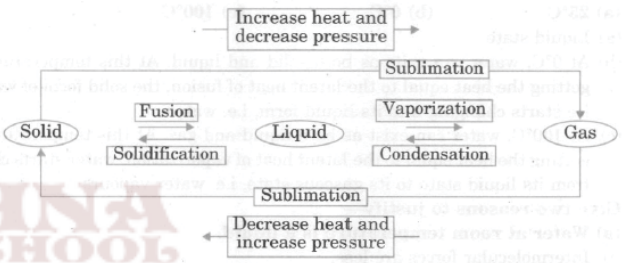
**Ans :**

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?
(a) Diffusion, evaporation, compression of gases
(b) Evaporation, compression of gases, solubility
(c) Evaporation, diffusion, expansion of gas
(d) 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 :
(a) Low temperature, low pressure
(b) High temperature, low pressure
(c) Low temperature, high pressure
(d) 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?
(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

**Ans :** (c) Gases and liquids behave like fluids

**4.** 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) 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?
(a) Water, air, wind (b) Air, sugar, oil
(c) Oxygen, water, sugar (d) 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 :
(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

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

**7.** Choose the correct statement of the following :
(a) Conversion of solid into vapours without passing through the liquid state is called vaporization.
(b) Conversion of vapours into solid without passing through the liquid state is called sublimation.
(c) Conversion of vapours into solid without passing through the liquid state is called freezing.
(d) 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?
(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

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

**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

**Ans :** (a) Increase in temperature 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)

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

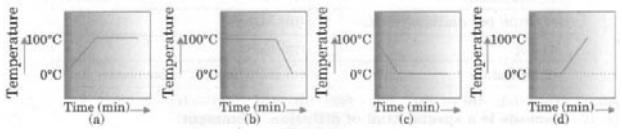
### Short Answer Questions

**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

melting the ice and the temperature does not change till all the ice melts because of latent heat of fusion. On further heating, the temperature of the water would increase.

**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 gaseous state directly to solid 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 _____.

**Ans :**

(a) cooling (b) stronger

(c) liquid, gaseous (d) Sublimation, liquid

(e) evaporation

**14.** Match the physical quantities given in column A to their SI units given in column B :

| | Column A | | Column 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 |

**Ans :**

(a) — (iii); (b) — (iv); (c) — (v); (d) — (ii); (e) — (i).

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

| | Column A | | Column 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 cubic metre |

**Ans :**

(a) — (iv); (b) — (iii); (c) — (v); (d) — (ii); (e) — (i).

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

**Ans :**

The movement of particles from low concentration to high concentration is diffusion in liquids and gases. The particles move from the low concentration to high concentration through the semi-permeable membrane through osmosis, this also happens because of diffusion.

Thus, osmosis is called a special kind of diffusion.

**17.** Classify the following into osmosis/diffusion :

(i) Swelling up of a raisin on keeping in water.

(ii) Spreading of virus on sneezing.

(iii) Earthworm dying on coming in contact with common salt.

(iv) Shrinking of grapes kept in thick sugar syrup.

(v) Preserving pickles in salt.

(vi) Spreading of smell of cake being baked throughout the house.

(vii) Aquatic animals using oxygen dissolved in water during respiration.

**Ans :**

(i) Osmosis (ii) Diffusion

(iii) Osmosis (iv) Osmosis

(v) Osmosis (vi) Diffusion

(vii) Diffusion

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

**Ans :**

Water turns into ice at 0°C and water turns into steam at 100°C when heat is supplied to water. Water as steam has more latent heat as compare to liquid (water). Hence, water as steam may cause severe burns while water as ice has a cooling effect.

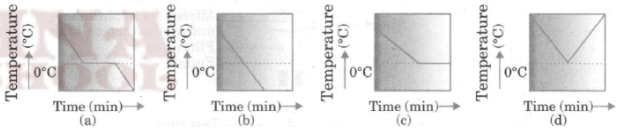


**19.** Alka was making tea in a kettle. Suddenly she felt intense heat from the puff of steam gushing out of the spout of the kettle. She wondered whether the temperature of the steam was higher than that of the water boiling in the kettle. Comment.

**Ans :**

The boiling point of water is 100°C. The temperature of boiling water does not rise instead of continuous supply of heat because extra heat is supplied to the water is used to turn water into steam. Hence, steam has a lot of latent heat which can cause severe burn. That's why Alka felt intense heat from the puff of steam gushing out of the spout of the kettle.

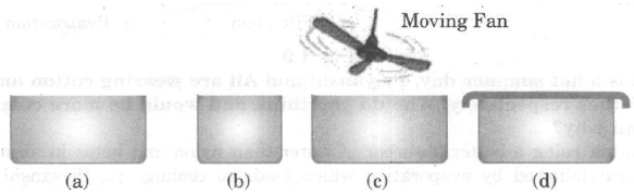
**20.** A glass tumbler containing hot water is kept in the freezer compartment of a refrigerator (temperature < 0°C). If you could measure the temperature of the content of the tumbler, which of the following graphs (fig.) would correctly represent the change in its temperature as a function of time.



**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.



**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 :**

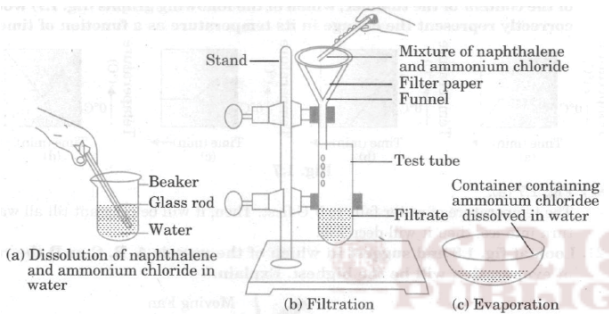
(a) The conversion of vapour to solid without changing into liquid or vice versa is known as 'sublimation'. This process is also known as 'deposition'.
(b) Latent heat of fusion is the heat required to melt the solid state to liquid state without only increase in temperature.

## 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.