

NCERT QUESTIONS WITH SOLUTIONS

1. Convert the following temperature to the Celsius scale.

- (i) 293 K (ii) 470 K

Ans. (i) $293 - 273 = 20^{\circ}\text{C}$

(ii) $470 - 273 = 197^{\circ}\text{C}$

2. Convert the following temperature to the kelvin scale.

- (i) 25°C (ii) 373°C

Ans. (i) $25 + 273 = 298\text{K}$

(ii) $373 + 273 = 646\text{K}$

3. (a) Naphthalene balls disappear with time without leaving any solid. Why?

(b) We can get the smell of perfume sitting several meters away.

Ans. (a) Naphthalene is a volatile solid and has a tendency to sublime, therefore, it changes into vapours completely which disappear into the air and no solid is left.

(b) This is because perfumes contain volatile solvent which carries pleasant smelling vapours. They diffuse quite fast and can reach to people sitting several meters away.

4. Arrange the following substances in the increasing order of forces of attraction between the 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) At 25°C , water is in liquid state.

(b) At 0°C , water is in solid state, provided heat is removed from it.

(c) At 100°C , water is in gaseous state, provided heat is supplied to it.

6. Give two reasons to justify.

(a) Water at room temperature is a liquid.

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

Ans. (a) (i) Intermolecular forces are less.

(ii) Intermolecular spaces and kinetic energy is more.

Hence, water is in liquid state at room temperature.

(b) (i) Intermolecular forces are very large.

(ii) Intermolecular spaces, as well as kinetic energy are very small.

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

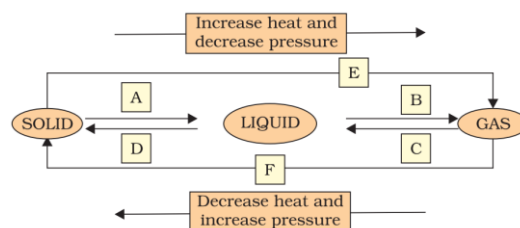
7. Ice at 273 K is more effective in cooling, than water at the same temperature, why?

Ans. At 0°C , both ice and water exist together. But the particles in water at 0°C have more energy as compared to particles in ice at the same temperature since during the change of state from ice to water, heat energy equal to latent heat of fusion has been absorbed. In the other words, ice at 0°C is more effective in cooling a substance than water at 0°C .

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

Ans. Steam will produce more severe burns than boiling water. It is because, 1 g of steam at 373 K (100°C) contains 2260 J of heat energy in the form of latent heat of vaporization as compared to water at 373 K (100°C). 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. A : Fusion
 B : Vaporization
 C : Condensation
 D : Solidification
 E : Sublimation
 F : De-sublimation/
 deposition.

EXERCISE-01

Multiple choice questions

1. Which of the following forms the basis of everything around us?
 (i) Joy (ii) Hate
 (iii) Energy (iv) Matter
 (1) (i) and (ii) (2) (iii) and (iv)
 (3) (ii) and (iv) (4) (i) and (iv)
2. Which of the following is not matter?
 (1) Joy (2) Pen
 (3) Pencil (4) Air
3. Name the process by which a drop of ink spreads in a beaker of water.
 (1) Diffusion (2) Vaporization
 (3) Condensation (4) Sublimation
4. Which of the following has the strongest interparticle force at the room temperature?
 (1) Nitrogen (2) Mercury
 (3) Iron (4) Chalk
5. Fluids are
 (1) liquids and gases
 (2) solids and gases
 (3) liquids and solids
 (4) only solids
6. Volume of gases can be defined as
 (1) definite
 (2) almost Nil
 (3) large
 (4) equal to the volume of container
7. The physical state of matter which can be easily compressed is _____.
 (1) liquid (2) gas
 (3) solid (4) none of these
8. The change of state from solid to liquid is known as
 (1) freezing (2) boiling
 (3) melting (4) none of these
9. The temperature at which a solid change into liquid at atmospheric pressure is called
 (1) melting point
 (2) boiling point
 (3) diffusion
 (4) evaporation
10. The melting point of ice is
 (1) 0°C (2) 4°C
 (3) 5°C (4) none of these
11. Convert the temperature of 373°C to the kelvin scale.
 (1) 646 K (2) 546 K
 (3) 300 K (4) 500 K
12. Convert the temperature of 270 K to the Celsius scale.
 (1) - 3°C (2) - 4°C
 (3) 2°C (4) 5°C
13. The SI unit of temperature is
 (1) °C (2) °F
 (3) K (4) all of these
14. What does the word 'Latent' means in Latent heat of fusion?
 (1) Like
 (2) Legend
 (3) Hidden
 (4) Same temperature
15. The temperature at which liquid starts boiling at atmospheric pressure is known as
 (1) melting point (2) boiling point
 (3) latent heat (4) condensation
16. The boiling point of water in kelvin scale is
 (1) 573 K (2) 273 K
 (3) 373 K (4) 100 K

- 17.** Which is more effective in cooling?
 (1) Water at 0°C (2) Water at 100°C
 (3) Ice at 0°C (4) All of these
- 18.** Condensation process is
 (1) change of state from gas to liquid.
 (2) change of state from liquid to gas.
 (3) change of state from gas to solid.
 (4) change of state from solid to liquid.
- 19.** The process for the change of a solid directly into its vapour is called
 (1) evaporation (2) melting
 (3) condensation (4) sublimation
- 20.** Dry ice is
 (1) water in solid state.
 (2) water in gaseous state.
 (3) CO₂ in liquid state.
 (4) CO₂ in solid state.
- 21.** Which of the following substances undergo sublimation process?
 (1) Naphthalene (2) O₂
 (3) H₂ (4) N₂
- 22.** The process of change of a liquid into vapour at any temperature is called
 (1) diffusion (2) evaporation
 (3) cooling (4) heating
- 23.** The factor(s) affecting evaporation is/are
 (1) temperature (2) surface area
 (3) both (1) and (2) (4) none of these
- 24.** On increasing the temperature of the liquid, the rate of evaporation
 (1) increases (2) decreases
 (3) no change (4) none of these
- 25.** Plasma is the ____ state of matter.
 (1) first (2) second
 (3) third (4) fourth

- 26.** Match the following and choose the correct answer

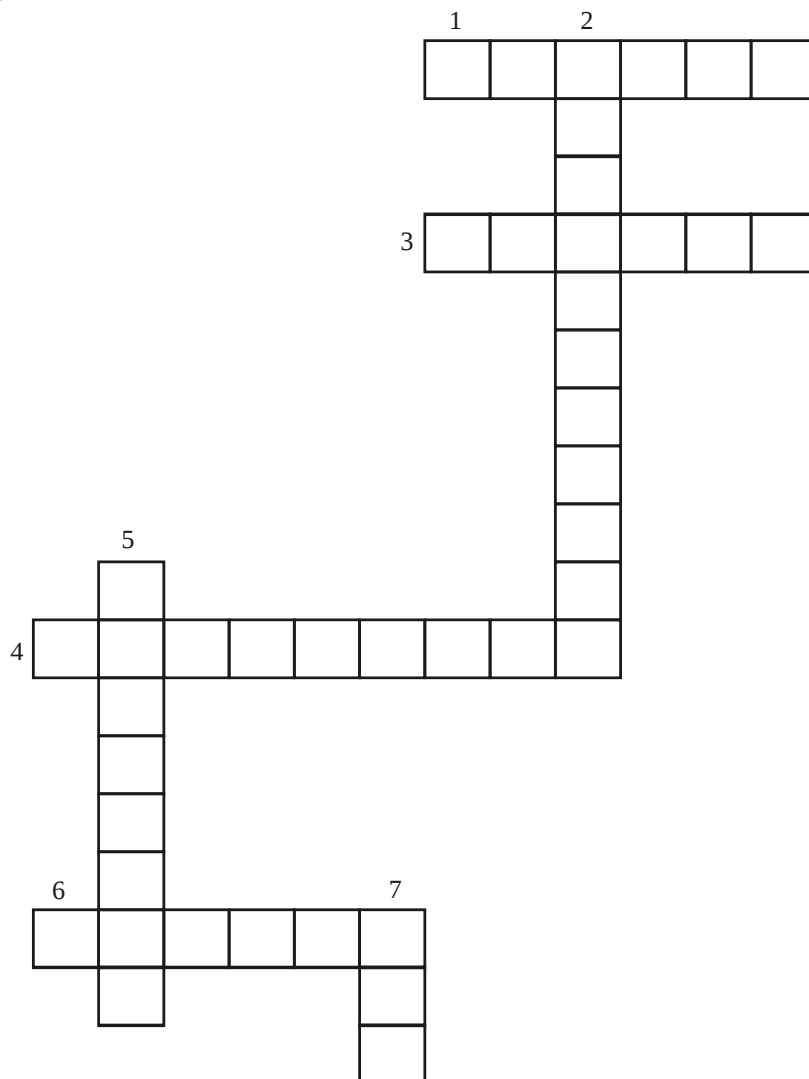
Column-I		Column-II	
(i)	Solid	(a)	Super energetic particles
(ii)	Liquid	(b)	No fixed shape nor fixed volume at a given pressure
(iii)	Gas	(c)	Has definite shape
(iv)	Plasma	(d)	Definite volume with less molecular forces than that in solids

- (1) (i) – a, (ii) – b, (iii) – c, (iv) – d
 (2) (i) – c, (ii) – d, (iii) – b, (iv) – a
 (3) (i) – c, (ii) – d, (iii) – a, (iv) – b
 (4) (i) – a, (ii) – d, (iii) – b, (iv) – c
- 27.** Which of the following is an example of matter?
 (1) Chalk (2) Anger
 (3) Light (4) Hate
- 28.** Which of the following has fixed shape and volume?
 (1) Milk (2) Stone
 (3) Pepsi (4) Hydrogen
- 29.** Arrange the solid, liquid and gas in increasing order of attraction forces between their particles.
 (1) Solid < Liquid < Gas
 (2) Gas < Liquid < Solid
 (3) Liquid < Gas < Solid
 (4) None of these
- 30.** The substance that does not have definite shape but has definite volume is
 (1) Solid (2) Matter
 (3) Liquid (4) Gas

31. Which state has maximum intermolecular force?
(1) Solid (2) Liquid
(3) Gas (4) Plasma
32. Which of the materials among the following is compressible?
(1) Iron rod (2) Salt solution
(3) Water (4) Air
33. Gases have neither definite shape nor definite
(1) Mass (2) Volume
(3) Weight (4) Rigidity
34. Which of the following have indefinite shape and indefinite volume?
(1) Honey (2) Ink
(3) Oxygen (4) Chalk
35. In gaseous state, molecules can move
(1) only in one direction.
(2) only in fixed path.
(3) randomly in all directions.
(4) upward and downward only.
36. The gases are highly compressible because
(1) the molecules move randomly.
(2) the molecular force of attraction is very strong.
(3) the separation between molecules is very large.
(4) the separating force is strong.
37. LPG and CNG are
(1) Liquids
(2) Compressed gases
(3) Solids
(4) None of the above
38. The state of matter can be changed by varying
(1) pressure (2) temperature
(3) mass (4) both (1) and (2)
39. On cooling, a liquid is converted to solid. This change is called
(1) Melting (2) Boiling
(3) Diffusion (4) Freezing
40. The conversion of a liquid into vapour by heating at a fixed temperature is called
(1) Melting (2) Condensation
(3) Freezing (4) Boiling
- Fill in the blanks**
- Matter is made up of very small _____.
 - Smell of cooked food reaches us in seconds due to the process known as _____.
 - The matter in our surrounding exists in three states _____, _____ and _____.
 - Intermolecular space in solids is _____ than that of liquids.
 - _____ have definite volume but not definite shape.
 - Intermolecular forces of attraction are _____ in solids, _____ in liquids and _____ in gases.
 - The change of a liquid into vapour is called _____.
 - Boiling point of water is _____ K and melting point of ice is _____ K.
 - Change of vapour state to liquid state is called _____.
 - The change of a solid directly into gas is called _____.
- True or False**
- Air, water, chair, table and smell are examples of matter.
 - Hunger is an example of matter.
 - Matter is basically continuous in nature.
 - Movement of hand through air shows matter has spaces between its particles.

5. The smell of hot food reaches us faster as compared to cold food.
6. Sponge has fixed shape and volume.
7. Attraction forces are maximum in solids and minimum in gases.
8. Gases have highest rate of diffusion among all the three states of matter.
9. Water has boiling point equal to 100°C .
10. Evaporation is a bulk phenomenon.

Crossword puzzle



Across

1. Process in which solid changes into liquid.
3. SI unit of temperature.
4. Spreading of smell of cake being baked throughout the house.
6. SI unit of pressure.

Down

2. The solid changes into vapour directly.
5. SI unit of mass
7. Cooking gas

ANSWER KEY

Multiple choice questions

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	1	1	3	1	4	2	3	1	1	1	1	3	3	2
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	3	3	1	4	4	1	2	3	1	4	2	1	2	2	3
Question	31	32	33	34	35	36	37	38	39	40					
Answer	1	4	2	3	3	3	2	4	4	4					

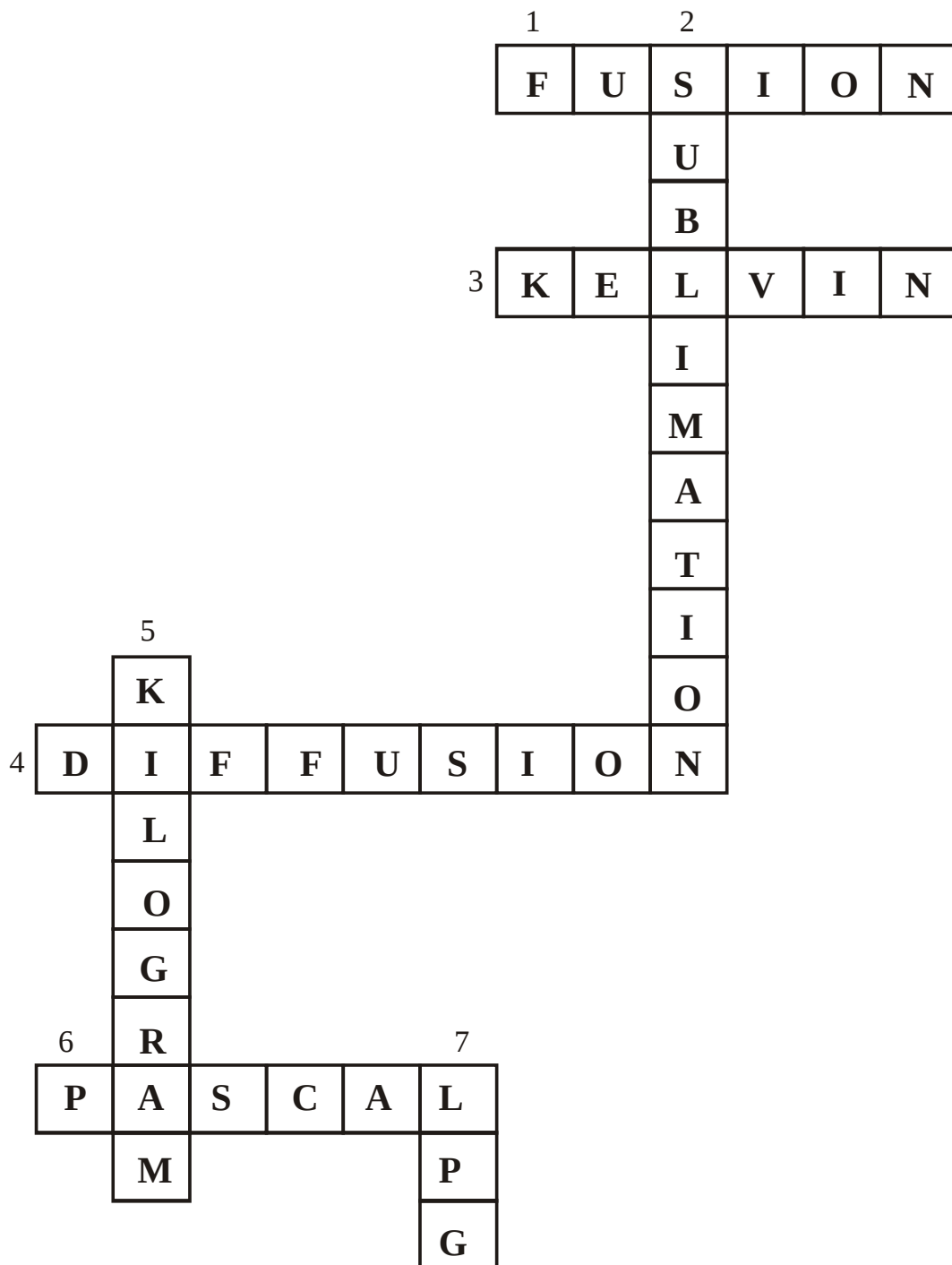
Fill in the blanks

- | | |
|--------------------------|-----------------------------------|
| 1. particles | 2. diffusion |
| 3. solid, liquid and gas | 4. less |
| 5. Liquids | 6. maximum, intermediate, minimum |
| 7. vaporization | 8. 373, 273 |
| 9. condensation | 10. sublimation |

True or False

- | | | | | |
|----------|----------|----------|---------|-----------|
| 1. False | 2. False | 3. False | 4. True | 5. True |
| 6. True | 7. True | 8. True | 9. True | 10. False |

Crossword puzzle



EXERCISE-02**Very short answer type questions**

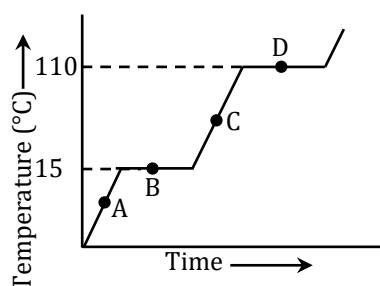
1. When a crystal of copper sulphate is placed at the bottom of a beaker containing water, the colour of water slowly becomes blue, why?
2. A substance has a definite volume but no definite shape. State whether this substance is a solid, a liquid or a gas.
3. Name the physical state of matter which can be easily compressed.
4. Convert the following temperatures to Celsius scale.
(i) 0 K (ii) 250 K
5. Change the following Celsius temperature to kelvin scale.
(i) -273°C (ii) -100°C
(iii) -40°C (iv) $+30^{\circ}\text{C}$
6. Convert (a) 300 K
(b) 573 K into Celsius scale.
7. Define (a) Boiling point
(b) Melting point
8. Define (a) Latent heat of fusion
(b) Latent heat of vaporisation
9. Suggest a method to liquefy gases.
10. What is sublimation?
11. What are full forms of CNG and LPG? Write their uses too.
12. What is plasma?
13. What is BEC?
14. Define matter.
15. Which among the sugar and oxygen has low attraction forces?

Short answer type questions

1. What are the characteristics of the particles of matter?
2. The smell of hot sizzling food reaches us several metres away. However, it is not so in case the food is cold. Explain.
3. Name the state of matter that
(i) has definite mass, volume and shape.
(ii) has no definite volume and shape.
(iii) has minimum inter particle attraction.
(iv) has maximum inter particle attraction.
4. Gases can be compressed but not solids. Explain.
5. For any substance, why does the temperature remain constant during the change of state?
6. 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. Explain.
7. How are the particles of perfume move rapidly when incense stick is lighted?
8. Why do liquid possess fluidity?
9. Why do we often sprinkle water on the road in summer?
10. Give two examples where evaporation process takes place and explain.

Long answer type questions

- What is diffusion? Give some examples of it.
- Write comparative properties of solids, liquids and gases.
- The graph below shows the heating curve for a pure substance. The temperature rises with time as the substance is heated.



- What is the physical state of the substance at the points A, B, C and D?
 - What is the melting point of the substance?
 - What is its boiling point?
 - What happens to the temperature while the substance is changing state?
 - The substance is not water. How can you judge from the graph?
- Which phenomenon occurs during the following changes?
 - Size of naphthalene balls decreases
 - Wax melts in the sun
 - Drying of wet clothes
 - Formation of clouds
 - Mixing of ink into water
 - Explain the interconversion of three states of matter in terms of force of attraction and kinetic energy of the molecules.

- Arrange the three states of matter in the increasing order of rate of diffusion and particle motion.
- What is evaporation? Explain about the factors affecting evaporation.
 - Out of solids, liquids and gases, which one has
 - maximum movement of particles
 - maximum interparticle forces of attraction
 - minimum spaces in between constitute particles
 - How will you demonstrate that particles of matter attract each other?
 - What happens when
 - sugar is added to water with constant stirring
 - Naphthalene balls kept in stored warm clothes.
 - Ice melts
 - Why do gases have maximum fluidity and minimum rigidity?
 - As compared to solids liquids are lighter, why?
 - Which property of gas is utilized when natural gas is used in vehicles?
 - Give two uses of gases in compressed form.
 - Why are gases so easily compressible whereas it is impossible to compress a solid?
 - How will you demonstrate that particles of matter have spaces between them?
 - What is sublimation process? Give an example to define it.

Exercise-01 Solutions

Multiple choice questions

1. **Option (2)**
Everything in this universe can be organised around two concepts, matter and energy.
2. **Option (1)**
The perception of joy, love, hate thought, cold, hot, pain is not considered as matter.
3. **Option (1)**
Diffusion is the process where molecules from a material move from an area of high concentration to an area of low concentration. Thus, ink spreads from its high concentration to a lower concentration area (beaker of water).
4. **Option (3)**
Solids have strongest interparticle forces of attraction at the room temperature. Both, iron and chalk are solids at room temperature but iron being stronger than chalk possesses strongest interparticle forces of attraction.
5. **Option (1)**
Both liquids and gases can flow, thus they are called fluids.
6. **Option (4)**
The molecules of gas have large intermolecular spaces and kinetic energy. Thus, molecules of gas spread in the entire space of the containing vessel.
7. **Option (2)**
Gases have maximum compressibility because of their maximum interparticle spaces present between their molecules.
8. **Option (3)**
Melting is a process in which a solid substance changes into its liquid state.
9. **Option (1)**
The temperature at which a solid melt to become a liquid at the atmospheric pressure is called its melting point.
10. **Option (1)**
The melting point of ice is 0°C , it may also be written as 273 K.
11. **Option (1)**
 $373^{\circ}\text{C} + 273 = 646\text{ K}$
12. **Option (1)**
 $270\text{ K} - 273\text{ K} = -3^{\circ}\text{C}$
13. **Option (3)**
Kelvin is the SI unit for measuring temperature.
14. **Option (3)**
Latent literally means not visible or hidden.
15. **Option (2)**
The temperature at which a liquid change into a gas or vapour at the atmospheric pressure is called its boiling point.
16. **Option (3)**
Boiling point of water is 100°C in kelvin scale
 $100^{\circ}\text{C} + 273 = 373\text{ K}$
17. **Option (3)**
Ice at 0°C is more effective in cooling as compared to water at 0°C , as it lacks the latent heat of fusion.

18. Option (1)

When a vapour is cooled by lowering its temperature, its interparticle distance decreases and changes into liquid. This process is known as condensation.

19. Option (4)

The process of converting a solid into gas without undergoing into liquid state is known as sublimation.

20. Option (4)

Dry ice is the solid form of carbon dioxide and used as a cooling agent.

21. Option (1)

Naphthalene converts directly from solid into gas without undergoing into liquid state, thus shows sublimation process.

22. Option (2)

The process of a liquid changing into vapour (or gas) even below its boiling point is called evaporation.

23. Option (3)

Both increase in surface area as well as increase in temperature increases the rate of evaporation.

24. Option (1)

Rate of evaporation increases with increase in temperature as more number of particle get enough kinetic energy to go into the vapour state.

25. Option (4)

Plasma is a fourth phase of matter, apart from the three; solid, liquid and gas phases.

26. Option (2)

Solids always have definite shape.

Liquids have definite volume but not definite shape, gases neither have definite shape nor volume, plasma are super energetic particles formed by heating and ionizing a gas.

27. Option (1)

Chalk is solid state of matter.

28. Option (2)

Stone has a fixed shape and volume because stone is solid. Solids have fixed shape and fixed volume.

29. Option (2)

Solid have the strongest intermolecular force of attraction. In liquids, it is less than solid but more than gases and in gases, it is very weak.

30. Option (3)

Liquids have a definite volume but indefinite shape. This is because the intermolecular forces of attraction in liquids are quite weak as compared to the solid states.

31. Option (1)

Solids have strongest intermolecular force.

32. Option (2)

Gases are compressible because on applying pressure, the space between the gaseous particles decreases. Therefore, gases can be compressed readily.

33. Option (2)

Gases do not have a fixed shape or volume. The particles are freely moving and they do not have a fixed position.

34. Option (3)

Gases have no definite shape or volume.

35. Option (3)

The particles in a gas do not have any particular arrangement and there are very weak forces between them. Molecules can move randomly in all directions.

36. Option (3)

Gases are highly compressible because the space between the molecules is very large. Its intermolecular force of attraction is less.

37. Option (1)

LPG stands for liquified petroleum gas. It consists of propane (C_3H_8) and butane (C_4H_{10}) as the major constituents. LPG (propane) is denser than air as compared to CNG (Methane). Which is lighter than air.

38. Option (4)

Matter changes from one state to another by changing temperature or pressure. We can convert from one state to another by adding or removing energy (heat). i.e. by changing temperature or by changing the pressure.

39. Option (4)

Freezing is a phase transition in which a liquid turn into a solid when its temperature is lowered to its freezing point.

40. Option (4)

Boiling is the process by which a liquid turn into a vapour when it is heated to its boiling point.

True or False**1. False**

Smell is not the example of matter.

2. False

Hunger is not an example of matter.

3. False

Matter is particulate in nature.

4. True

Movement of hands through air is possible because air (matter) has spaces between its particles

5. True

Rate of diffusion increases with rise in temperature

6. True

Sponge is a solid.

7. True

Solids have least interparticle space due to strongest attraction forces while gases have maximum interparticle space due to weakest attraction forces.

8. True

The rate diffusion is highest in gases.

9. True

Boiling point of water is $100^{\circ}C/373 K/212^{\circ}F$.

10. False

Evaporation is a surface phenomenon.

Exercise-02 Solutions

Very short answer type questions

1. The colour of the water becomes blue because of the diffusion of copper sulphate particles placed at the bottom of the beaker containing water. There are millions of tiny particles in just one crystal of copper sulphate which keep on dividing themselves into smaller and smaller particles, hence making the water blue coloured.
2. A substance that has a definite volume but no definite shape is said to be in the liquid state.
3. Gases can be easily compressed due to minimum intermolecular forces of attraction.
4. $K - 273 = ^\circ C$
Therefore, (i) $0K = 0 - 273 = -273 ^\circ C$
(ii) $250 K = 250 - 273 = -23 ^\circ C$
5. $^\circ C + 273 = K$
Therefore, (i) $-273 ^\circ C = -273 + 273 = 0K$
(ii) $-100 ^\circ C = -100 + 273 = 173 K$
(iii) $-40 ^\circ C = -40 + 273 = 233 K$
(iv) $+30 ^\circ C = +30 + 273 = 303 K$
6. $K - 273 = ^\circ C$
Therefore, (a) $300 K = 300 - 273 = 27 ^\circ C$
(b) $573 K = 573 - 273 = 300 ^\circ C$
7. (a) Boiling point: "The temperature at which a liquid change into a gas/ vapour at atmospheric pressure is called its boiling point."
- Eg. Boiling point of water is $100 ^\circ C$
- (b) Melting point: "The temperature at which a solid melt to become a liquid at atmospheric pressure is called its melting point."
Eg. Melting point of ice is $0 ^\circ C$
8. (a) Latent heat of fusion: "The amount of heat energy required to change the state of 1kg solid into liquid at atmospheric pressure without any change in temperature at its melting point is called as latent heat of fusion."
Eg. Latent heat of fusion of ice is $3.34 \times 10^5 J/kg$
- (b) Latent heat of vaporisation: "The amount of heat energy required to change the state of 1kg liquid into gas at atmospheric pressure without any change in temperature at its boiling point is called as latent heat of vaporisation."
Eg. Latent heat of vaporisation of water is $22.5 \times 10^5 J/kg$
9. Increasing the pressure applied and lowering the temperature will help to liquefy a gas.
(1) Decrease in pressure
(2) Increase in temperature

10. The process of change of state of a substance from solid to gas directly upon heating, without passing through the liquid state, and vice versa upon cooling is called sublimation.
11. CNG - Compressed Natural Gas; used as fuel in vehicles, automobiles.
LPG - Liquefied Petroleum Gas; used as domestic fuel for cooking.
12. Plasma is the fourth state of matter that consists of super excited and super energetic particles in the form of ionised gases and free electrons.
13. BEC stands for Bose-Einstein Condensate. It is a gaseous superfluid phase formed by atoms cooled to temperature very near to absolute zero.
14. Anything that has mass and occupies space is called matter. A matter is made up of tiny particles called atoms. For example, table chair, air, water, honey etc.
15. Sugar is solid. In solid, particles are very closer to each other so forces of attraction between the particles are also more.
Oxygen is gas. In gas, particles are very far from each other, so forces of attraction between the oxygen particles are less.

Short answer type questions

1. The characteristics of particles of matter are as follows:
 - (a) The particles of matter have spaces between them.
 - (b) The particles of matter are continuously moving
 - (c) The particles of matter are very small.
 - (d) The particles of matter attract each other.

These characteristics vary from substance to substance and hence results in the existence of three states of matter viz. solid, liquid and gas.
2. The smell of hot sizzling food reaches us more quickly as compared to the smell of cold food. This is because rate of diffusion is faster at higher temperature than at lower temperature. The rate of diffusion of hot sizzling food is more and hence, reaches you even several metres away. On the other hand, rate of diffusion of cold food is less therefore, you have to go quite close to it in order to get its smell.
3.
 - (i) Has definite mass, volume and shape - Solid
 - (ii) Has no definite volume and shape - Gas or Plasma
 - (iii) Has minimum interparticle attraction - Gas
 - (iv) Has maximum interparticle attraction - Solid
4. Since the interparticle spaces in the gaseous state particles are very large, they can be changed by altering the amount of pressure applied. Thus, a gas can be compressed to a large extent as

compared to solid which have almost negligible interparticle spaces.

5. For any substance, the temperature remains constant during the change of state because the heat supplied is used up in changing the state by breaking the intermolecular forces of attraction which hold them together without raising the temperature. This energy which is required to change the state is known as "latent heat".
6. The temperature of the steam is same as that of the boiling water inside the kettle, but the steam has an additional energy of $22.5 \times 10^5 \text{ J/kg}$ in the form of latent heat of vaporization.
7. When the incense stick is lighted the heat energy makes the particles of perfume move rapidly. Thus, they easily drift through the air in the room and hence we can smell it anywhere in the room.
8. Unlike solids, the liquids have fluidity and not rigidity i.e. they have tendency to flow. This is due to lesser interparticle or intermolecular forces that are present in the liquid state as compared to the solid state.

However, the liquids differ in their relative fluidity. For example, water flows at a faster rate than honey because in honey, the particles are heavier and also more closely packed.

9. The water evaporates rapidly from the hot surface of the road, there by taking away heat from it. Thus, the road becomes cool.

10. (i) Water keeps cool in the earthen pot(matki) during summer.

When the water oozes out of the pores of an earthen pot, during hot summer, it evaporates rapidly. As the cooling is caused by evaporation, therefore, the temperature of water within the pot falls and hence it becomes cool.

(ii) Rapid cooling of hot tea.

If tea is too hot to sip, we pour it in the saucer. In doing so, we increase the surface area and the rate of evaporation increases. This, in turn, causes cooling and the tea attains a desired temperature for sipping.

Long answer type questions

1. **Diffusion:** Spontaneous intermixing of particles of two or more different substances is called diffusion

The rate of diffusion becomes faster with increase in temperature because at higher temperature, the particles have more energy and hence move faster.

Diffusion is,
 - (i) Fastest between two different gases.
 - (ii) Slower between two different liquids or a solid and a liquid.
 - (iii) Slowest (or almost negligible) in case of two different solids.

Example

1. As the drop of ink trickles along the sides of the beaker, the blue colour of the ink starts diffusing in water, which appears like wavy blue streaks in water.
2. The honey drop continues travelling along the side of beaker and there is no visible diffusion of it in water.
3. The ink spreads evenly in the water in about two hours.

Therefore,

Rate of diffusion depends upon the nature of substances.

More viscous substances which have particles with less kinetic energy, takes more time to get diffused.

From these activities it is observed that when two different forms of matter are brought in contact, they intermix spontaneously. This intermixing is possible due to motion of the particles of matter and also due to the spaces between them. The intermixing takes place due to movement of particles of one form into the spaces between the particles of the other form of matter.

2.

Property	Solids	Liquids	Gases
Shape	Definite	Not definite. Takes the shape of container	Not definite. Fill the container
Volume	Definite	Definite	Not definite. Take volume of container
Interparticle space	Very small. Particles are closely packed	Comparatively large. Particles are loosely packed	Very large. Particles are very loosely packed
Interparticle force	Very strong	Weak	Very weak
Compressibility	Almost nil	Very small	Highly compressible
Fluidity/Rigidity	Hard and rigid	Fluid	Fluid
Density	High	Low	Very low
Diffusion	Negligible	Slow	Very fast
Kinetic energy	Low	Comparatively high	Very high

3. (a) A indicates solid state, at point B the substance can be in liquid as well as solid state. At point C substance is in

liquid state while at point D the substance can be in liquid as well as gaseous state.

- (b) Melting point of the substance is 15°C .
- (c) Boiling point of the substance is 110°C .
- (d) The temperature remains constant while the substance is changing state.
- (e) Pure water has fixed boiling point of 100°C , whereas this substance is found to have a boiling point of 110°C . Hence, we can conclude that the substance is not water.

4. (a) (i) Size of naphthalene balls decreases - Sublimation
 (ii) Wax melts in the sun - Melting
 (iii) Drying of wet clothes - Evaporation
 (iv) Formation of clouds - Condensation
 (v) Mixing of ink into water - Diffusion

(b) When we heat a solid, its particles become more energetic and kinetic energy of the particles increases. Due to the increase in kinetic energy, the particles start vibrating more strongly with greater speed. The energy supplied by heat overcomes the intermolecular forces of attraction between the particles. As a result, the particles leave their mean position and break away from each other. After this solid melt and a liquid is formed. When we supply heat energy to the liquid, the particles of water start vibrating even faster. Some of the particles become so energetic that

they can overcome the attractive forces of the particles around them. Therefore, they become free to move and escape from the liquid. Thus, the liquid evaporates i.e. starts changing into gas.

(c) Diffusion is,

- (i) Fastest between two different gases.
- (ii) Slower between two different liquids or a solid and a liquid.
- (iii) Slowest (or almost negligible) in case of two different solids.

5. "The process of a liquid changing into vapour (or gas) even below its boiling point is called evaporation."

Whatever be the temperature at which evaporation takes place, the latent heat of vaporization must be supplied whenever a liquid change into vapour (or gas).

Explanation about evaporation: Some particles in a liquid always have more kinetic energy than the others.

So, even when a liquid absorbs heat, below its boiling point, some of its particles have enough energy to overcome the forces of attraction between the particles and escape from the surface of the liquid in the form of vapour (or gas). Thus, the fast-moving particles (or molecules) of a liquid are constantly escaping from the liquid to form vapour (or gas).

Examples

- (i) Water in ponds changes from liquid to vapour without reaching the boiling point.
- (ii) Water when left uncovered slowly changes into vapour.
- (iii) When we put wet clothes for drying, the water from the clothes goes to the atmosphere.

There are five factors which affects the rate of evaporation:

- (i) Nature of liquid :** Different liquids have different rates of evaporation. A liquid having weaker interparticle attractive forces evaporates at faster rate because less energy is required to overcome the attractive forces.

Example : Acetone evaporates faster than water.

- (ii) Surface area of the liquid :** The evaporation depends upon the surface area. If the surface area is increased, the rate of evaporation increases because the high energy particles from liquid can go into gas phase only through surface.

Example :

- (a) The rate of evaporation increases when we put kerosene or petrol in an open China dish than in a test tube.

- (b) Clothes dry faster when they are well spread because the surface area for evaporation increases.

- (iii) **Temperature:** Rate of evaporation increases with increase in temperature. This is because with the increase in temperature more number of particles get enough kinetic energy to go into the vapour state (or gaseous state)

Example :

Clothes dry faster in summers than in winters.

- (iv) **Humidity in the air :** The air around us contains water vapour or moisture. The amount of water present in the air is referred to as humidity. The air cannot hold more than a definite amount of water vapour at a given temperature.

If the humidity is more, the rate of vaporization decreases. The rate of evaporation is more if the air is dry.

Example :

Clothes do not dry easily during rainy season because the rate of evaporation is less due to high moisture content (humidity) in the air.

- (v) **Wind speed :** The rate of evaporation also increases with increase in speed of the wind. This is because with increase in speed of wind, the particles of water vapour move away with wind in resulting decrease in the amount of vapour in the atmosphere.

Example :

- (a) Clothes dry faster on a windy day.
- (b) In a desert cooler an exhaust fan sucks the moist air from the cooler chamber which results in greater rate of evaporation of water and hence greater cooling.

6. (i) (a) Gases have maximum movement of particles since they have maximum space between them.
- (b) Solids have maximum interparticle attractions, so they are close to each other.
- (c) Solids have minimum space between particles because of the strong force of attraction.

(ii) Aim



Bihu Dancers

To demonstrate the strength of attractive forces between particles of different kinds of matter.

Method

Play this game in the field. Make four groups and form human chains.

- (a) The first group should hold each other from the back and lock arms like Bihu dancers.
- (b) The second group should hold hands to form a human chain.

- (c) The third group should form a chain by touching each other with only their fingertips.
- (d) Now, the fourth group of students should run around and try to break the three human chains one by one into as many small groups as possible.

Now answer

- a. Which group was the easiest to break Why?
- b. If we consider each student as a particle of matter, then in which group the particles held each other with the maximum force?

Answers

- a. Third group, because they were weakly bonded with each other.
- b. 1st group
If particles are bonded tightly, it is difficult to separate them.

Conclusion

Particles of matter attract each other.

7. (i) String increases the rate of interaction. Stirring helps to increase the interaction between sugar molecules and water molecules. Which causes sugar molecules to break away from each other. Hence they get dissolved faster.
- (ii) Naphthalene balls disappear with time without leaving any solid because of they undergoes sublimation easily i.e., the change of state of naphthalene from solid to gas takes place easily.

(iii) when the temperature increases, the ice starts changing into water. This change is called "Melting". The temperature remains same till all the ice changes into water. The thermometer shows 0°C until all the ice has melted.

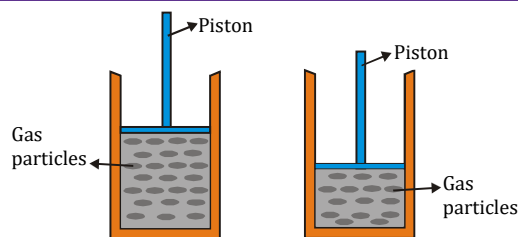
8. **(i)** Since the interparticle spaces are the maximum in the gaseous state, the attractive forces are the least. As a result, the fluidity is very large while rigidity is negligible.

(ii) As compared to solids, liquids are generally light. This is on account of greater number of interparticle spaces in the liquid state as compared to the solid state of the same substance.

(iii) Natural gas is used extensively in the compressed form in vehicles. This form of natural gas is called compressed natural gas (CNG).

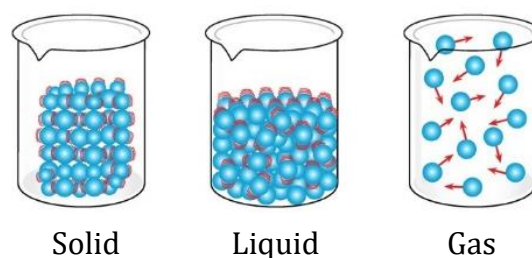
(iv) LPG (Liquified petroleum gas) and oxygen gas are the two gases that are supplied in compressed form in houses and hospitals.

9. Gases are compressible because on applying pressure, the spaces between the gaseous particles decrease. Therefore, gases can be compressed readily.



By applying pressure particles of gas can be brought close together.

(ii) Particles of matter have space between them when sugar is dissolved in water, the volume of the liquid remains unchanged because during dissolution, the particles of sugar get into the spaces between the particles of water.



Matter has spaces between the particles

As a result, they get evenly distributed and there is no noticeable change in volume. Similarly, when potassium permanganate is dissolved in water, its particles get evenly distributed throughout the bulk of water. This is indicated by the uniform colour of the solution.

This indicates that there are spaces between particles of matter. The particles of potassium permanganate get uniformly distributed in the spaces between water molecules.

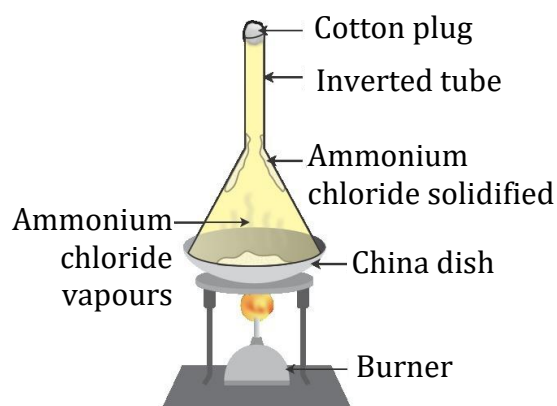
Similarly, when we prepare tea, coffee or lemonade (nimbu pani) we observe that particles of one type of matter get into the spaces between particles of other.

- 10.** Sublimation is the process by which a solid directly changes into a gaseous state on heating, without getting into the liquid state and vice versa upon cooling.

E.g. Ammonium chloride/Camphor changes into vapour upon heating.

Aim

To demonstrate the process of sublimation



Method

- (a) Take some camphor or ammonium chloride.
- (b) Powder it and put in a China dish.
- (c) Place an inverted funnel over the China dish.
- (d) Put a cotton plug on the stem of the funnel.
- (e) Heat the China dish slowly.

Observation

We observe that solid camphor on heating gets converted into vapour which gets condensed on the funnel.

Solid state is directly converted into gaseous state. This experiment shows sublimation process.

More examples of sublimation

- (i) In very cold places, the snow does not melt but sublimates directly to vapours.
- (ii) In frost-free refrigerators, ice on the walls of the freezer sublimates when warm air is circulated through the compartment during the defrost cycle.