

EXPLORING MIXTURES AND THEIR SEPARATION

Class 09 - Science (Exploration)

Time Allowed: 1 hour and 30 minutes

Maximum Marks: 140

1. What is the common application of emulsions in medicine? [1]
 - a) To separate active ingredients from the inactive ones.
 - b) To increase the viscosity of the medicine.
 - c) To make medicines easily palatable and reduce greasy feeling.
 - d) To enhance the medicine's shelf life without refrigeration.
2. Which of the following solutions has the highest mass by mass percentage? [1]
 - a) 15 g of sugar in 160 g of water
 - b) 60 g of potassium permanganate in 200 g of water
 - c) 20 g of sodium carbonate in 90 g of water
 - d) 10 g of sodium chloride in 200 g of water
3. When iron filings and powdered sulphur are mixed together in a china dish: [1]
 - a) the constituents present can easily be seen
 - b) a heterogeneous mixture results
 - c) All of these
 - d) the constituents can be separated by a magnet
4. What are the solute-like components in a colloid referred to as? [1]
 - a) Solution particles
 - b) Emulsifying agent
 - c) Dispersed phase
 - d) Dispersion medium
5. How does the solubility of a solid solute in a liquid solvent generally change with increasing temperature? [1]
 - a) It remains constant.
 - b) It generally decreases.
 - c) It first increases then decreases.
 - d) It generally increases.
6. What is the component in which the dispersed phase of a colloid is suspended called? [1]
 - a) Dispersed phase
 - b) Suspension agent
 - c) Solvent
 - d) Dispersion medium
7. Which will not give a stable solution even when stirred for sometimes? [1]
 - a) Common salt in water
 - b) Egg albumin in water
 - c) Sugar in water
 - d) Milk in water
8. A scientist observes that the particles in a liquid mixture are easily visible and settle down over time. Upon shining a laser light through it, the path of the beam is clear. Based on these [1]

observations, how would the scientist classify this mixture, and what properties support this classification?

- a) Heterogeneous mixture, because particles are visible, settle, and scatter light (Tyndall effect).
 - b) Colloid, because colloids have visible particles that scatter light but do not settle immediately.
 - c) Homogeneous mixture, because the laser path is clear, indicating uniform composition.
 - d) Solution, because solutions exhibit particle settling and light scattering.
9. If 5 g of glucose is dissolved in water to make 100 mL of solution, what is its concentration in mass by volume percentage? [1]
- a) 0.05% m/v
 - b) 5% m/v
 - c) 20% m/v
 - d) 100% m/v
10. In a solution of sugar and water, which component acts as the solute? [1]
- a) Sugar
 - b) Both sugar and water equally
 - c) Water
 - d) Neither, they form a suspension
11. Sublimation can be used to separate: [1]
- a) volatile liquids and non-volatile liquids
 - b) Soluble liquids and insoluble liquids
 - c) volatile solids and non-volatile solids
 - d) miscible liquids and immiscible liquids
12. A student by mistake mixed iron filings and sulphur powder. He wanted to separate them from each other. The method you would advise him to use it to dissolve the mixture in [1]
- a) carbon disulphide
 - b) cold water
 - c) boiling water
 - d) kerosene
13. Which of these is an example of a homogeneous mixture? [1]
- a) Aerated drinks (carbon dioxide in water)
 - b) Oil and water
 - c) Muddy water
 - d) Sand and water
14. The process of evaporation is fast when the mixture is: [1]
- a) covered but not heated
 - b) heated but not covered
 - c) heated but covered
 - d) neither heated nor covered
15. What is the role of emulsifying agents in emulsions? [1]
- a) To increase the viscosity
 - b) To color the emulsion
 - c) To dissolve the dispersed phase
 - d) To stabilize emulsions
16. How does the Tyndall effect manifest when a fine beam of light enters a dark room through a small hole? [1]
- a) Light gets scattered by dust and smoke particles, making the beam visible.

- b) The light beam passes straight through without any change.
- c) The temperature of the room increases significantly.
- d) The light beam becomes invisible.

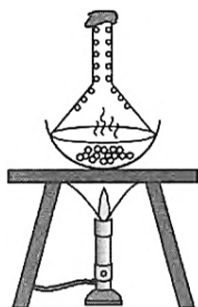
17. What is a homogeneous mixture of two or more metals, or a metal and a non-metal, called? [1]

- a) Suspension
- b) Colloid
- c) Alloy
- d) Compound

18. Which of the following is an example of a naturally formed crystal? [1]

- a) Snowflakes
- b) Boiled sugar syrup
- c) Salt dissolved in water
- d) Distilled water

19. Preeti heated a mixture of iodine and common salt by keeping an inverted funnel on it. After some time, she observed that [1]



- a) Agas with popping sound comes out.
- b) White fumes come out from the mixture
- c) White particles deposit on the neck of the funnel
- d) Violet particles deposit on the neck of the funnel

20. Which of the following describes a homogeneous mixture? [1]

- a) It has a uniform composition throughout.
- b) It consists of distinct layers that do not mix.
- c) Its components can be readily distinguished individually.
- d) Particles are easily visible and settle over time.

21. Choose the correct options, and explain the reason for the correct and incorrect options. [1]

Which among the following mixtures show the Tyndall Effect?

A mixture of:

- i. air and dust particles
- ii. copper sulfate and water
- iii. starch and water
- iv. acetone and water

- a) b and d
- b) a and b
- c) c and d
- d) a and c

22. Consider a saturated solution of potassium nitrate. If its solubility decreases significantly with decreasing temperature, how would the amount of solid deposited change if the cooling rate is increased compared to slow cooling? [1]

- a) No solid would be deposited with increased cooling rate.
- b) The amount of solid deposited would be less.
- c) The amount of solid deposited would be greater.
- d) The amount of solid deposited would be the same, but crystals would be smaller.

23. The system when starch is added to hot water is: [1]

- a) colloid
- b) suspension
- c) true solution
- d) mixture

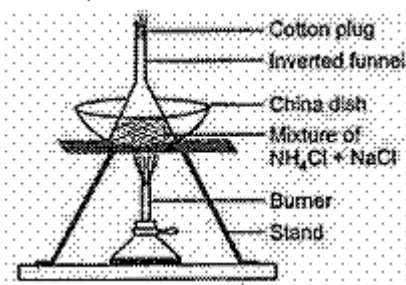
24. What is the formula for calculating mass by mass percentage of a solution? [1]

- a) $(\text{Mass of solvent} / \text{Mass of solution}) \times 100$
- b) $(\text{Mass of solute} / \text{Mass of solution}) \times 100$
- c) $(\text{Mass of solute} / \text{Volume of solution}) \times 100$
- d) $(\text{Volume of solute} / \text{Volume of solution}) \times 100$

25. If Group B adds one spatula of chalk powder to 50 mL of water and stirs it, and then conducts the laser light experiment, what observation would be expected from the side, perpendicular to the laser beam? [1]

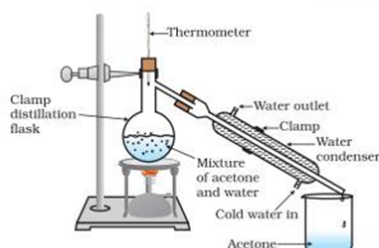
- a) The laser light will pass through undeflected, with no visible beam.
- b) The path of the laser beam will be clearly visible due to scattering by chalk particles.
- c) The mixture will absorb all the laser light, making it invisible.
- d) The laser light will reflect off the surface of the mixture.

26. A mixture of sodium chloride and ammonium chloride is heated in the set-up shown below. After the experiment, ammonium chloride will be obtained in the part labelled as: [1]



- a) China dish
- b) The cotton plug
- c) Inverted funnel
- d) The funnel and the China dish

27. This method of separation is used for the separation of a mixture of acetone and water. Which of the following is correct for the given method? [1]



a) Simple distillation

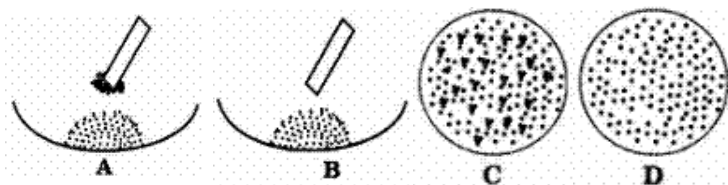
b) Crystallisation

c) Fractional distillation

d) Centrifugation

28. Observe these diagrams and choose the correct statement:

[1]



a) A and C are mixtures and B and D are compounds

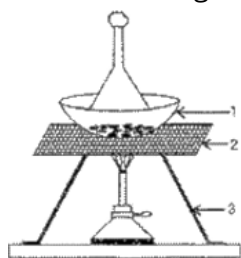
b) A and B are mixtures and C and D are compounds

c) All of them are mixtures

d) All of them are compounds

29. In the following diagram, the respective correct labelling of 1, 2 and 3 is

[1]



a) china dish, tripod stand, wire gauze

b) wire gauze, china dish, tripod stand

c) tripod stand, wire gauze, china dish

d) china dish, wire gauze, tripod stand

30. Out of the following, the only incorrect statement is:

[1]

A. in a colloidal system, the dispersion medium is always in the liquid state.

B. no residue is left on the filter paper when a colloidal solution is filtrated off

C. in a colloidal system dispersion medium is a gas.

D. the colloidal system is a heterogeneous mixture.

a) (B)

b) (D)

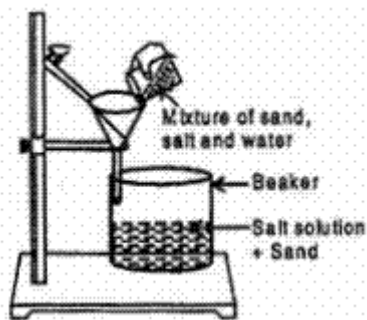
c) (A)

d) (C)

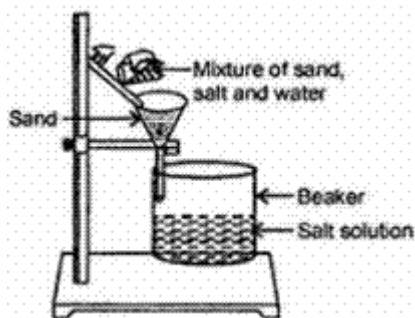
31. Four students were asked to separate sand from a mixture of sand and salt by using water to dissolve the salt in it and then filtering the mixture. The teacher provided them with a funnel, filter paper, beaker, glass stick and stand. Students have set-up apparatus as shown in options. The teacher stopped three of them for using the wrong procedure. The correct way of separating the mixture is that in the set-up

[1]

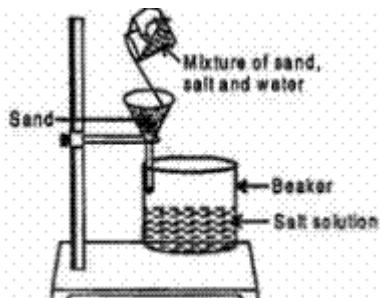
a)



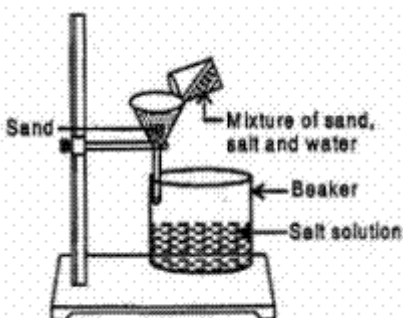
b)



c)



d)



32. A student takes three test tubes A, B and C containing salt solution, starch in water and suspension of sand in water. He pastes small strips of coloured paper on one side of each test tube. He then observes the coloured paper from the other side of the test tube through the liquid one by one. The correct observation out of the following is:

[1]

- a) coloured spot is not visible in A, not visible in B and not visible in C
- b) coloured spot is not visible in A, appear dim in B, visible in C.
- c) coloured spot is visible in A, not visible in B, appear dim in C.
- d) coloured spot is clearly seen in A, appears dim in B, not visible in C.

33. Which of the following is correct about the true solution?

[1]

- A. Its composition is fixed
- B. It has a variable composition
- C. Its components can be separated by filtration
- D. It is homogeneous & transparent

a) (A), (B), (C) and (D)

b) (A), (B) and (C)

c) (A) and (B)

d) (B) and (D)

34. Which of the following is correct about solubility-

[1]

- A. It increases with increase in temperature
- B. Mass of solute dissolution in 100 units of solvent
- C. The Solubility of common salt in water in 46g at 20° C
- D. It decreases with decrease in temperature

- a) All of these
b) A, B and D
c) A, B and C
d) A, C and D

35. Which of the following is correct about the true solution? [1]
A. Its composition is fixed.
B. It has a variable composition.
C. Its components can be separated by filtration.
D. It is homogeneous and transparent.

a) All of these
b) A and D
c) B and D
d) A, B and D

36. Which of the following is correct about solubility: [1]
A. It increases with increase in temperature
B. Mass of solute dissolution in 100 units of solvent
C. The solubility of common salt in water is 46g at 20°C
D. It decreases with decrease in temperature

a) (A), (B) and (D)
b) (A) and (B)
c) (B) and (C)
d) (A), (B), (C) and (D)

37. **Assertion (A):** A mixture of camphor and ammonium chloride cannot be separated by sublimation. [1]
Reason (R): Camphor on heating sublimes, ammonium chloride does not.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

38. **Assertion (A):** Solutions do not exhibit the Tyndall effect. [1]
Reason (R): The particles in solutions are larger than 100 nm, so they cannot scatter light.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

39. **Assertion (A):** Impure benzoic acid can be purified by sublimation. [1]
Reason (R): Benzoic acid sublimes on heating.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

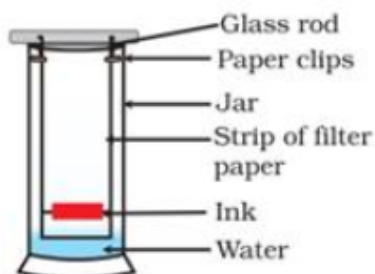
40. **Assertion (A):** A mixture of sugar and benzoic acid can be separated by shaking with ether. [1]
Reason (R): Sugar is insoluble in water.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

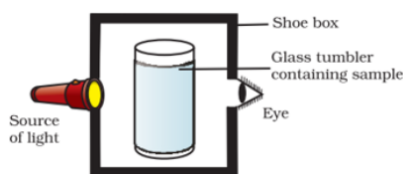
41. **Assertion (A):** True solution exhibits Tyndall effect. [1]
Reason (R): Particles are very large in size.
- a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
 c) A is true but R is false. d) A is false but R is true.
42. A solution contains 40 g of common salt in 320 g of water. Calculate the concentration in terms of mass by mass percentage of the solution. [1]
43. Match the following: [2]
- | | |
|----------------|--|
| (a) Suspension | (i) Size of solute particles is bigger than true and smaller than suspension |
| (b) Colloids | (ii) Heterogeneous Mixture |
| (c) Sol | (iii) Solid or liquid is dispersed in a gas |
| (d) Aerosol | (iv) Solid particles are dispersed in a liquid medium |
44. Match the following: [2]
- | | |
|--------------------|-----------------------------------|
| (a) Brass | (i) Solution of gas in a liquid |
| (b) Sugar Solution | (ii) Solution of liquid in liquid |
| (c) Vinegar | (iii) Solution of solid in liquid |
| (d) Soda-water | (iv) Solution of solid in solid |
45. Match the following: [2]
- | | |
|-----------------------|---|
| (a) Solute | (i) In which solute is dissolved |
| (b) Solute particles | (ii) Dissolving various solutes in water |
| (c) Aqueous Solutions | (iii) are also called dispersed particles |
| (d) Solvent | (iv) Substance which is dissolved |
46. Alloys are sometimes called substitution solid solutions. Explain. [2]
47. Give some examples of Tyndall effect observed in your surroundings? [2]
48. Give an example each for the mixture having the following characteristics. Suggest a suitable method to separate the components of these mixtures: [2]
- A volatile and a non-volatile component.
 - Two volatile components with an appreciable difference in boiling points.
 - Two immiscible liquids.
 - One of the components changes directly from solid to gaseous state.
 - Two or more coloured constituents soluble in some solvent.
49. Name the technique to separate salt from sea water [2]
50. Identify the solutions among the following mixtures:- [2]
- Soil
 - Sea water
 - Air
 - Coal

e. Soda water

51. A child wanted to separate the mixture of dyes constituting a sample of ink. He marked a line by the ink on the filter paper and placed the filter paper in a glass containing water as shown in Fig. The filter paper was removed when the water moved near the top of the filter paper. [2]
- What would you expect to see, if the ink contains three different coloured components?
 - Name the technique used by the child.
 - Suggest one more application of this technique.



52. How is evaporation different from boiling? [2]
53. Which separation techniques will you apply for the separation of the wheat grains from husk? [2]
54. Describe how coagulation with alum improves the efficiency of removing suspended particles from muddy water. [2]
55. Explain the Colloid. [2]
56. Calculate the masses of cane sugar and water required to prepare 250 g of 25% solution of cane sugar. [2]
57. A group of students took an old shoe box and covered it with a black paper from all sides. They fixed a source of light (a torch) at one end of the box by making a hole in it and made another hole on the other side to view the light. They placed a milk sample contained in a beaker/tumbler in the box as shown in the Fig. They were amazed to see that milk taken in the tumbler was illuminated. They tried the same activity by taking a salt solution but found that light simply passed through it. [3]
- Explain why the milk sample was illuminated. Name the phenomenon involved.
 - Same results were not observed with a salt solution. Explain.
 - Can you suggest two more solutions which would show the same effect as shown by the milk solution?



58. Can we create artificial blood that works just as real blood for all patients? [3]
59. Explain why mustard oil forms the upper layer and water forms the lower layer when a mixture of the two is allowed to settle. [3]
60. Differentiate between a true solution and a colloid. [3]
61. Answer the following questions with the help of the data given in Table. [3]

Solubility of various salts (in g per 100 g of water) at different temperatures

Salts	Temperature ($^{\circ}C$)
-------	-----------------------------

	10° C	20° C	30° C	40° C	60° C	80° C
Potassium nitrate	21	32	45	62	106	167
Sodium chloride	36	36	36.3	36.5	37	37
Potassium chloride	35	35	37.4	40	46	54
Ammonium chloride	24	37	41	41	55	66

- What mass of potassium nitrate would be needed to prepare its saturated solution in 50 g of water at 40 °C?
- A student makes a saturated solution of potassium chloride in water at 80 °C and leaves the solution to cool at room temperature (25 °C). What would she observe as the solution cools? Explain.
- What is the effect of a change in temperature on the solubility of salts? Also, compare the changes in the solubility of the four given salts with increasing temperature from 10 °C to 80 °C.

- Why do not the dispersed phase particles in a colloidal solution combine with one other? [3]
- How does the size of particles in a mixture influence the visibility of a light beam passing through it? [3]
- How does light behave differently in a transparent solution compared to a colloid or suspension? [3]
- Why do immiscible liquids form two separate layers in a separating funnel? [3]
- How would you separate the mixtures given in Table? Mention the reason for choosing your method. If a mixture cannot be separated, explain why. [3]

Table

Mixture	Method of separation	Reason for selection
Mud from muddy water		
Plasma from other components in the blood sample		
Naphthalene and sand		
Chalk powder and common salt		
Common salt and water		
Oil from water		
Pigments of the flower		

- Read the following text carefully and answer the questions that follow:** [4]
 Air is a homogeneous mixture and can be separated into its components by fractional distillation. The air is compressed by increasing the pressure and is then cooled by decreasing the temperature to get liquid air. This liquid air is allowed to warm-up slowly in a fractional distillation column, where gases get separated at different heights depending upon their boiling points. The properties that can be observed and specified like colour, hardness, rigidity, etc. are

the physical properties. The interconversion of states is a physical change because these changes occur without a change in composition and no change in the chemical nature of the substance.

- i. What is Homogeneous mixture? (1)
- ii. What is boiling point? (1)
- iii. What is crystallization? (2)

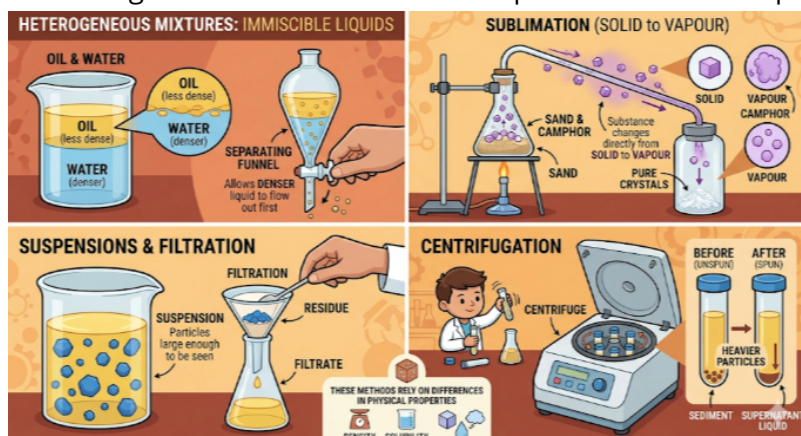
OR

What are the four methods of separation? (2)

68. **Read the following text carefully and answer the questions that follow:**

[4]

Heterogeneous mixtures consist of components that are not uniformly mixed and can often be seen separately. One common example is oil and water, which form separate layers because they are immiscible liquids. A separating funnel is used to separate such mixtures by allowing the denser liquid to flow out first. Another method used for separating mixtures is sublimation, where a substance changes directly from solid to vapour without becoming liquid. For example, camphor sublimates when heated and can be separated from sand. Suspensions are another type of heterogeneous mixture where solid particles remain suspended in a liquid.



These particles are large enough to be seen and can be separated using filtration or centrifugation. Centrifugation involves spinning the mixture rapidly so that heavier particles settle at the bottom. These methods rely on differences in physical properties such as density, solubility, and state of matter.

Questions:

- i. What is a heterogeneous mixture? (1)
- ii. Why do oil and water form separate layers? (1)
- iii. Explain the method of centrifugation. (2)

OR

How does sublimation help in separation? (2)

69. **Read the following text carefully and answer the questions that follow:**

[4]

A solution of a solid in a liquid such as water can be prepared by adding it slowly to water with constant stirring at a certain temperature (room temperature). If the addition process is continued, a stage is ultimately reached in the dissolution process when no more of the solid dissolves. Rather it starts settling at the bottom of the container such as a glass beaker. The solution at this stage is said to be saturated. The solubility of a solute is always expressed with respect to the saturated solution. It may be defined as the maximum amount of the solute that can be dissolved in 100 g of the solvent to form a saturated solution at a given temperature.

Please remember that the role of temperature is very important. If temperature is increased, the solution becomes unsaturated. In case the temperature is decreased, the solution becomes supersaturated. As a result, crust of the solute gets deposited on the surface.

- What do mean by the term Solubility? (1)
- 20 g of a solute are dissolved in 500 g of the solvent. The solubility of the solute is: (1)
- When a saturated solution becomes unsaturated? (2)

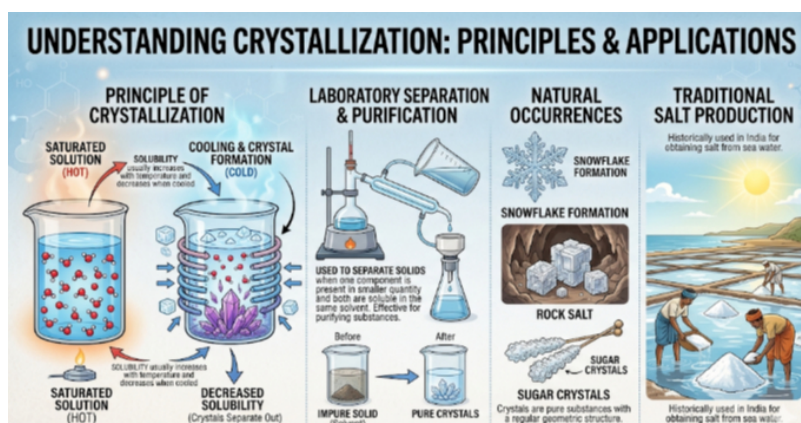
OR

What do you mean by concentration of solution? (2)

70. **Read the following text carefully and answer the questions that follow:**

[4]

Crystallization is a method used to separate and purify solids from a solution based on differences in solubility at different temperatures. When a saturated solution is cooled, the solubility of the solute decreases, causing excess solute to separate out in the form of crystals. These crystals are pure substances with a regular geometric structure. This process occurs naturally, as seen in the formation of snowflakes, rock salt, and sugar crystals. In laboratories, crystallization is used to separate solids when one component is present in smaller quantity and both are soluble in the same solvent.



It is also an effective technique for purifying substances. The principle behind crystallization is that solubility usually increases with temperature and decreases when cooled. This method has been used traditionally in India for obtaining salt from sea water. Crystallization remains an important technique in chemistry for obtaining pure solids from mixtures.

Questions:

- What is crystallization? (1)
- Why do crystals form when a solution is cooled? (1)
- Explain the principle behind crystallization. (2)

OR

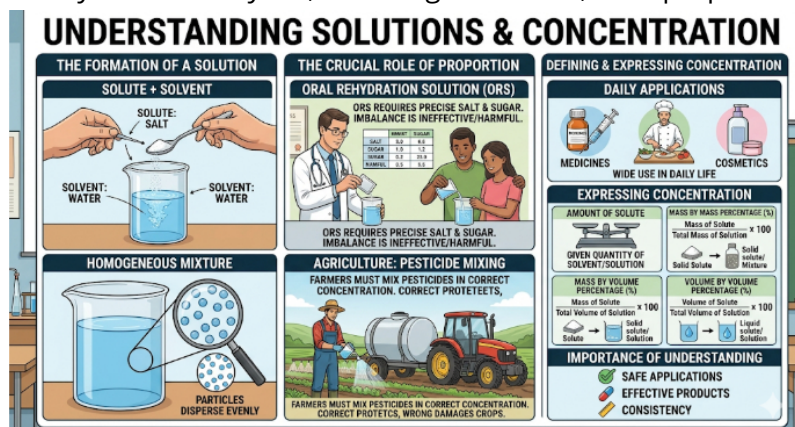
Give one natural and one laboratory use of crystallization. (2)

71. **Read the following text carefully and answer the questions that follow:**

[4]

A solution is a homogeneous mixture formed when a solute dissolves in a solvent. The proportion of solute and solvent is crucial in determining the properties of the solution. For example, Oral Rehydration Solution (ORS) requires precise amounts of salt and sugar in water; any imbalance can make it ineffective or harmful. Similarly, farmers must carefully mix pesticides in the correct concentration to protect crops without damaging them. The concentration of a solution refers to the amount of solute dissolved in a given quantity of solvent or solution. It is

widely used in daily life, including medicines, food preparation, and cosmetics.



Concentration can be expressed in different ways, such as mass by mass percentage, mass by volume percentage, and volume by volume percentage. Each method is suitable for different types of mixtures. Understanding concentration helps ensure safety, effectiveness, and consistency in both scientific and everyday applications.

Questions:

- What is meant by concentration of a solution? (1)
- Why is correct concentration important in ORS? (1)
- Explain two methods of expressing concentration. (2)

OR

How is concentration useful in everyday life? (2)

- Under which category of mixtures will you classify alloys and why? [5]
 - Whether a solution is always liquid or not. Comment.
 - Can a solution be heterogeneous?
- Pragya tested the solubility of three different substances at different temperatures and collected the data as given below (results are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution). [5]

Temperature in K					
Substance dissolved	283	293	313	333	353
Solubility					
Potassium Nitrate	21	32	62	106	167
Sodium Chloride	36	36	36	37	37
Potassium Chloride	35	35	40	46	54
Ammonium Chloride	24	37	41	55	66

- What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?
- Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools? Explain.
- Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?
- What is the effect of change of temperature on the solubility of a salt?

74. i. How is the traditional perfume "Mitti ka Ittar" prepared in Kannauj? [5]
ii. Which traditional distillation technique is used in its preparation?
iii. Why is Kannauj famous in India in relation to perfumes and fragrances?
75. i. To make a saturated solution, 36 g of sodium chloride is dissolved in 100 g of water at 293K. [5]
Find its concentration at this temperature.
ii. Calculate the mass of glucose and mass of water required to make 200g of 25% solution of glucose.

USP

Solution
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1.
(c) To make medicines easily palatable and reduce greasy feeling.
Explanation:
Some medicines are prepared as emulsions to disperse them in water and make them easily palatable. This also reduces the greasy feeling of the liquid medicine.
2.
(b) 60 g of potassium permanganate in 200 g of water
Explanation:
Mass by mass percentage = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
Concentration of solution I = $\frac{10}{10+200} \times 100 = 4.76\%$
Concentration of solution II = $\frac{15}{160+15} \times 100 = 8.57\%$
Concentration of solution III = $\frac{60}{200+60} \times 100 = 23.07\%$
Concentration of solution IV = $\frac{20}{90+20} \times 100 = 18.18\%$
3.
(c) All of these
Explanation:
Iron filings and sulphur powder will form a heterogeneous mixture, particles can be easily seen and iron filings can be easily seen and iron filings can be removed by a magnet.
4.
(c) Dispersed phase
Explanation:
The solute-like component or dispersed particles in a colloid constitute the dispersed phase.
5.
(d) It generally increases.
Explanation:
For solid solutes in liquid solvents, solubility typically increases as the temperature rises.
6.
(d) Dispersion medium
Explanation:
The component in which the dispersed phase is suspended is known as the dispersion medium.
7.
(b) Egg albumin in water
Explanation:
Egg albumin in water will not give a stable solution. The protein in egg albumin coagulated to form a lump in hot water.
8.
(a) Heterogeneous mixture, because particles are visible, settle, and scatter light (Tyndall effect).
Explanation:
Visible particles, settling over time, and scattering of light (making the laser beam path clear) are all defining characteristics of a heterogeneous mixture, specifically a suspension or certain colloids

where larger particles are present.

9.

(b) 5% m/v

Explanation:

Mass by volume percentage = (Mass of solute / Volume of solution) $\times$ 100 = (5 g / 100 mL) $\times$ 100 = 5% m/v.

10. **(a)** Sugar

Explanation:

The solute is the substance that gets dissolved, while the solvent is the substance that dissolves the solute. In sugar and water, sugar is dissolved, making it the solute.

11.

(c) volatile solids and non-volatile solids

Explanation:

Sublimation is the process in which sublimable volatile solid components can be separated from non-volatile solids by converting it into its vapours.

12. **(a)** carbon disulphide

Explanation:

Addition of carbon disulphide to a mixture containing iron filings and sulphur powder leads to the formation of a clear yellow solution when sulphur powder dissolves in carbon disulphide, on gentle shaking. Iron fillings being insoluble settle in the bottom. These can be separated by filtration. When the solution is allowed to evaporate, the powder of solid sulphur is obtained.

13. **(a)** Aerated drinks (carbon dioxide in water)

Explanation:

Aerated drinks are cited as an example of a homogeneous mixture (solution) where carbon dioxide is dissolved uniformly in water.

14.

(b) heated but not covered

Explanation:

Evaporation is a type of vaporization, that occurs on the surface of a liquid as it changes into the gaseous phase. When heating is done and the mixture is not covered at that time evaporation is fast.

15.

(d) To stabilize emulsions

Explanation:

Emulsifying agents are present to stabilize emulsions.

16. **(a)** Light gets scattered by dust and smoke particles, making the beam visible.

Explanation:

This effect can also be observed when a fine beam of light enters a dark room through a small hole. This happens because light gets scattered by the dust and smoke particles in the air.

17.

(c) Alloy

Explanation:

An alloy is defined as a homogeneous mixture of two or more metals, or a metal and a non-metal.

18. **(a)** Snowflakes

Explanation:

Snowflakes are mentioned as naturally formed crystals when water vapor freezes in the air.

19. **(d)** Violet particles deposit on the neck of the funnel
Explanation:
Iodine being a sublimable solid, sublimes from the mixture of iodine and common salt as violet iodine vapours and condense on the neck of the funnel as violet particles.
20. **(a)** It has a uniform composition throughout.
Explanation:
A homogeneous mixture is characterized by its uniform composition throughout, meaning its properties are the same everywhere.
21. **(d)** a and c
Explanation:
The Tyndall Effect is shown by colloids (particles large enough to scatter light), not by true solutions.
22. **(d)** The amount of solid deposited would be the same, but crystals would be smaller.
Explanation:
The amount of solid deposited depends on the solubility difference, which is temperature-dependent. Increased cooling rate primarily affects crystal size and formation (smaller and less well-formed), not the overall amount that precipitates out due to the solubility curve.
23. **(a)** colloid
Explanation:
The colloid of starch is prepared by the dispersion method. 2-3 g of powdered/crushed starch is dissolved in 3- 4 ml of water to make a thin paste. This paste is added to 100 ml of boiling water while stirring. Allow the solution to cool and filter. The filtrate is colloid of starch.
24. **(b)** $(\text{Mass of solute} / \text{Mass of solution}) \times 100$
Explanation:
Mass by mass percentage is calculated as $(\text{Mass of solute} / \text{Mass of solution}) \times 100$.
25. **(b)** The path of the laser beam will be clearly visible due to scattering by chalk particles.
Explanation:
Chalk powder in water forms a suspension or a heterogeneous mixture where particles are large enough to scatter light, making the beam path visible (Tyndall effect).
26. **(c)** Inverted funnel
Explanation:
Solid NH_4Cl will be formed on the sides of inverted funnel. On heating it gets converted into vapours. And the vapours are not able to escape due to the cotton plug at its end. So the condensed vapours are seen on funnel tube.
27. **(a)** Simple distillation
Explanation:
Simple distillation is used for the separation of components of a mixture containing two miscible liquids that boil without decomposition and have a sufficient difference in their boiling points. This method is used for the separation of a mixture of acetone and water.

28. (a) A and C are mixtures and B and D are compounds

Explanation:

Mixture can be separated by physical process. In mixture of Fe and S, iron is attracted by magnet but FeS is not attracted. Mixture can be heterogeneous whereas compound is always homogeneous. Therefore, 'A' and 'C' are mixtures and 'B' and 'D' are compound.

29.

- (d) china dish, wire gauze, tripod stand

Explanation:

In the above given figure: 1 - is a china dish, 2 - is a wire gauze and 3 - is a tripod stand.

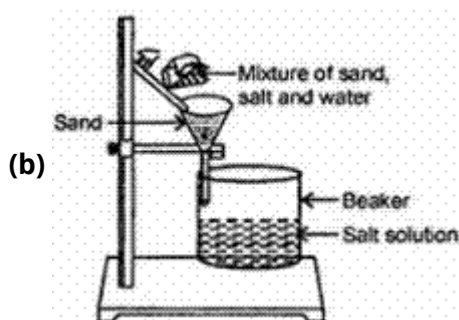
30.

- (c) (A)

Explanation:

Colloidal system or colloidal dispersion is a heterogeneous system that is made up of the Dispersed phase and the Dispersion medium. In colloidal dispersion, one substance is dispersed as very fine particles in another substance called dispersion medium. The dispersed phase and dispersion medium can be solid, liquid, or gas. Depending upon the state of the dispersed phase and dispersion medium. So the given statement is incorrect.

31.



Explanation:

The mixture solution should be added with the help of glass rod and the stem of funnel should touch the side of beaker.

32.

- (d) coloured spot is clearly seen in A, appears dim in B, not visible in C.

Explanation:

coloured spot is clearly seen in A because it is a true solution which is clear. Spot appears dim in B because it is colloidal with slightly greater solute particles than true solution. Spot not visible in C because it is suspension which has larger solute particles.

33.

- (d) (B) and (D)

Explanation:

In solution, the composition is not fixed and it has a variable composition. In solution, the solute particles cannot be separated by filtration. A true solution is a homogeneous and transparent mixture. So, statement B and D are correct statements regarding the solution.

34.

- (b) A, B and D

Explanation:

- For liquids and solid solutes, increasing the temperature not only increases the amount of solute that will dissolve but also increases the rate at which the solute will dissolve. For gases,

the reverse is true. An increase in temperature decreases both solubility and rate of solution.

- So, statement A and D correct.
- A way to measure solubility is to determine the maximum mass of solute that can be dissolved in 100 grams of solvent at a particular temperature. So, statement B correct.
- Sodium chloride, NaCl, is a soluble salt. The solubility of sodium chloride is 36 g/100 mL water at 25°C. So, statement B incorrect.

35.

(c) B and D

Explanation:

In solution, the composition is not fixed and it has a variable composition. In solution, the solute particles cannot be separated by filtration. A true solution is a homogeneous and transparent mixture. So, A and D are correct statements regarding the solution.

36. **(a)** (A), (B) and (D)

Explanation:

- For liquids and solid solutes, increasing the temperature not only increases the amount of solute that will dissolve but also increases the rate at which the solute will dissolve. For gases, the reverse is true. An increase in temperature decreases both solubility and rate of solution.

So, statement A and D are correct.

- A way to measure solubility is to determine the maximum mass of solute that can be dissolved in 100 grams of solvent at a particular temperature.

So, statement B correct.

- Sodium chloride, NaCl, is a soluble salt. The solubility of sodium chloride is 36 g/100 mL water at 25°C.

So, statement C incorrect.

37.

(c) A is true but R is false.

Explanation:

Both camphor and ammonium chloride sublime on heating.

38.

(c) A is true but R is false.

Explanation:

Assertion (A):

"Solutions do not exhibit the Tyndall effect."

This is true.

- True solutions have particle size < 1 nm
- These particles are too small to scatter light
- So, no visible light path is seen (no Tyndall effect)

Reason (R):

"Particles in solutions are larger than 100 nm, so they cannot scatter light."

This is false because:

- In fact, particles larger than 100 nm belong to colloids or suspensions, not true solutions
- True solution particles are much smaller (< 1 nm)

So the reason is incorrect in both size and explanation.

39. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Benzoic acid sublimes on heating while impurities do not.

40.
(c) A is true but R is false.
Explanation:
Sugar is soluble in water and insoluble in ether.
41.
(d) A is false but R is true.
Explanation:
True solutions do not exhibit the Tyndall effect since the particle size is very small to scatter light.
42. Mass of solution (salt) = 40 g
Mass of solvent (water) = 320 g
We know,
Mass of solution = Mass of solute + Mass of solvent
= 40 g + 320 g
= 360 g
Mass percentage of solution
= $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
= $\frac{40}{360} \times 100 = 11.1\%$
43. (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)
44. (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
45. (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
46. Alloys are the homogeneous mixtures of two or more metals. For example, brass is a mixture of a copper and zinc. Actually, copper is a crystalline solid in which the atoms are closely packed to form a crystal lattice. Some of these atoms have been replaced or substituted by atoms of zinc.
47. Following are some examples of Tyndall effect:-
i. Sunlight entering a room through ventilation near the ceiling.
ii. A beam of light coming inside a forest through a canopy of trees.
iii. Shining a flashlight beam into a glass of milk.
iv. The visible beam of headlights in fog.
48. i. Water and alcohol; can be separated by distillation.
ii. Petroleum contains many volatile components and they can be separated by fractional distillation.
iii. Water and kerosene oil; can be separated by separating funnel.
iv. Salt and ammonium chloride mixture; can be separated by sublimation.
v. Ink; different pigments can be separated by chromatography.
49. The separation can be done either by crystallisation or by evaporation.
50. The solution is a homogeneous mixture of two or more substances. Among the given mixtures solution are as follows:-
(b) Sea water: Seawater can be considered as a solution since it has dissolved salts (solid solute) in water (liquid solvent).
(c) Air: Air is a gas-in-gas solution.
(e) Soda water: Aerated drinks like soda water are gas-in-liquid solutions. Soda water contains carbon dioxide as a gaseous solute and water as a liquid solvent.
51. i. If the ink contains three different coloured components, three different bands will be seen on the filter paper.
ii. The child used the technique of Paper Chromatography.
iii. Paper Chromatography can be used to separate the pigments present in chlorophyll.
52. i. Evaporation:
 - Occurs at any temperature
 - Takes place only at the surface
 - It is a slow process

ii. Boiling:

- Occurs at a fixed temperature (boiling point)
- Takes place throughout the liquid
- It is a rapid process

53. Winnowing: Wheat grains from husk can be separated with the help of high speed wind blown in front of the grains which are slowly dispersed on the ground from some height.

54. Alum acts as a coagulant, causing fine suspended particles in muddy water to clump together into larger, heavier aggregates. These larger clumps settle much more quickly due to gravity (sedimentation). This process makes it easier to separate the settled particles from the water through decantation or subsequent filtration, improving removal efficiency.

55. A colloid is a kind of heterogeneous mixture/solution in which the particle size is between 10^{-7}cm and 10^{-5}cm such that the solute particles neither dissolve nor settle down. Colloids have a dispersion medium and a dispersed phase. E.g. Smoke, milk, shaving cream, jelly, cheese, etc.

$$56. \text{Mass percent} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

Mass percent = 25, Mass of solution = 250 g

$$25 = \frac{\text{Mass of cane sugar}}{(250\text{g})} \times 100$$

$$\text{Mass of cane sugar} = \frac{25 \times (250\text{g})}{100} = 62.5 \text{ g}$$

$$\text{Mass of water} = 250 - 62.5 = 187.5 \text{ g}$$

57. i. Milk is a colloid. The particulate matter present inside milk scatter the light passing through milk and shows Tyndall effect.

ii. Salt solution is a homogeneous solution. Small particles present in a salt solution do not scatter light and hence, a salt solution does not exhibit Tyndall effect.

iii. Detergent solution and sulphur solution will also show Tyndall effect.

58. No, we cannot yet create artificial blood that fully works like real blood for all patients.

Blood is a very complex colloidal mixture made of:

- Red blood cells (carry oxygen)
- White blood cells (fight infections)
- Platelets (help in clotting)
- Plasma (transport medium)

Artificial substitutes (often called blood substitutes) can:

- Carry oxygen to some extent
- Be used in emergency situations

However, they cannot completely replace real blood because:

- They do not perform all functions (like immunity and clotting)
- They may have side effects
- They are usually temporary solutions

59. Mustard oil forms the upper layer and water forms the lower layer in their mixture due to differences in their densities. Water is generally denser than most oils, including mustard oil. Density is a measure of mass per unit volume; a denser substance will sink below a less dense substance when they are immiscible. Since mustard oil has a lower density than water, it will float on top of the water, creating two distinct layers with the oil uppermost.

60.	True solution	Colloid
	1. A true solution is a homogeneous mixture of two or more substances. 2. The size of the particles is less than 1 nm. 3. It is always clear and transparent. 4. The particles cannot be seen even with a microscope. 5. It does not show Tyndall effect. 6. Example: Salt solution	1. A colloidal solution is a heterogeneous mixture of two substances. 2. The range of particle size is between 1 nm and 100 nm. 3. It is translucent. 4. The particles of a colloidal solution can be seen with the help of a microscope.

5. It shows Tyndall effect since a beam of light can be scattered by the particles.
6. Example: Milk

61. i. Mass of potassium nitrate needed

From the table:

Solubility of potassium nitrate at $40^{\circ}\text{C} = 62\text{ g}$ per 100 g water

For 50 g water:

$$\text{Required mass} = \frac{62}{100} \times 50 = 31\text{ g}$$

Answer: 31 g of potassium nitrate

ii. At 80°C , solubility of potassium chloride = $54\text{ g}/100\text{ g}$ water At 25°C ($\approx 20 - 30^{\circ}\text{C}$), solubility $\approx 35 - 37\text{ g}/100\text{ g}$ water

As the solution cools:

Solubility decreases

Excess potassium chloride comes out of the solution as crystals

Observation: Crystals of potassium chloride will form on cooling.

iii. **General Effect:**

For most salts, **solubility increases with increase in temperature**

62. They do not come closer because of the presence of either positive or negative charge on them. Due to mutual repulsion, these particles remain scattered in a colloidal solution.

63. The size of particles in a mixture directly affects whether a beam of light can be seen. In a true solution, the particles are extremely small and do not scatter light, so the path of the beam remains invisible. In colloids and suspensions, particles are larger and scatter light in different directions. This scattering makes the light path visible, a phenomenon known as the Tyndall effect. Thus, larger particle size increases light scattering and visibility.

64. Light behaves differently in these mixtures because of particle size. In a transparent solution, the dissolved particles are extremely small, so light passes through without scattering and the beam path cannot be seen. In a colloid or suspension, the particles are larger and scatter light in different directions. As a result, the path of the light beam becomes visible. This scattering of light is called the Tyndall effect.

65. Immiscible liquids form separate layers because:

- They do not dissolve in each other
- They have different densities

The denser liquid settles at the bottom, and the lighter one stays on top, forming two distinct layers.

66.	Mixture	Method of separation	Reason for selection
	Mud from muddy water	Sedimentation and decantation/Filtration	Mud is insoluble and heavier, so it settles or can be trapped by filter paper
	Plasma from other components in the blood sample	Centrifugation	Blood components separate based on density under high-speed spinning
	Naphthalene and sand	Sublimation	Naphthalene sublimes on heating, sand does not
	Chalk powder and common salt	Dissolving in water + filtration + evaporation	Salt dissolves in water, chalk does not; they can be separated by solubility difference
	Common salt and water	Evaporation / Distillation	Water evaporates leaving salt behind (distillation if water is to be collected)
	Oil from water	Separating funnel	Oil and water are immiscible and form separate layers due to density difference
	Pigments of the flower	Chromatography	Different pigments travel at different speeds in a solvent

67. i. A homogeneous mixture is a gaseous, liquid or solid mixture that has the same proportions of its components throughout a given sample.
ii. The boiling point of a liquid is the temperature at which the vapour pressure of the liquid becomes equal to the atmospheric pressure of the liquid's environment. At this temperature, the liquid is converted into a vapour.
iii. Crystallization is the process of separating solid compounds from the solution in the form of crystals. This method is mainly employed for the separation of a solid in pure form from the solution.

OR

Mixtures can be physically separated by using methods that use differences in physical properties to separate the components of the mixture, such as evaporation, distillation, filtration and chromatography.

68. i. A heterogeneous mixture is a mixture in which the components are not uniformly distributed and can often be seen separately. Examples include oil and water, sand in water, and mixtures where particles remain visibly distinct.
ii. Oil and water form separate layers because they are immiscible liquids and do not mix. Their different densities cause oil to float on water, forming two distinct layers that can be easily separated.
iii. Centrifugation is a method in which a mixture is spun at high speed, causing heavier particles to move outward and settle at the bottom. The lighter liquid remains at the top and can be separated easily.

OR

Sublimation helps in separation by converting a solid directly into vapour on heating. The vapour then cools and forms a solid again, allowing separation from substances that do not sublime, such as sand mixed with camphor.

69. i. The maximum amount of solute that can dissolve in a given amount of solvent.

- ii. Given, Mass of solute = 20g

Mass of solvent = 500g

$$\text{Mass-Volume percentage} = \frac{20}{500} \times 100$$

$$= 4\%$$

$$\text{Solubility of 500 g of solvent} = \frac{4}{100} \times 500$$

$$= 20\text{g}$$

Hence, the solubility of 20g of solute in 500g of solvent is 20g.

- iii. A saturated solution becomes unsaturated by either heating it or by adding more of the solvent.

OR

Concentration of a solution is defined as the amount of solute that is present in a given amount of solution. It can be expressed in terms of: Mass by the mass percentage of a solution =

$$\frac{\text{mass of solute}}{\text{mass of solution}} \times 100.$$

70. i. Crystallization is a process used to separate and purify solids from a solution by forming crystals. It occurs when a saturated solution is cooled, causing the dissolved substance to come out in a pure solid form.
ii. Crystals form when a solution is cooled because the solubility of the solute decreases. As a result, the excess solute can no longer remain dissolved and separates out in the form of solid crystals.
iii. The principle of crystallization is based on the change in solubility with temperature. Most solids dissolve more at higher temperatures and less at lower temperatures. When a hot saturated solution is cooled, excess solute crystallises out as pure solid particles.

OR

A natural example of crystallization is the formation of snowflakes or salt crystals. In laboratories, crystallization is used to purify substances and separate solids from mixtures where components are dissolved in the same solvent.

71. i. Concentration of a solution refers to the amount of solute dissolved in a given quantity of solvent or solution. It indicates how strong or dilute a solution is and is essential for ensuring correct composition in various applications.

- ii. Correct concentration in ORS is important because it ensures proper balance of salts and sugar needed for hydration. If the proportion is incorrect, it may not be effective or could harm the body instead of helping recovery.
- iii. Concentration can be expressed in different ways depending on the situation. Mass by mass percentage shows grams of solute in 100 grams of solution, while mass by volume percentage shows grams of solute in 100 millilitres of solution, often used in medicines and laboratories.

OR

Concentration is useful in everyday life as it helps maintain proper proportions in food, medicines, and agriculture. It ensures safety, effectiveness, and consistency in processes like preparing solutions, using pesticides, or manufacturing products.

72. i. Alloys are a homogeneous mixture of metals or non-metals because
- a. It shows the properties of its constituents, and
 - b. It has variable composition, e.g. brass is considered a mixture because it shows the properties of its constituents, copper and zinc; and it has a variable composition.
- ii. No, a solution is not generally a liquid always. For e.g. alloys are known to be solid solutions.
- iii. The term solution is generally used for 'true solution'. In this case, the solution is always homogeneous.
- In the case of 'colloidal solution', that is not a true solution i.e. the solution is heterogeneous.
73. a. The amount of potassium nitrate required to produce a saturated solution at 313 K in 100 g of water = 62 g
The amount of potassium nitrate that would be required to produce a saturated solution at 313 K in 50 g of water = $(62 \times 50) / 100$ g
Therefore, 31 g of potassium nitrate would be required to produce a saturated solution at 313 K in 50 g of water.
- b. At 373 K, preparation of a saturated solution will need 54 g of potassium nitrate. At a room temperature of 293 K, a saturated solution of potassium nitrate requires just 35 g potassium nitrate. As the solution cools, excess potassium nitrate ($54 \text{ g} - 35 \text{ g} = 19 \text{ g}$) will precipitate out as insoluble salt.
- c. Solubility of potassium nitrate, sodium chloride, potassium chloride and ammonium chloride in 100 g of water at 293 K are 32 g, 36 g, 35 g and 37 g respectively.
Ammonium chloride has the highest solubility (37 g) at this temperature.
- d. Effect of change of temperature on the solubility of a salt: As a general rule, the solubility of the salts is directly proportional to the temperature. If the temperature is increased, the solubility of the salt generally increases.
74. i. Mitti ka Ittar is prepared by collecting the natural earthy fragrance released from wet soil after the first rain. This scented soil is then heated in a traditional setup so that the vapours containing the fragrance are captured and condensed, producing a natural perfume that carries the smell of rain-soaked earth.
- ii. The Deg-Bhapka method is used for the distillation of Mitti ka Ittar. In this traditional process, the fragrant vapours are collected in a receiver and cooled so that the essence is separated and stored as perfume.
- iii. Kannauj is famous as the "perfume capital of India." It has a long-standing tradition of producing natural perfumes using age-old distillation techniques. The region is well known for its skilled artisans and heritage-based fragrance industry that has been passed down through generations.

75. i. Concentration of sol = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

$$= \frac{36}{136} \times 100$$

$$= 26.4\% \text{ (by mass)}$$

- ii. Given mass of solution(M) = 200g
Concentration of solution = 25%

Since, Mass by Mass percentage of solution = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

$$\Rightarrow 25 = m \times \frac{100}{200} \text{ g}$$

$$\Rightarrow m = 25 \times \frac{200}{100} = 50\text{g}$$

$\therefore$ mass of solute = 50g

$$\text{mass of solvent (water)} = M - m = 200\text{g} - 50\text{g} = 150\text{g}$$

USP