Matter in our Surroundings

Exercise-1.1-1.2 Page: 3

1. Which of the following are matter?

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

Solution: The following substances are matter:

- Chair
- Air
- Almonds
- Lemon water

The smell of perfume (Smell is considered as a matter due to the presence of some volatile substances in air that occupy space & have mass.)

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2. Give reasons for the following observation:

The smell of hot sizzling food reaches you several meters away, but to get the smell from cold food, you have to go close.

Solution:

Particles in the air, if fueled with higher temperatures, acquire high kinetic energy, which aids them to move fast over a stretch. Hence, the smell of hot sizzling food reaches a person even at a distance of several meters.

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

Solution:

The diver is able to easily cut through the water in the swimming pool because of the weak forces of attraction between water molecules. It is this property of water that attributes to easy diving.

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

Solution:

The characteristics of particles of matter are as follows:

(a) Presence of intermolecular spaces between particles

(b) Particles are in constant motion

(c) They attract each other

(d) All matter is composed of very small particles which can exist independently.

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Exercise-1.3 Page: 6

1. The mass per unit volume of a substance is called density. (density=mass/volume). Arrange the following in the order of increasing density – air, exhaust from the chimneys, honey, water, chalk, cotton and iron.

Solution: The following substances are arranged in increasing density:

- Air
- Exhaust from chimney
- Cotton
- Water
- Honey
- Chalk
- Iron

2. Answer the following.

a) Tabulate the differences in the characteristics of matter.

b) Comment upon the following: rigidity, compressibility, fluidity, filling a gas container, shape, kinetic energy and density.

Solution:

(a) The difference in the characteristics of the three states of matter.

Characteristics	Solid	Liquid	Gas
Shape	Fixed shape	No Fixed shape	No Fixed shape
Volume	Fixed volume	Fixed volume	No Fixed volume
Intermolecular force	Maximum	Less than solids	Very less
Intermolecular space	Very less	More than solids	maximum
Rigidity/Fluidity	Rigid/cannot flow	Can flow/not rigid	Can flow/not rigid
Compressibility	negligible	compressible	Highly compressible

(b) (i) **Rigidity:** It is the property of matter to continue to remain in its shape when treated

with an external force.

(ii) **Compressibility:** It is the attribute of the particles to contract their intermolecular space when

exposed to an external force, thereby escalating its density.

(iii) **Fluidity:** It is the ability of a substance to flow or move about freely.

(iv) **Filling the gas container:** The particles in a container take their shape as they randomly vibrate in all possible directions.

(v) **Shape:** It is the definite structure of an object within an external boundary

(vi) **Kinetic energy:** Motion allows particles to possess energy which is referred to as kinetic energy. The increasing order of kinetic energy possessed by various states of matter are:

Solids < Liquids < Gases

Mathematically, it can be expressed as K.E = 1/2 mv^2, where 'm' is the mass and 'v' is the velocity of the particle.

(vii) **Density:** It is the mass of a unit volume of a substance. It is expressed as:

d = M/V, where 'd' is the density, 'M' is the mass and 'V' is the volume of the substance

3. 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 the air, but to do the same through a solid block of wood, we need a karate expert.

Solution:

(a) There is a low force of attraction between gas particles. The particles in the filled vessel are free to move about.

(b) Gaseous particles have the weakest attraction force. They are always moving in a haphazard manner. When a gas particle collides with the container's walls, it exerts force and, thus pressure on the wall.

(c) There is a distinct contour and volume to the hardwood table. The wood particles are tightly packed. They do not conform to the container's shape. As a result, the solid features of a hardwood table are satisfied.

(d) The boundaries between air particles are quite loose. They are a long way apart and have a lot of space between them. As a result, we may move our hands freely in the air. The particles in a solid block, on the other hand, are bound together by a strong force of attraction. As a

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result, there is either some or no space between them. As a result, we will require a karate expert.

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

Solution:

In general, the volume of a liquid is more than the volume of a solid because liquid particles are freer to move, resulting in more volume. Ice, on the other hand, has a maximum density of water at 4 degrees Celsius. Ice is lighter than water and has a lower density. As a result, it floats on water.

Exercise – 1.4 Page: 9

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1. Convert the following temperature to Celsius scale:

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

Solution:

a. 0°C=273K

300K= (300-273)°C = 27°C

b. 573K= (573-273)°C = 300°C

2. What is the physical state of water at:

a. 250°C **b. 100**°C ?

Solution:

(a) At 250°C – Gaseous state since it is beyond its boiling point.

(b) At 100°C – It is at the transition state as the water is at its boiling point. Hence it would be present in both liquid and gaseous states.

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

Solution:

It is due to the latent heat as the heat supplied to increase the temperature of the substance is used up to transform the state of matter of the substance; hence, the temperature stays constant.

4. Suggest a method to liquify atmospheric gases.

Solution:

It can be achieved by either increasing the pressure or decreasing the temperature, which ultimately leads to the reduction of spaces between molecules.

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Exercise – 1.5 Page:10

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

Solution:

It is because the temperature is high and less humid on a hot dry day, enabling better evaporation. High levels of this evaporation provide better cooling effects.

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

Solution:

An earthen pot is porous in nature. These tiny pores facilitate the penetration of water and hence their evaporation from the pot surface. The process of evaporation requires energy which is contributed by water in the pot as a result of which water turns cooler.

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

Solution:

Acetone, petrol, and perfume are volatile substances that evaporate when they come in contact with air. Evaporation is facilitated as it uses energy from the palm, hence leaving a cooling effect on our palms.

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

Solution:

A saucer has a larger surface area than a cup, promoting quicker evaporation. Hence, the tea or milk in a saucer cools down faster.

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

Solution:

In summer, it is preferred to wear light-coloured cotton clothes because light colour reflects heat and cotton materials have pores that absorb sweat, facilitating evaporation, and hence causing a cooling effect on the skin.

Chapter Exercise – Page: 12

1. Convert the following temperature to Celsius scale.

(a) 293K (b) 470K

Solution:

0°C=273K

(a) 293K= (293 – 273)°C = 20°C

(b) 470K= (470 – 273)°C = 197°C

2.Convert the following temperatures to the Kelvin scale.

(a) 25°C **(b) 373**°C

Solution:

0°C = 273K

(a) 25°C = (25+273)K = 298K

(b) 373°C = (373+273)K = 646K

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 while sitting several metres away.

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Solution:

(a) At room temperature, naphthalene balls undergo sublimation wherein they directly get converted from a solid to a gaseous state without having to undergo the intermediate state, i.e., the liquid state.

(b) Molecules of air move at a higher speed and have large intermolecular spaces. Perfumes comprise substances that are volatile, which scatter quickly in air, becoming less concentrated over a distance. Hence, we are able to smell perfume sitting several metres away.

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

Solution:

Oxygen (gas) < water (liquid) < sugar (solid)

5. What is the physical state of water at –

(a) 25°C (b) 0°C (c) 100°C?

Solution:

(a) At 25°C, the water will be in liquid form (normal room temperature)

(b) At 0°C, the water is at its freezing point, hence both solid and liquid phases are observed.

(c) At 100°C, the water is at its boiling point, hence both liquid and gaseous states of water (water vapour) are observed.

6. Give two reasons to justify –

(a) Water at room temperature is a liquid.

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

Solution:

(a) Water persists as a liquid at room temperature since its melting point is lower than room temperature and its boiling point (100^{o} C) is higher.

Similarly,

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(i). A fixed volume is occupied by a fixed mass of water.

(ii). At room temperature, water does not have a fixed shape and flows to fit the container's shape.

As a result, water is a liquid at room temperature.

(b) Because its melting and boiling points are above room temperature, an iron almirah is a solid at room temperature. In the same way,

(i) An iron almirah is rigid and has a predetermined shape.

(ii) Metals have a relatively high density.

As a result, at room temperature, iron almirah is a solid.

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

Solution:

At 273 K, ice will absorb heat energy or latent heat from the medium to overcome fusion and transform into water. As a result, ice has a greater

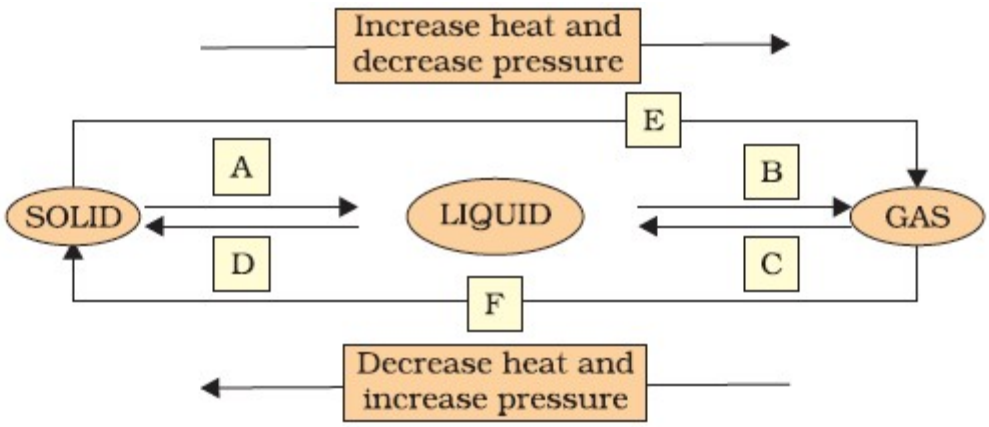
cooling impact than water at the same temperature since water does not absorb the excess heat from the medium.

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

Solution:

Steam produces severe burns. It is because it is an exothermic reaction that releases a high amount of heat which it had consumed during vaporization.

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



Solution:

Interconversion of three states of matter: Using temperature or pressure, any state of matter can be turned into another.

(A) Solid to Liquid → Melting (or) fusion (or) liquefaction

(B) Liquid to Gas → Evaporation (or) vaporization

(C) Gas to liquid → Condensation

(D) Liquid to Solid → Solidification

(E) Solid to Gas → Sublimation

(F) Gas to Solid → solidification