Grade IX

Lesson 1. Matter in our surroundings

CHAPTER AT A GLANCE

MATTER

It is a substance which occupies space and has mass. Air, Earth, Fire, Sky and water are five basic elements. 'The Panch Tatva' according to the earlier Indian Philosophers. According to them everything i.e., living or non-living is made up of these five elements.

1.Physical Nature of Matter

- Matter is composed of particles, All matter constitute minutely small particles, These small particles are known as atoms.
- These particles are too small so they cannot be visually perceived [seen] by naked eye of simple microscope.
- Particles of matter are continuously moving as they posses kinetic energy. With the increase in temperature. Kinetic energy of particles additionally increases so particle move faster.

2. Characteristics of Matter

- Particle of matter have space between them e.g. when, we mix some salt in water and stir it, the salt disappears but the water level remain same. This is because the salt occupies the space between the particle of matter of water. This shows that particles of matter have space between them.
- Particles of matter are continuously moving. Take water in a jar. Put some water colour in it. Soon the water colour will dissolve and water will change into the desired colour in it. This shows the particles of matter are continuously moving as the particle of water colour diffuse with particle of water.
- Particles of matter attract each other. To move our hand in liquid. Such as sea water. We have to apply some. Force. But in solids such as wood. We can not move our hand. In air, we can move our hand very easily because of forces of attraction which is practically negligible in gas, moderate in liquids and highest in solid.

3. Physical State of Matter

4. Change of State of Matter

Contd. on next page

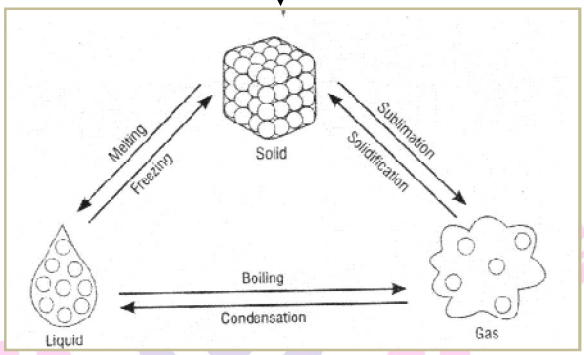
3. Physical State of Matter

Solids	Liquids	Gases
1. Fixed shape 2. Fixed volume 3. Cannot be compressed 4. Strong force of attraction between particles. 5. High melting and boiling point. 6. Least inter particle space. 7. Ordered arrangement of particle. 8. Mostly have high density 9. Particles are not time to move. 10. Do not flow.	1. No fixed shape. 2. Fixed Volume 3. Cannot be compressed easily. 4. Less force of attraction between particles than solids. 5. Low melting point but boiling point is higher 6. More inter particle space. 7. Little order in arrangement of particles 8. Mostly have less density. 9. Particle can move. 10. Flows from higher to lower level.	1. No fixed shape 2. No fixed volume. 3. Can be compressed easily 4. Least force of attraction between particles. 5. Low melting and boiling point 6. Maximum inter particle space. 7. No order in arrangement of particles. 8. Least density 9. Particle move in all direction, 10. Exert pressure on walls of container, flow in all direction.

Plasma. It is fourth state of matter. It consists of super energetic and super excited particles which are in the form of ionised gases. The fluorescent tube. Neon sign bulbs consist of plasma. Inside the neon bulb, there is neon gas whereas inside the fluorescent tube. There is helium gas or some other gas . The gas gets ionised, i.e. gets charged when electrical energy flows through it. This charging up creates glowing plasma inside the tube or bulb. The plasma glows with a special colour depending upon the nature of gas. The sun and stars glow because of presence of plasma in them. The plasma is created in stars due to very high temperature. Plasma TV is based on fourth state of matter called plasma.

Bose-Einstein Condensate [B.E.C] : It is fifth state of matter which is formed from matter that has been cooled to near absolute zero [-273^0 C] when a group of atoms is cooled to a very low temperature. The velocity decreases because they have very low energis. This causes the individual atoms to overlap each other forming a single super atom with all of its constituting atoms sharing a single energy state.
A rotating B.E.C. could be used as model black hole. Allowing light to enter but not to escape. Condensate can also be used to 'freeze' pulses of light, to be released again
when condensate break down. Research in this field is going on.

4. Change of State of Matter



FACTORS AFFECTING CHANGE OF STATE OF MATTER

Melting: The process in which solid changes into liquid is called melting. It is also called fusion.

Freezing: The process of converting liquid into solid is called freezing, e.g. convert water into ice in fridge in ice tray..

Boiling: The process of converting liquid into vapour completely is called boiling. It is bulk phenomenon, i.e. particles from inside the liquid gain enough energy to change into vapour state. It takes place only at boiling point.

Condensation
The process of converting gas or vapours into liquid is called condensation. E.g. Water vapours get condensed on the surface of glass containing chilled water.

Sublimation: It is a process in which solid directly changes into vapour without changing into liquid state. E.g. camphor, I_2, NH_4Cl, Naphthalene can sublime.

Solidification: The process of conversion of gas or liquid into solid is called solidification, e.g. water [liquid] solidifies to form ice. Iodine vapours on cooling form iodine solid, Carbon dioxide at high pressure changes into dry ice [Solid CO_2)

Evaporation: It is a process in which liquid changes into vapours e.g. water changes into vapours if left uncovered. Wet clothes dry up because water gets evaporated. The particles of water collide with each other as well as with particles of gases in atmosphere. After some time, the particles on the surface gain sufficient energy so as to change into vapours. It is a surface phenomenon.

Factors Affecting Rate of Diffusion

1. Density : The rate of diffusion depends upon density of liquid. Higher the density, lesser will be the rate of diffusion.
2. Temperature: The rate of diffusion depends upon temperature. [i.e. the rate of diffusion increases with an increase in temperature which can be shown experimentally.
3. Physical State: Solids can diffuse into liquids slowly whereas liquids can diffuse into liquids faster and gases can also diffuse into liquids.

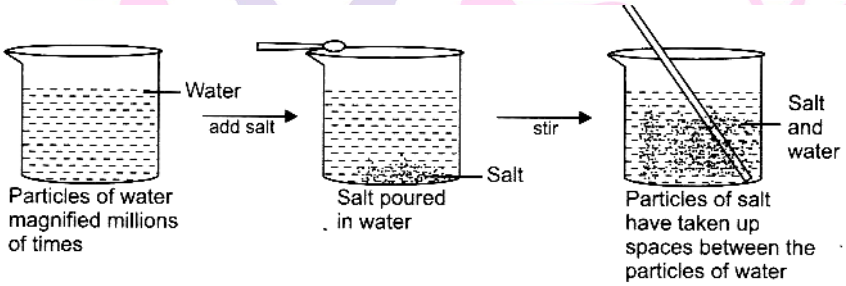
Know the terms

Activity / Project 1 : To show that there is space between particles of matter. [CBSE 2013]

Materials Required : 100 ml beaker, water, salt, glass rod.

Procedure :

- Take a 100 ml beaker and fill it with water and mark the level of water.
- Dissolve the given salt with the help of glass rod.
- Observe the change in the water level and record your observations.



To show – Space between particles of matter

Observations : The salt gets dissolved in water. The particles of salt have entered the space between water molecules, therefore, the level of water does not change.

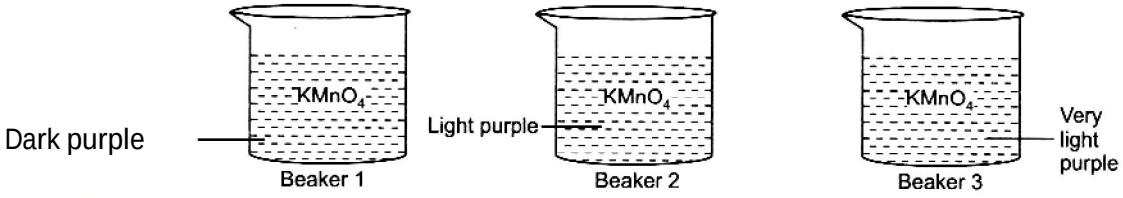
Conclusion ; The salt consists of large number of small particles which occupy the space between molecules of water.

Activity / Project 2 : To show that matter is made up of very small particles [CBSE 2014]

Materials Required : Crystals of $KMnO_4$ **[Potassium permanganate]**, water, 3 separate beakers.

Procedure :

- Take 2-3 crystals of $KMnO_4$ and dissolve them in 50ml of water in beaker.1.
- Take 5 ml of solution from beaker 1 and put it into 50ml of water in beaker 2.
- Take 5 ml of solution from beaker 2 and put it into 50ml of water in beaker 3 and observe the colour of solution.



Observations : The colour of solution remains purple in all the beakers.

Conclusion ; It shows that even 2-3 crystals of $KMnO_4$. Consist of millions of small particles which dissolve in water giving purple colour to the solution.

Activity / Project 3 : **To show that particles of matter are continuously moving..**

Materials Required : Incense stick or agarbatti, match box

Procedure :

- Put an unlit incense stick in a corner of your class.
- Go close to the incense stick to smell it.
- Now light up the incense stick. And try to get the smell from a distance.

Observations : The colour of solution remains purple in all the beakers. The smell of unlit incense stick can be observed only by going close to it whereas the smell of lighted incense stick can be observed from a distance.

Conclusion ; The particles of matter are continuously moving but the speed of particles is very slow. The speed of particles increases with the increase in temperature.

Activity / Project 4 : To compare the rate of diffusion of liquids having different densities. [CBSE2011]

Materials Required : Two beakers filled with wtr, blue ink, honey.

Procedure :

- Take two beakers filled with water.
- Add a drop of blue ink into first beaker slowly and honey in the second beaker
- Leave them undisturbed at your home or in a corner in the class
- Record your observations

Observations : The blue ink diffuses into water and water becomes light blue in colour
Honey diffuses very slowly into water, therefore, takes lots of time to diffuse evenly.

Conclusion ; Liquids with higher density, diffuse slower than liquids having lower density.

Activity / Project 5 : **To study the variation of rate of diffusion with temperature of solid in liquid**

Materials Required : Copper sulphate, two beakers, cold water and hot water.

Procedure :

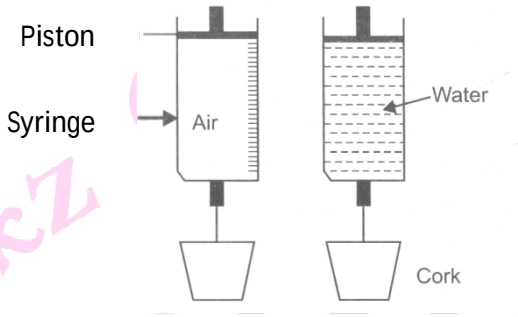
- Take 50ml of cold water in a beaker.
- Take 50ml of hot water in another beaker.
- Add a crystal of copper sulphate into the beaker containing 50ml of cold water
- Add a crystal of copper sulphate into the beaker containing 50ml of hot water
- Leave them undisturbed.
- Record the observations.

Observations : The colour of solution in first beaker becomes blue slowly whereas the colour becomes blue faster in second beaker.

Conclusion ; The rate of diffusion increases with increase in temperature because kinetic energy of molecules increases.

Activity / Project 6 : To show that gases can be compressed more easily than liquids [CBSE2015]

Materials Required : Two 10 ml syringes, rubber cork, Vaseline,



To show – Gases can be compressed more easily than liquids

Procedure :

- Take two 10ml syringes and close their nozzles by inserting them in a rubber cork as shown in figure.
- Remove the piston from both they syringes.
- Allow the air to fill the space inside one syringe and fill water in the other.
- Insert the pistons back into syringes
- Apply some Vaseline on the piston for smooth movement,
- Now try to compress by pushing piston in the syringe.
- Record your observations.

Observations : In case of air, piston is easily pushed in as compared to syringe filled with water

Conclusion ; The gases can be compressed more easily than liquids. It is because there are weak intermolecular forces of attraction between particles, so the distance between the particles in gaseous state is very large as compared to solids and liquids, e.g CNG is compressed natural gas which is being used in vehicles as a fuel. LPG is liquefied petroleum gas which is used for cooking.

Activity / Project 7 : To study the effect of temperature on solids and liquids.

Materials Required : Ice, thermometer, beaker.

Procedure :

- Take about 50g of ice in a beaker and hang a laboratory thermometer in it so that bulb is in contact with ice.
- Start heating the beaker at low flame,
- Note down the temperature when ice starts melting
- Note the temperature when all the ice has converted into water
- Record your observations for conversion of solid into liquid state.
- Now put a glass rod in the beaker and heat while constant stirring till the water starts boiling.
- Keep a close look at the thermometer reading till most of the water has vaporised.
- Record your observations for the conversion of ice into liquid water and then into vapour state.

Observations : When temperature of solid is increased, the kinetic energy of particles increases.

Conclusion ; Due to increase in kinetic energy, the particles start vibrating at a greater speed and overcome intermolecular forces of attraction. A stage is reached when intermolecular forces become so less that ice changes into liquid, when temperature is further increased, a stage comes when liquid changes into vapour.

Activity / Project 8 : To show the process of sublimation experimentally

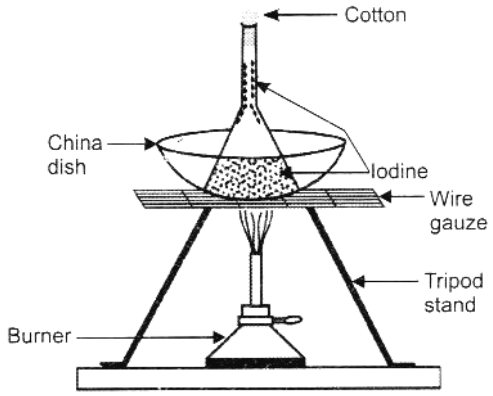
Materials Required : Solid iodine, funnel, tripod stand, china dish, wire gauze, burner or spirit lamp, cotton,

Procedure :

- Take 2 g of iodine in china dish.
- Put an inverted funnel over it whose stem is closed by cotton plug and set the apparatus as shown in diagram.
- Heat the china dish so that vapours are formed and record the observations,
- The vapours of iodine get condensed on the walls of the funnel.

Observations : The violet coloured vapours of iodine get condensed and change into solid iodine.

Conclusion ; Iodine can sublime and can be purified by sublimation.



Process of Sublimation

Grade IX

Lesson 1. Matter in our surroundings

SCIENCE

I Multiple choice questions

1. Seema took a 100 ml beaker and filled half the breaker with water and marked the level of water. She dissolved some salt with water and marked the level of water. She dissolved some salt with the help of a glass rod and recorded water level again

   Choose the correct observation related to above activity.

   a) the water level increases appreciably

   b) The water level decreases

   c) The water level remains the same

   d) There is little increase in water level

2. Which of the following is not a characteristic of matter?

   a) Matter is made up of extremely small particles

   b) There is no space between particles of matter

   c) The particles of matter are continuously moving

   d) The particles of matter attract each other.

3. Which one of the following sets of phenomenon would increase on rising the temperature?

   a) Diffusion, evaporation and compression of gases.

   b) Evaporation, compression of gases and solubility of solid in liquid

   c) Evaporation, diffusion, expansion of gases and solubility of solid in liquid

   d) Evaporation, solubility of gas in liquid, diffusion and compression of gases

4. Shivam visited as LPG unit and found that the gas can be liquefied at specific conditions of temperature and pressure. Help him to identify the correct set of conditions.

a) High temperature and high pressure

b) Low temperature and low pressure

c) Low temperature and high pressure

d) High temperature and low pressure

5. During summer, water kept in earthen pot becomes cool due to phenomenon of

a) Diffusion b) Transpiration c) Distillation d) Evaporation

6. Which of the following is correct order of forces of attraction?

a) Water > Air > Sand b) Air > Sugar > Oil

c) Air < Water <Sugar d) Salt > Air > Juice

7. If we keep cold drink bottle in freezer, what will happen?

a) Water will change into ice b) Cold drink bottle will break

c) CO_2 gas will get solidified d) Nothing happens

8. Choose the correct statement out of the following.

a) Conversion of solid into vapours without becoming liquid is called evaporation.

b) Conversion of vapours into solid without becoming liquid is called sublimation

c) Conversion of liquid into vapours is called fusion

d) Conversion of solid into liquid is called freezing.

9. Which of the following will produce severe burns?

a) Cold water b) Hot water c) Boiling water d) Steam

10. Which of the following conditions will increase the rate of evaporation?

a) Increase in temperature of water b) Decrease in wind speed

c) Decrease in surface area of water d) Adding sugar to water

11. Which of the following is incorrect?

a) Solids have fixed shape and fixed volume

b) Liquids have fixed volume but not shape

c) Gases have neither fixed shape nor volume

d) The particles have least intermolecular space but maximum kinetic energy in liquids.

12. Which of the following is correct order to density?

a) Air < Exhaust from chimneys < Honey <Water < Chalk < Cotton < Iron

b) Air < Exhaust from chimneys < Water < Honey < Cotton <Chalk < Iron

c) Air < Exhaust from chimneys < Honey <Water < Chalk < Iron < Cotton

d) Air < Exhaust from chimneys < Water < Honey < Cotton <Chalk < Iron

13. Ice floats on water because

a) It has higher density than water

b) It has lower density than water due to more volume

c) It is solid

d) It is low melting solid

14. The physical state of a matter depends upon

a) temperature and pressure b) temperature only

c) pressure only d) nature of substance

15. The boiling point of water at higher altitude is.

a) 373 K b) < 373 K c) > 373 K d) 273 K

16. Latest heat of fusion is amount of

a) heat energy required to change 1 kg solid into liquid completely at its melting point.

b) heat energy required to change 1 kg solid into liquid at room temperature

c) heat energy required to change 1 kg solid into liquid completely

d) heat energy required to change 1 kg solid into liquid at any temperature

17. The temperature at which vapour pressure of liquid becomes equal to atmospheric pressure is called.

a) melting point b) boiling point

c) ignition temperature d) sublimation temperature

18. Which of the following is not correct?

a) SI unit of temperature is Kelvin b) SI unit of pressure is atm

c) SI unit of density is kg/m^3 d) 1 litre = 1000 cm^3 = 1 dm^3

19. Which of the following has minimum kinetic energy?

a) Particles of ice below 0^0C b) Particles of water at 0^0C

c) Particles of water 100^0C d) Particles of steam 100^0C

20. Which of the following cannot be separated by sublimation?

a) Iodine and NaCl. b) Iodine and Ammonium chloride

c) Camphor and Sodium chloride d) Naphthalene and Sand

21. Which one of the following sets of phenomena would increase on raising the temperature?

a) Diffusion, evaporation, compression of gases, solubility.

b) Evaporation, compression of gases, solubility.

c) Evaporation, diffusion, expansion of gases

d) Evaporation, solubility, diffusion, compression of gases,

22. 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

23. The property to flow is unique to fluids. Which one of the following statement 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 and fluids

24. During summer, water kept in an earthen pot becomes cool because of the phenomenon of .

a) diffusion b) transpiration c) osmosis d) evaporation

25. 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

26. On converting 25^0C, 38^0C and 66^0C to Kelvin scale, the correct sequence of temperature will be

a) 298 K, 311 K and 339K b) 298 K, 300 K and 338K

c) 273K, 278K and 543 K d) 298 K, 310 K and 338K

1.c	2. b	3. c	4. c	5. d	6. c	7. b	8. b	9.d	10.a
11. d	12. b	13. b	14. a	15. b	16. a	17. b	18. b	19. a	20. b
21. c	22. c	23. c	24. d	25. c	26. a				

I Match the following

27. The son S.I. and S.I. units of some physical quantities are given in column 'A' and 'B' respectively. Match the units belonging to same physical quantity.

	Column I		Column II
1.	Degree Celsius	A.	Metre
2.	Centimetre	B.	Kelvin
3.	g cm^{-3}	C.	Pascal
4.	Atm	D.	Kilogram
5.	mg (milligram)	E.	Kg m^{-3}

1. B	2. A	3. E	4. C	5. D

I Fill in the blanks

28. The melting point of ice on Kelvin scale is _____.

29. The best evidence that particles of matter are constantly moving comes from the studies of diffusion and_____.

28. 273 k	29. Brownian motion

I True or False

30. At room temperature the forces of attraction between the particles of solid substance are more than those which exist in gaseous state.

31. At room temperature kinetic energy of particles in solids is less than of particles of gaseous state [True/False]

30. True	31. True

Direction [Q.32 to Q.34] : In the following Question, the Assertion and Reason have been put forward, Read the statements carefully and choose the correct alternative from the following

a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.

b) The Assertion and the Reason are correct but the Reasons is not the correct explanation of the Assertion.

c) Assertion is true but the Reason is false

d) The statement of the Assertion is false but the Reason is true.

32. Asserion: In pressure cooker temperature of water becomes more than 100^0 C

Reason: Boiling point is directly proportional to pressure acting on liquid

c) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.

33. Assertion: Ice mixed with common salt is freezing mixture having temperature below 0^0C

Reason: It will melt at 0^0C

(c) Assertion is true but the Reason is false

34. Assertion : Dry ice is solid CO_2

Reason: Dry ice is same as ice.

(c) Assertion is true but the Reason is false.

35. A substance has no mass. Can we consider it as matter?

No, matter must have mass and occupy space.

36. Select the substances from the following which do not have the property of sublimation. Camphor, Potassium permanganate, copper sulphate, Naphthalene.

Potassium permanganate, copper sulphate do not have property of sublimation.

34. Convert 300k into Celsius scale and -10^0 C into Kelvin scale

i. 300K – 273= 27^0 C

ii. -10^0 C + 273 = 263 K

35. Name the property of gases due to which it is possible to fill CNG in cylinders for using as fuel in cars.

Gases can be easily compressed

36. Rubber band change its shape. Is is solid?

Yes it is solid because it regains its shape.

37. Does evaporation cause a physical change or a chemical change?

Evaporation is a physical change

38. List any two properties of particles of matter

i. They attract each other.

ii. The particles of matter are extremely small in size which cannot be seen even with a powerful microscope.

39. Give reasons to explain why it takes longer to dry wet clothes in humid weather?

It is because air is already saturated with water vapours therefore it willnot be able to hold more water vapours easily

40. How does spreading of wet clothes quicken their drying? Explain. It increases exposed surface area due to which water gets evaporated at faster rate.

41. What is dry ice? What happens when the pressure under which it is stored is decreased to 1 atmosphere?

Dry ice is solid carbon dioxide. If pressure is decreased it will change into vapours.

42. With which name is the phenomenon of changing of a liquid into its vapours at temperature below its boiling point known?

Sublimation

43. The melting points of three solids X,Y and Z are 298K 314K and 398K respectively. Arrange these in increasing order of their inter particle force of attraction.

X< Y < Z is the order of increasing inter particle force of attraction. Higher the force of attraction higher will be melting point.

44. What is full form of CNG? Mention its one property which makes it so important Compressed Natural Gas. It does not create pollution on condition

Compressed Natural Gas. It does not create pollution on combustion it is clean fuel which makes it so important.

45. Write one important characteristic property of particles of matter. Particles

Particles of matter attract each- other.

46. When camphor is heated in China dish, it changes into gas without changing into liquid. What is the name given to this change of state?

Sublimation

47. Sponge is solid but still it can be compressed why?

Sponge has pores which has air, therefore, it can be compressed

48. Why is the temperature remain constant during sublimation?

It is because heat of vaporisation and fusion overcome the force of attraction between particles.

49. What is evaporation?

It is process of converting liquid into vapours

50. When a solid melts, its temperature remains constants, so where does the heat energy go? What is the name given to this heat?

The heat energy is used to overcome intermolecular force of attraction. It is called latent heat of fusion.

51. Convert the following thermometer readings into Kelvin-100^{0}C, 200^{0}C

-100^{0}C + 273 = 173 K , 200^{0}C+273= 473 k

52. Why is light not considered as a matter?

It is because it does not occupy space.

53. Is smell of clove or cardamom a matter?

No, because it does not have mass and does not occupy space.

54. What happens to the boiling point of a liquid when atmospheric pressure decreases?

Boiling point of liquid is the temperature at which its vapour pressure becomes equal to external pressure (atmospheric pressure)

Thus, when atmospheric pressure decreases, boiling point of liquid also decreases.

55. What are heterogeneous mixtures?

Those mixtures whose composition is not same throughout are called heterogeneous mixtures. E.g. sulphur powder and iron filings

56. Why mixture does not have a fixed melting or a fixed boiling point? Give two reasons

a. It does not have fixed composition.

b. It does not have uniform ordered arrangement of particles.

57. When common salt is dissolved in water, what will be change in volume and why?

There is no change in volume. It is because common salt particles occupy the spaces between molecules of water.

58. Write one similarity between three states of matter

All the three states of matter are made up of particles.

59. What is tincture of iodine?

A solution of iodine in alcohol is known as 'tincture of iodine'.

60. Define latent heat of vaporisation

Latent heat of Vaporisation : It is defined as heat required to convert 1 kg of liquid into vapours completely at its boiling point.

61. Give reason : During summer sitting under a fan makes us comfortable.

Fan takes hot air up and cold air comes down which makes us comfortable. It also helps in evaporation of sweat which causes cooling.

62. Gases exert pressure on the walls of the container. Why?

The molecules of gases collide with themselves as well as with the walls of container, i.e. they exert pressure

63. Evaporation causes cooling. Why?

Evaporation needs heat energy which it takes from surroundings and leads to decrease in temperature, i.e. cooling takes place.

64. Arrange the following substances in increasing order of force of attraction between the particles.

a. water b. hydrogen c. sand

Hydrogen < water < sand

65. Why does the temperature remain constant at the melting point?

It is because latent heat of fusion overcomes inter particle force of attraction.

66. A gas fills completely the vessel in which it is kept, why?

It is due to least force of attraction between gas molecules, therefore, gases fill completely in vessel and it does not have a fixed volume.

67. Explain how camphor disappears without leaving any residue?

It is due to sublimation, it changes into vapours completes at room temperature, so does not leave any residue.

68. We feel cold when we touch a piece of ice. Why?

It is because ice takes heat from our body and therefore, we fell cold.

69. Evaporation is known as surface phenomenon. Why?

The kinetic energy of surface of molecules increase which get evaporated first, therefore it is called surface phenomenon

70. State which property of gas is used in supplying oxygen cylinder to hospitals?

It can be easily liquefied at high pressure and low temperature.

71. Why Kelvin scale is regarded better than Celsius scale of temperature?

It is because negative temperature are difficult to handle. In Kelvin scale all temperature are positive.

72. Why do tree acquire less leaves during winter and more in summer?

During winter, trees gets less sunlight due to which photosynthesis becomes difficult. Therefore, trees acquire less leaves in winter to allow sunlight to reach all the leaves.

73. Why it is advised to put wet cloth strips on the forehead of a person suffering from high fever?

It is because ice cold water get heat from body and reduce the temperature of body having high fever.

Short Answer Questions

1. a) Why path of light is not visible in a solution when a beam of light is passed through it ?

b) Classify each of the following as solution, colloid or suspension:

i) a mixture whose particles are big enough to scatter to beam of light passing through it

ii) a mixture whose particles settle down when it is left undisturbed.

a) It is because particles of true solution are very small and cannot scatter light.

b) Colloidal solution have particles of true solution are very small and cannot scatter light and path of light becomes clearly visible. E.g. when beam of light enters the dark room we can see the dust particles in air which make its path visible. Suspension has particles which

are bigger and they get settle down under the force of gravity, e.g. if we keep muddy river water undisturbed for some time, particles will settle down.

2. Describe an activity to show that air contains water vapours.

1. Take a beaker containing ice-cold water in a tumbler.

2. Keep it for sometime

3. We will see water droplets at the outer surface of the tumbler.

4. It shows there are water vapours in the air, on coming in contact with the cold glass of water, vapours lose energy and get converted to liquid state, which we see in the form of water droplets.

Observation: Water droplets are formed on the surface of glass.

Conclusion: Air containing water vapours which get condensed by coming in contact with surface of glass.

3. With the help of an activity show that diffusion become faster with the increase in temperature.

Activity/ Project:

To study the variation of rate of diffusion with temperature of solid in liquid.

Materials Required : Copper sulphate, two beakers, cold water and hot water.

Procedure : Take 50ml of cold water in a beaker.

Take 50ml of hot water in another beaker.

Add a crystal of copper sulphate into the beaker containing 50 ml of cold water

Add a crystal of copper sulphate into the beaker containing 50 ml of cold water

Leave them undisturbed

Record the observations

Observations: The colour of solution in first beaker becomes blue slowly whereas the colour becomes blue faster in second beaker

Conclusion : The rate of diffusion increases with increases in temperature because kinetic energy of molecules increases.

4. a) Define matter and write its three states

b) Explain how these states of matter arise due to variation in the characteristics of the particles.

a) Matter is substance which has mass and occupy space. Solid, liquid and gaseous are three state of matter.

b) Solids have fixed shape and volume due to strong forces of attraction between particles and least space between particles.

Liquid state have fixed volume and but not fixed shaped due to less force of attraction and more intermolecular space.

Gaseous state do not have fixed shape and volume due to least force of attraction and maximum inter molecular space.

5. With the help of an activity show that gases are more easily compressible than liquids and solids.

Take three 10 ml syringes and close their nozzles by rubber corks, as shown in the figure

Remove pistons from all the syringes

Leaving one syringe, put water in another syringe, chalk pieces in third syringe

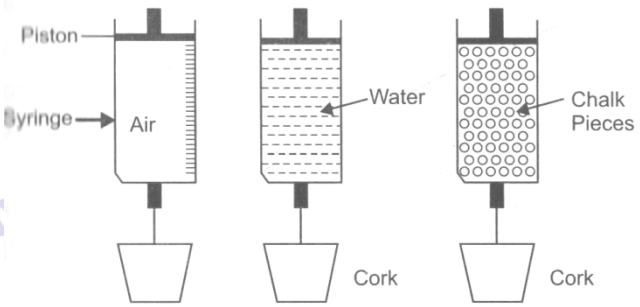
Insert pistons back into the syringes

Apply some Vaseline on the pistons before inserting them into the syringes for their smooth movement.

Try to compress the content by pushing the piston in each syringe.

Observation : Piston of first syringe can be moved very easily but less easily in second and is most difficult in third.

Conclusion : Gases can be compressed more easily than liquids and liquids can be compressed more easily than solids.



6. Give reasons for the following:

a) Camphor disappears if kept in open air for a few days.

b) Wet clothes do not dry easily on a rainy days.

c) We sweat more on humid days.

a) Camphor has weak inter particle forces of attraction which can be overcome by room temperature and it changes from solid state to vapours directly and disappears.

b) On rainy day, air is saturated with water vapours, therefore it cannot take more vapours, therefore wet clothes do not dry up easily.

c) We sweat more on humid days because our sweat does not get evaporated easily due to higher content of water vapours in at mosphere, therefore, we sweat more and feel uncomfortable in coastal areas where humidity is high.

7. a) Enumerate the changes that take place inside the matter during the change of states.

b) When a solid melts, its temperature remains the same. Given reason

a) When solid changes into liquid inter molecular force of attraction decreases and distance between molecules increases when liquid changes into gas, force of attraction between molecules becomes very less. This increases intermolecular space and kinetic energy.

b) When solid melts, it makes use of latent heat of fusion that is why temperature remains constant.

9. a) Wax id heated in a china dish. How will the following change during heating-

i) kinetic energy of particle

ii) inter particle distance

b) Melting points of three substances A,B,C are 52^0C, 175^0C and 80^0C. Arrange them in the decreasing order of the inter particle force of attraction in each of them. Give reason for your answer.

a) i) Kinetic energy of particles will increases

ii) Inter particle distance will increase

b) B > C> A

'B' has strongest inter particle force of attraction therefore more energy is needed to convert it into liquid. So it has highest melting point. 'C' has less inter particle force of

attraction than 'B" therefore it has less melting point 'A' has least inter particle force of attraction. Thus least energy is needed to convert it into liquid. It has lowest melting point.

10. Differentiate between evaporation and boiling. Give any three differences.

Evaporation	Boiling
i. It takes place at all temperatures	i. It takes place only at boiling point
ii. It causes cooling	ii. It does not cause cooling
iii. It is surface phenomenon, i.e, starts from the surface	iii. It is bulk phenomenon i.e. starts from bulk.

11. Define the following terms

a) Latent heat of fusion

b) Melting point

c) Fusion

a) Latent heat of fusion: The amount of energy that is required to change 1 kg of a solid into liquid at atmospheric pressure without any change of temperature at its melting point is called latent heat of fusion.

b) Melting point : The temperature at which solid changes into liquid completely is called melting point.

Melting point of solids gives indication of the strength of intermolecular forces of attraction. Higher the melting point, more will be intermolecular forces of attraction.

c) Fusion (Melting) : The process in which solid changes into liquid is called melting. It is also called fusion.

12. Give reasons for the following:

a) Why does Ice float on water?

b) Why does a gas fill completely the vessel in which it is kept?

c) Latent heat of evaporation of two liquids A and B is 100J/kg and 150J/kg respectively. Which one can produce more cooling effect and why?

a) It is because ice is lighter, i.e. it has lower density than water.

b) It has very less force of attraction between particles and particles have high kinetic energy.

c) 'B' has more heat of evaporation and will take more heat from the surroundings. Therefore it will cause more cooling.

13. a) "Evaporation causes cooling " Explain the reason for this effect.

b) Explain two examples from our daily life where we feel the effect of cooling due to evaporation

a) In evaporation, heat is taken from surrounding to overcome inter-molecular force of attraction which causes cooling.

b) i. When we take bath with hot water after taking bath we feel more cold because hot water gets evaporated faster.

ii. When we place nail polish remover or perfume on our palm. We feel coldness because it takes heat from the palm and causes cooling.

14. What determines the state of a substance? Suggest a method of liquefy gases. Water droplets are observed on the outer surface of a glass tumbler containing ice cold water. Give reason

The physical state of a substances is decided by temperature and pressure. e. .g water exist as solid below 0^0C till 100^0C but above 100^0Cit exists as gas. LPG is present in cylinders in form of liquid at high pressure but changes into gas at atmospheric pressure and room temperature. Carbon dioxide gas can be solidified at low temperature .and high pressure water vapours . present in air get condensed on the cold surface of glass forming water droplets

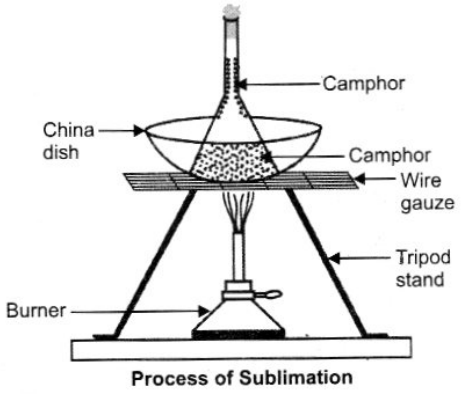
15. a) Why does the a water kept in an earthen pot become cool in summer?

b) Draw a well labelled diagram showing sublimation of camphor

c) Convert 340K to degree Celsius

a) It is because water comes out through pores which gets evaporated and causes cooling.

b)

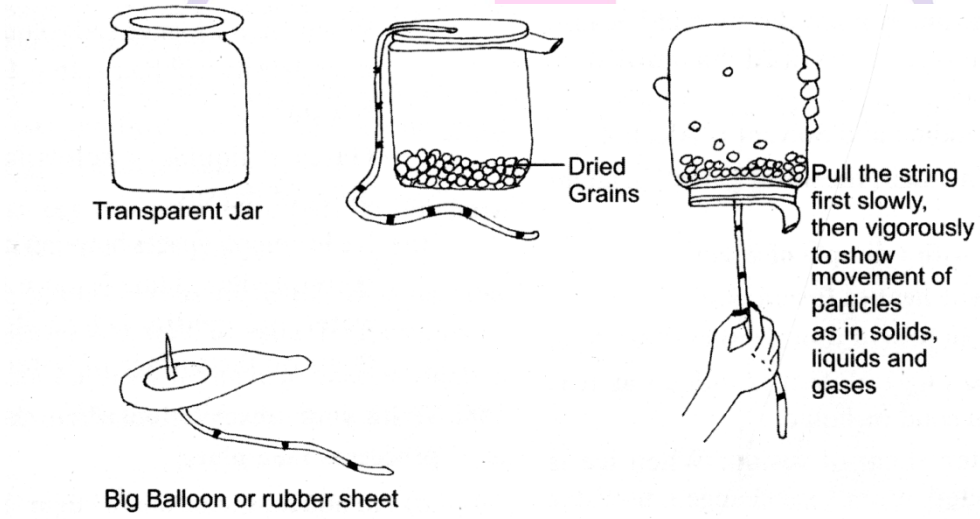


Process of Sublimation

c) 340K - 273 = 67

16. Prepare a model to demonstrate movement of particles in solids liquids and gases?

Material required :A transparent jar, a big rubber balloon or piece of suitable rubber sheeta string *few* black gram or dry green peas.



Procedure :

Put seeds in the jar. Put dry seeds in second and wet seeds in third jar

Sew the string to the centre of the runner sheet and put some tape to keep it tied securely

Stretch and tie the runner sheet on the mouth of the jar.

Your model is ready. Now run your fingers up and down the string by first tugging at it slowly and the rapidly and observe the movement happening inside

A model showing movement of particles in solid liquid and gas.

Observation :

1. In first jar, there is only air present and particles are moving faster

2. In second jar dried solid grains are present which do not move due to strong force of attraction

3. In third jar slight movement of wet seeds will take place due to less force of attraction between wet seeds.

Conclusion : Movement of particles in solids liquids and gases can be show by this experiment.

Long Answer Questions

1. List four point to prove that tincture of iodine is a true solution. Mention the solute and the solvent in tincture of iodine

1. Observe tincture of iodine solution. Light can pass through it, therefore, it shows it is transparent

2. Keep tincture of iodine solution for some time. You will observe particles do not settle down. It shows it is stable.

3. Pass the beam of light with the help of light cannot be seen. It does not scatter light i.e. does not show Tyndall effect.

4. Observe the colour of solution. You will observe colour of solution. You will observe colour of solution. You will observe colour is same throughout because it is homogeneous and has uniform composition.

Solute is Iodine and Solvent is Alcohol

2. a. What is meant by the word 'Latent' in latent heat

b. Explain with example of water

i. latent heat of fusion, and

ii. latent heat of vaporization

a. The meaning of latent is hidden as it is stored in solid or liquid

b. i) Latent heat of fusion: When ice is melted at 0^0C ice change into water completely but the temperature remains constant. The energy required to melt one mole of ice into water at 0^0C is called latent heat of fusion.

ii) Latent heat of vaporisation: Water on heating changes into vapours. When temperature reached 100^0C water changes into stream completely but the temperature remains constant. The energy required to convert 1 mole of liquid into vapours completely at its boiling point is called latent heat of vaporisation.

3. a. Convert 574 k to the Celsius scale

b. What will be the state of water at:

i. 108^0C ii. 275k iii. 370k

c. Give reason why water at room temperature is a liquid?

a. $574 - 273 = 301^0C$

b. i. Steam (gas) ii. Liquid iii. Liquid

c. At room temperature forces of attraction between molecules of water are not high and position of particle are not fixed particles are moving and water can flow from higher level to lower level. It shows water is liquid at room temperature

4. Explain the term density. Arrange different states of matter increasing order of density.

Explain how ice floats on water?

i. Density is defined as mass per unit volume when mass is higher and volume is smaller then density will be greater. Its CGS unit is g cm-3.

Gases <liquids <solids is increasing order of density.

ii. Ice has empty spaces between its molecules, therefore its volume is more than that of water and density is less , that is why it floats on the surface of water.

5. Write your observation when the following processes take place.

a. An aqueous solution of sugar is heated till it gets dried up.

b. A saturated solution of potassium chloride prepared at 60^0C is allowed to cool at room temperature.

c. A mixture of iron filings and sulphur powder is heated strongly.

d. A beam of light is passed through a colloidal solution.

e. Dil- HCI is added to the mixture of iron filings and sulphur powder.

a. Sugar remains as residue in the form of a solid mass.

b. Potassium chloride crystallise out

c. A black coloured compound is formed

d. The path of the light become visible.

e. A colourless gas is evolved.

6. a. Define diffusion explain the rate of order of diffusion in solids, liquids and gases.

b. State the effect of temperature on diffusion.

a) Diffusion : The process of intermixing of two or more substance is called diffusion

The rate of diffusion is fastest in gases due to more kinetic energy and less inter molecular forces of attraction.

The rate of diffusion is less in liquids due to less kinetic energy and more force of attraction between particles. The rate of diffusion is minimum in solids due to least kinetic energy and maximum inter particle force of attraction

b) The rate of diffusion increases with increase in temperature because kinetic energy of molecules increases

7. a. List any two properties that liquids have in common with gases.

b. Give two reasons to justify that an iron almirah is a solid at room temperatures

c. What happens to the heat energy which is a supplied to the solid once it starts melting?

a (i) Liquids and gases can flow from higher level to lower level . The smell of food can reach as while sitting away from kitchen,

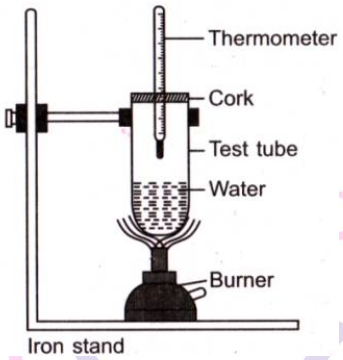
(ii) Liquids and gases can take the shape of container e.g. milk will take the shape of container and bromine gas can dill up whole test tube and when we transfer it to round bottom, flask it will fill in the whole flask.

b) i) it has fixed shape and volume

ii) It cannot move, i.e. it is rigid and hard.

c. Heat supplied is used to overcome has force of attraction between particles of solids.

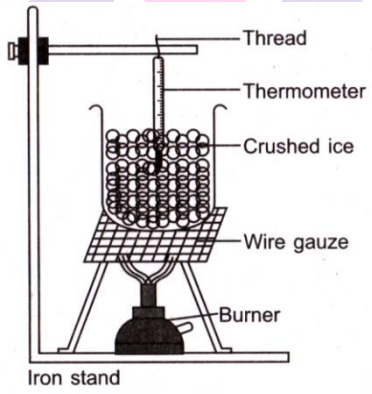
8. Describe an activity to determine the boiling point of water and melting point of ice



- Take water in a test tube
- Set the apparatus as shown in diagram
- Heat water with the help of burner
- Note down the reading when temperature of thermometer becomes constant

Observations: The temperature becomes constant at 0^0C

Conclusion **:** The melting point of ice is 0^0C



- Take crushed ice in the beaker
- Set the apparatus as shown in diagram
- Heat the beaker with the help of burner
- Note down the temperature at which ice changes into liquid and temperature remains constant.

9. a) Co_2 is a gas. Write its two gaseous properties to justify it.

b) How can we liquefy a gas ?

c) Solid CO_2 is also known as dry ice. Why?

d) Write the full form of:

i) CNG **ii) LPG**

a. i) It does not have fixed shape. It takes the shape of container.

ii) It does not have fixed volume. Its volume becomes equal to volume of container

b. We can liquefy gas at low temperature and high pressure.

c. Solid CO_2 *is* called dry ice because it does not contain water. It changes directly into vapours without becoming liquid.

d. i) Compressed Natural Gas

ii) Liquefied Petroleum Gas.

10. a) State one similarity and one difference between evaporation and boiling.

b) Account for the following:

i) We wear cotton clothes in summer.

ii) A wet hand kerchief is placed on the forehead of a person suffering from high fever.

iii) Wet clothes dry slowly during rainy season

a) Both in evaporation and boiling liquid changes into vapours.

Evaporation takes place at all temperature whereas boiling takes place only at boiling point.

b) i) Cotton clothes have pores through which air can pass and keep us cool. Cotton can absorb sweat which makes as comfortable. Evaporation of sweat which makes as comfortable. Evaporation

ii) It takes heat from the body of a person for evaporation of water and reduces temperature of the body of the person.

iii) The humidity is high in rainy season there, rate of evaporation decreases and clothes dry slowly.

11. a) Give reason for the following

i. Why do we see droplets of water on the outer surface of a glass containing ice cold water.

ii. After a hot sunny day, people sprinkle water on the roof or open ground.

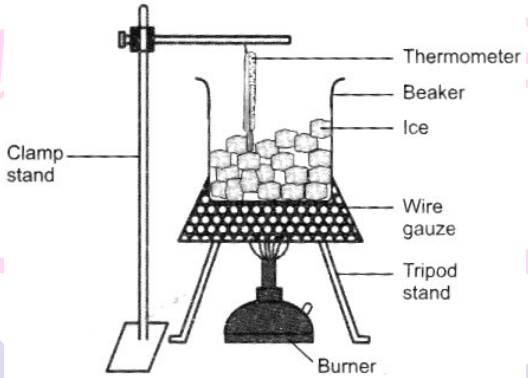
b. Describe an activity with labelled diagram to illustrate the effect of increase of temperature on ice.

a. (i) It is due to condensation of water vapours present in air

(ii) Water gets evaporated and causes cooling.

b. **Experiment :** To study the effect of temperature on solids and liquids

Material required : Ice, thermometer, beaker



Process of Sublimation

Procedure :

- Take about 50 g of ice in a beaker and suspend a laboratory thermometer in it so that its bulb is in contact with ice as shown in figure.
- Start heating the beaker on a low flame
- Note down the temperature when ice starts melting.
- Note the temperature when all the ice has converted into water.
- Record your observations for conversion of solid into liquid state.
- Now put a glass rod in the beaker and heat with constant stirring till the water starts boiling
- Keep a close look at the thermometer reading till most of the water has vapourised.
- Record your observations for the conversion of ice into liquid water and then into vapour state.

Observations and Conclusions : When temperature of solid is increased, the kinetic energy of particles increases. Due to increase in kinetic energy, the particles start vibrating at a greater speed and overcome intermolecular forces of attraction. A stage is reached when intermolecular forces become so weak that it changes into liquid. When temperature is further increased, a stage comes when liquid changes into vapour due to further decrease in inter molecular forces of attraction.

12. a) Define latent heat of fusion, why is it called latent heat?

b) How does the presence of impurities affect the boiling point and freezing point of a substance?

c) What is dry ice? How is it stored?

a) Latent heat of fusion : It is defined as a heat required to convert 1 kg of solid into liquid completely at its melting point.

It is called latent because it is stored as a force of attraction between particles of the solid and required to overcome the force of attraction between particles of the solid and required to overcome the force of attraction between particles.

b) Boiling point of liquid increases. Due to presence of impurities freezing point decreases due to presence of impurities.

c. Solid CO_2 is called dry ice. It is stored at low temperature and high pressure.

13. Define evaporation. List the factors on which the rate of evaporation depends and explain how it depends on each of them.

Evaporation is a process in which a liquid changes into vapours.

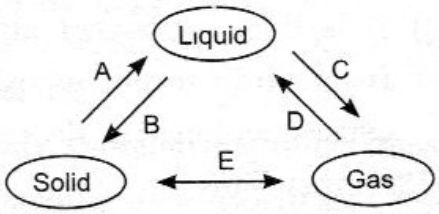
i) Surface area: Greater the surface area more will be the rate of evaporation e.g. tea becomes cold faster in a saucer than a cup

ii) Temperature : Higher the temperature, more will be the rate of evaporation. Humidity is more in summer than in winters due to faster rate of evaporation of water during summer.

iii) Wind speed :Higher the wind speed, more will be the rate of evaporation e.g. clothes dry up faster on windy day.

iv. Humidity : Greater the humidity, lesser will be the rate of evaporation e.g. clothes dry up slowly on a rainy day because humidity in air is more.

14. Explain the different processes involved in the flowchart given below.



'A is called melting in which solid changes into liquid completely at its melting point

'B' represents freezing in which liquid changes into solid at freezing in which liquid changes into solid at freezing point.

'C' represents boiling (vapourisation) in which liquid changes into gas completely at its boiling point.

'D ' represents condensation in which vapours on cooling form liquid.

'E' represents sublimation in which solid change into vapours directly on heating and becomes solid again on cooling.

15. a) Define matter. Name the state of matter in which the forces between the constituent particles are :

i) strongest ii) weakest

b) Give reason for the following :

i) A liquid generally flows easily

ii) Ice at 0^0C appears colder to the mouth than water at 0^0C Why?

iii) Doctors advice to put strips of wet cloth on the forehead of a person having high temperature.

a) Matter is a substance which has mass and occupies space.

(i) In solids, force of attraction between particles is strongest

(ii) In gases, force of attraction between particles is weakest.

b) i) It is due to less force of attraction between particles in liquids than solids.

ii) Ice take s latent heat of fusion from mouth to melt and therefore we feel more cold than water at 0^0C.

iii) It is because water absorbs heat from body to get evaporated and causes cooling, i.e. decrease in body temperature.

16. a. What temperature in Kelvin scale is equal to 50^0C?

b. Describe an activity to show that rate of evaporation increases with surface area.

c. State two differences between evaporation and boiling

(a) 50^0C + 273 = 323 K

(b) Activity : Take water in three containers having different surface area.

- Keep 10 ml of water in each
- Keep them in sunlight for half an hour
- Measure the volume of water left.
- Calculate rate of evaporation

i.e. $\frac{Volume\ of\ water\ evaporated}{Time}$

Conclusion : Evaporation will be faster in container having maximum surface area

c)

Evaporation	Boiling
i) It takes place at all temperatures	i) It takes place only at boiling point
ii) It is surface phenomenon	ii) It is bulk phenomenon

17. a. What is matter? Write two properties of solids and two properties of solids and two properties of liquids

b. Ramesh took two beakers A and B containing hot water and cold water respectively. In each beaker he dropped a crystal of copper sulphate. He kept the beakers undisturbed After some time what did he observe? Why?

a) Matter is a substance which has mass and occupies space.

Properties of solids:

i) They have fixed shape and fixed volume.

ii) These are not compressible

Properties of liquids:

i) They have fixed volume but not shape

ii) They can flow from higher level to lower level.

b) Copper sulphate will dissolve faster in hot water then cold water because solubility increase in temperature. Copper sulphate solution will be dark blue in hot water and light blue in cold water.

NCERT EXEMPLER

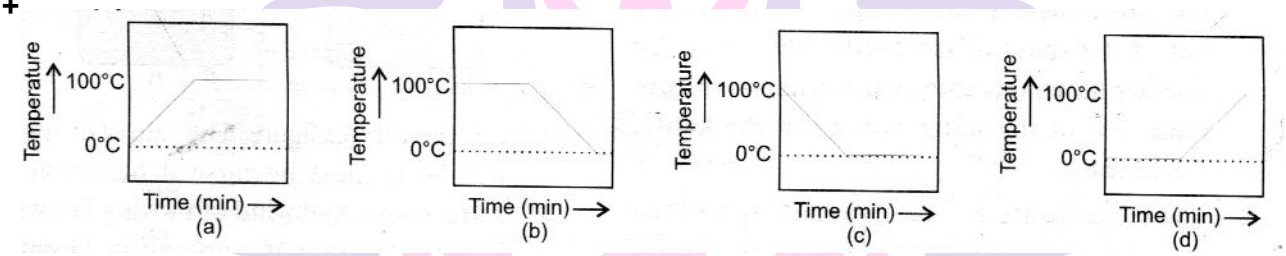
Short Answer Questions

1. A sample of water under study was found to boil at 102^{0}C at normal temperature and pressure. Is the water pure?

Water is not pure because soluble impurities increase the boiling point of liquid. It will not freeze at 0^{0}C as it is impure and will freeze below 0^{0}C.

2. 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?

+



d. Ice and water both are present at 0 ^{0}C. The temperature will remain constant till whole ice changes into water because ice will melt by taking latent heat of fusion. On further heating, temperature of water will increase, So the correct option is (d)

3. Match the physical quantities given in column A to their SI units given 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

a-iii	**b-iv**	**c-v**	**d-ii**	**e-i**

4. 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

a-iv	**b-iii**	**c-v**	**d-ii**	**e-i**

5. 'Osmosis is a special kind of diffusion' Comment

Yes, because in both the processes, movement of molecules take place from lower concentration to higher concentration, but in osmosis solvent moves through a semi permeable membrane which can allow only passage of solvent molecules.

6. Classify the following into osmosis/diffusion

a) Swelling up of raisin on keeping in water,

b) Spreading of virus on sneezing

c) Earthworm dying on coming in contact with common salt.

d) shrinking of grapes kept in thick sugar syrup

e) Preserving pickles in salt

f) Spreading of smell of cake being baked through out the house

g) Aquatic animals using oxygen dissolved in water during respiration

(a) Osmosis (b) Diffusion (c) Osmosis (d) Osmosis

(e) Osmosis (f) Diffusion (g) Diffusion

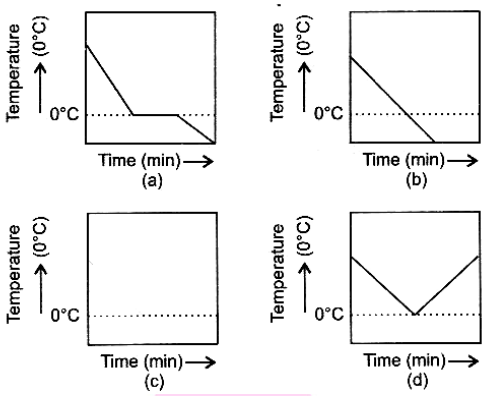
7. Water as ice has a cooling effect whereas water as steam may cause severe burns. Explain these observation

Ice takes latent heat of fusion from the body and causes cooling effect whereas, steam has very high energy because it has greater latent heat of vaporisation. Therefore, it causes severe burns.

8. 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

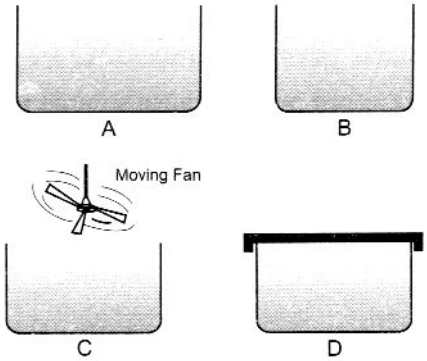
The temperature of steam was not higher than that of boiling water but it had more energy. Due to latent heat of vaporisation, she felt intense heat.

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



a) is the correct graph. The temperature of hot water decreases to 0^0C and remains constant due to latent heat of fusion that is involved in formation of ice and then temperature decreased further.

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



C is the correct figure. The rate of evaporation will be highest because it has large open surface area and wind of moving fan will also increase the rate of evaporation. Greater the surface area and more the wind speed, higher will be the rate of evaporation.

11. a) Conversation of solid to vapour is called sublimation. Name the term used to denote the conversation of vapour to solid.

b) Conversation of solid state to liquid state is called fusion. What is meant by latent heat of fusion?

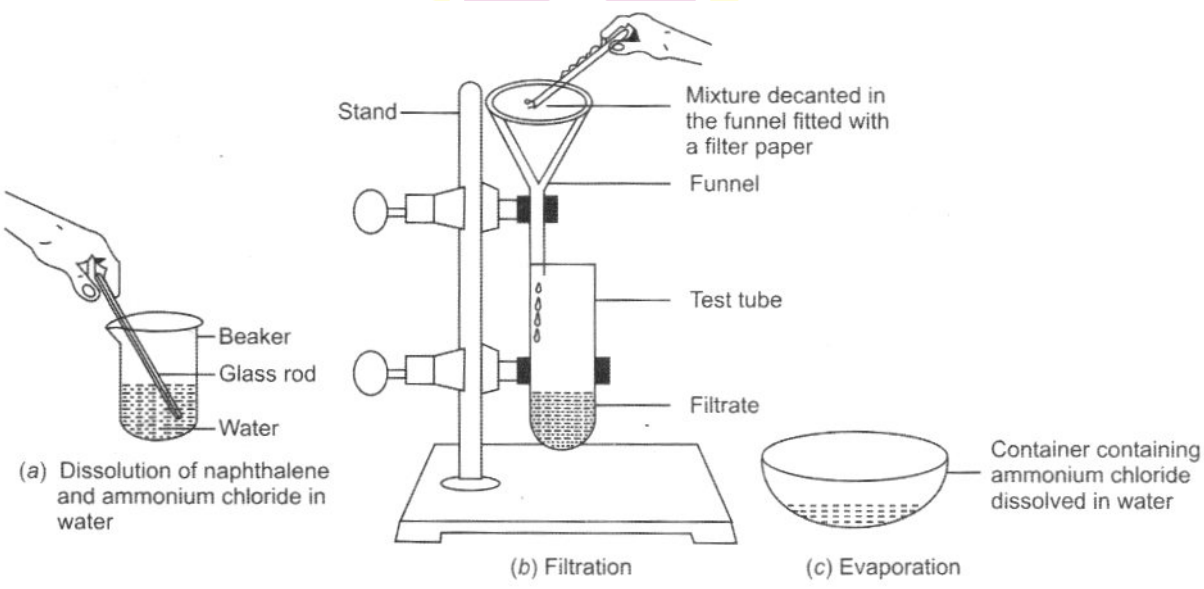
a) It is also called sublimation.

b) It is the amount of heat required to convert one kilogram of solid into liquid at one atmospheric pressure at its melting point. It is know as latent heat of fusion.

Long Answer Questions

12. You are provided with a mixture of naphthalene and ammonium chloride by your teacher. Suggest an activity to separate them with well labelled diagram.

Naphthalene is insoluble in water but soluble in benzene (organic solvent). Ammonium chloride changes into vapours at room temperature whereas, ammonium chloride changes into vapours on heating. Add water tothe mixture and shake it vigorously so that ammonium chloride will dissolve. Filter the mixture. Naphthalene is obtained as residue whereas, filtrate contains ammonium chloride dissolved in water. Crystallise it be heating till saturated solution of ammonium chloride is obtained. Cool the hot saturated solution to get crystals of pure ammonium chloride.



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

Cotton is more comfortable because it can absorb water (sweat) more than nylon followed by evaporation which causes cooling. Secondly, cotton clothes have pores through which air can pass through. Therefore, Priyanshi is more comfortable.

14. 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?

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

i) Spread out the shirt so as to increase the surface area so that water can be evaporated faster.

ii) Increase the wind speed by switching on fan.

iii) If wind speed is high outside and sunlight is present, dry it outside. It will dry faster due to higher temperature and higher wind speed. If sunlight is not available, usd hot iron to dry it.

15. Comment on the following statements :

a) Evaporation produces cooling

b) Rate of evaporation of an aqueous solution decreases with increase in humidity.

a) In Evaporation , surface molecules take heat from surroundings and cause cooling effect.

b) If humidity is high, is high then air already has lot of water vapours, it will not take more water vapours easily. Therefore the rate of evaporation will be slow.

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

The temperature of a substance remains constant during melting and boiling point till melting and boiling is complete. It is because substance makes use of latent heat of fusion to overcome force of attraction between particles of solid to change into liquid. It is latent heat of vaporisation to overcome force of attraction between particles of liquid so as to change them into vapours. Therefore, temperature remains constant.