Chapter 9
Solutions

I. Choose the best Answer:

Question 1.
A solution is a mixture.
(a) homogeneous
(b) heterogeneous
(c) homogeneous and heterogeneous
(d) non-homogeneous
Answer:
(a) homogeneous

Question 2.
The number of components in a binary solution is _____.
(a) 2
(b) 3
(c) 4
(d) 5.
Answer:
(a) 2

Question 3.
Which of the following is the universal solvent?
(a) Acetone
(b) Benzene
(c) Water
(d) Alcohol
Answer:
(c) Water

Question 4.
A solution in which no more solute can be dissolved in a definite amount of solvent at a given temperature is called _____.
(a) Saturated solution
(b) Un saturated solution
(c) Supersaturated solution
(d) Dilute solution.
Answer:
(a) Saturated solution

Question 5.
Identify the non-aqueous solution.
(a) sodium chloride in water
(b) glucose in water
(c) copper sulphate in water
(d) sulphur in carbon-di-sulphide
Answer:
(d) sulphur in carbon-di-sulphide

Question 6.
When pressure is increased at a constant temperature the solubility of gases in liquid _____.
(a) No change
(b) increases
(c) decreases
(d) no reaction.
Answer:
(b) increases

Question 7.
Solubility of NaCl in 100 ml water is 36 g. If 25 g of salt is dissolved in 100 ml of water how much more salt is required for saturation:
(a) 12 g
(b) 11 g
(c) 16 g
(d) 20 g
Answer:
(b) 11 g

Question 8.
A 25% alcohol solution means _____.
(a) 25 ml of alcohol in. 100 ml of water
(b) 25 ml of alcohol in 25 ml of water
(c) 25 ml of alcohol in 75 ml of water
(d) 75 ml of alcohol in 25 ml of water.
Answer:
(c) 25 ml of alcohol in 75 ml of water

Question 9.
Deliquescence is due to:
(a) Strong affinity to water
(b) Less affinity to water
(c) Strong hatred to water
(d) Inertness to water
Answer:
(a) Strong affinity to water

Question 10.
Which of the following is hygroscopic in nature?
(a) ferric chloride
(b) copper sulphate pentahydrate
(c) silica gel
(d) none of the above.
Answer:
(c) silica gel

II. Fill in the blanks:

1. The component present in lesser amount, in a solution is called ……..
2. Example for liquid in solid type solution is ……….
3. Solubility is the amount of solute dissolved in ……… g of solvent.
4. Polar compounds are soluble in ……… solvents.
5. Volume percentage decreases with increases in temperature because ………

Answer:

1. solute
2. amalgam
3. 100
4. Polar
5. of expansion of liquid

III. Match the following:

	Column I		Column II
A	Blue vitriol	(i)	$CaSO_4.2H_2O$
B	Gypsum	(ii)	CaO
C	Deliquescence	(iii)	$CuSO_4.5H_2O$
D	Hygroscopic	(iv)	$NaOH$

Answer:
A. (iii)
B. (i)
C. (iv)
D. (ii)

IV. True or False: (If false give the correct statement):

1. Solutions which contain three components are called binary solution.
2. In a solution the component which is present in lesser amount is called solvent.

3. Sodium chloride dissolved in water forms a non-aqueous solution.
4. The molecular formula of green vitriol is $MgSO_4. 7H_2O$
5. When Silica gel is kept open, it absorbs moisture from the air, because it is hygroscopic in nature.

Answer:

1. False – Solutions which contain two components are called binary solution.
2. False – In a solution the component which is present in lesser amount is called solute.
3. False – Sodium chloride dissolved in water forms an aqueous solution.
4. False – The molecular formula of green vitriol is $FeSO_4. 7H_2O$
5. True

V. Short Answer Questions:

Question 1.
Define the term: Solution
Answer:
A solution is a homogeneous mixture of two or more substances.

Question 2.
What is mean by the binary solution?
Answer:
A solution must at least be consisting of two components. Such solutions which are made of one solute and one solvent are called binary solutions.
E.g., On adding $CuSO_4$ crystals to water.

Question 3.
Give an example each

1. gas in liquid;
2. solid in liquid;
3. solid in solid;
4. gas in gas.

Answer:

1. Gas in liquid – CO_2 in water
2. Solid in liquid – NaCl in water
3. Solid in solid – Alloys
4. Gas in gas – He – O_2 gas

Question 4.
What is the aqueous and non-aqueous solution? Give an example.

Answer:
Aqueous solution: The solution in which water act as a solvent is called aqueous solution. In general, ionic compounds are soluble in water and form aqueous solutions more readily than covalent compounds. E.g. Common salt in water.

Non – Aqueous solution: The solution in which any liquid, other than water act as a solvent is called non-aqueous solution. Alcohols, benzene, ethers, etc., are used as non – aqueous solvents. E.g. Sulphur dissolved in carbon disulphide.

Question 5.
Define Volume percentage.
Answer:
Volume percentage is defined as the percentage by volume of solute (in ml) present in the given volume of solution.

$$\left.\begin{array}{c} \text{Volume} \\ \text{Percentage} \end{array}\right\} = \frac{\text{Volume of the solute}}{\begin{array}{c}\text{Volume of solute}\\+\text{Volume of solvent}\end{array}} \times 100$$

Question 6.
The aquatic animals live more in a cold region. Why?
Answer:
Aquatic animals live more in cold regions because the solubility of oxygen is more in cold water (at low temperature). Therefore, aquatic animals are more comfortable in cold water.

Question 7.
Define Hydrated salt.
Answer:
Ionic substances which crystallise out from their saturated aqueous solution with a definite number of molecules of water are called hydrated salts.

Question 8.
A hot saturated solution of copper sulphate forms crystals as it cools. Why?
Answer:
The capability of a solution to maintain a certain concentration of solute is temperature-dependent. When a saturated solution of copper sulphate at above room temperature is allowed to cool, the solution becomes supersaturated and in the absence of stirring or the return of the previous solution temperature, the solute starts to precipitate out. i.e., crystal formation occurs.

Question 9.
Classify the following substances into deliquescent, hygroscopic. Cone. Sulphuric acid, Copper sulphate penta hydrate, Silica gel, Calcium chloride and Gypsum salt.

Answer:

Deliquescent	Hygroscopic
Calcium chloride	Conc. H_2SO_4
	$CuSO_4.5H_2O$
	Silica gel
	$CaSO_4.2H_2O$ (Gypsum)

VI. Long Answer Questions:

Question 1.
Write notes on?

1. saturated solution
2. unsaturated solution

Answer:

1. Saturated solution: A solution in which no more solute can be dissolved in a definite amount of the solvent at a given temperature is called saturated solution, e.g. 36 g of sodium chloride in 100 g of water at 25°C forms a saturated solution.
2. Unsaturated solution: Unsaturated solution is one that contains less solute than that of the saturated solution at a given temperature, e.g. 10 g or 20 g or 30 g of Sodium chloride in 100 g of water at 25°C forms an unsaturated solution.

Question 2.
Write notes on various factors affecting solubility.
Answer:
There are three main factors which affects the solubility of a solute. They are

1. Nature of the solute and solvent
2. Temperature
3. Pressure

1. Nature of the solute and solvent : The nature of the solute and solvent plays an important role in solubility. Even though water is Universal solvent, all substances do not dissolve in water. Dissolution occurs when similarities exist between the solvent and the solute.

Ionic compounds are soluble in polar solvent like water and covalent compounds are soluble in non-polar solvents like ether, benzene, alcohol etc.

2. Effect of Temperature :
Solubility of solid in liquid : Generally solubility of a solid solute in a liquid increases with

increase in temperature.
In Endothermic process : Solubility increases with increase in temperature.
In Exothermic process : Solubility decreases with increase in temperature.
Solubility of Gases in liquid : Solubility of gases in liquid decreases with increase in temperature.

3. Effect of Pressure : Effect of pressure is observed only in the case of solubility of a gas in a liquid. When the pressure is increased, the solubility of a gas in liquid increases.
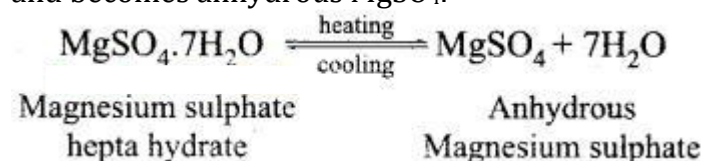
Question 3.
(a) What happens when $MgSO_4.7H_2O$ is heated? Write the appropriate equation
(b) Define solubility.
Answer:
(a) When Epsom salt $MgSO_4.7H_2O$ crystals are gently heated, it loses seven water molecules and becomes anhydrous $MgSO_4$.

$$MgSO_4.7H_2O \underset{\text{cooling}}{\overset{\text{heating}}{\rightleftharpoons}} MgSO_4 + 7H_2O$$

Magnesium sulphate   Anhydrous
  hepta hydrate   Magnesium sulphate

(b) Solubility is defined as the amount of solute in grams that can be dissolved in 100 g of the solvent to form its saturated solution at a given temperature and pressure.

$$\text{Solubility} = \frac{\text{Mass of the solute}}{\text{Mass of the solvent}} \times 100$$

Question 4.
In what way hygroscopic substances differ from deliquescent substances.
Answer:

Hygroscopic substances	Deliquescence substances
When exposed to the atmosphere at ordinary temperature, they absorb moisture and do not dissolve.	When exposed to the atmospheric air at ordinary temperature, they absorb moisture and dissolve.
Hygroscopic substances do not change its physical state on exposure to air.	Deliquescent substances change its physical state on exposure to air.
Hygroscopic substances may be amorphous solids or liquids.	Deliquescent substances are crystalline solids.

Question 5.
A solution is prepared by dissolving 45 g of sugar in 180 g of water. Calculate the mass percentage of solute.
Answer:
Mass of the solute (sugar) = 45 g

Mass of the solvent (Water) = 180 g
Formula:
Mass percentage of solute (sugar)

$$= \frac{\text{Mass of the solute}}{\text{Mass of the solute} + \text{Mass of the solvent}} \times 100$$

$$= \frac{45}{45 + 180} \times 100$$

$$= \frac{45}{225} \times 100 = 20\%$$

The mass percentage of solute = 20%

Question 6.
3.5 litres of ethanol is present in 15 litres of aqueous solution of ethanol. Calculate volume percent of ethanol solution.
Answer:
Volume of ethanol = 3.5 lit = 3500 ml
Volume of water = 15 lit = 15000 ml
Formula:

$$\left.\begin{array}{c}\text{Volume} \\ \text{Percentage}\end{array}\right\} = \frac{\text{Volume of the solute (ml)}}{\text{Volume of the solute} + \text{Volume of the solvent (ml)}} \times 100$$

$$= \frac{3500}{3500 + 15000} \times 100 = 18.92\%$$

The volume percentage of ethanol solution = 18.92

VII. HOT Questions

Question 1.
Vinu dissolves 50 g of sugar in 250 ml of hot water, Sarath dissolves 50 g of same sugar in 250 ml of cold water. Who will get a faster dissolution of sugar? and Why?
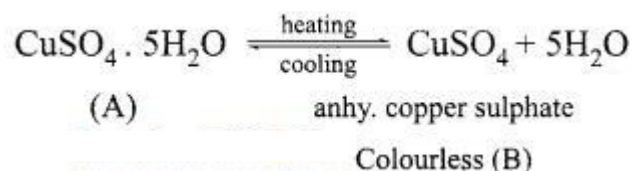### Answer:
Vinu will get a faster dissolution of sugar. Because generally solubility of a solid solute in a liquid solvent increases with increase in temperature. Therefore Vinu dissolves 50 g of sugar in 250 ml of hot water than Sarath dissolves 50 g of sugar in 250 ml of cold water.

Question 2.
'A' is a blue coloured crystalline salt. On heating it loses blue colour and to give 'B' When water is added, 'B' gives back to 'A'. Identify A and B, write the equation.
Answer:
Since 'A' is a blue coloured crystalline salt, it is $CuSO_4 . 5H_2O$ (Blue vitriol). On heating it loses all five water molecules and becomes colourless anhydrous $CuSO_4$.

$$CuSO_4 \cdot 5H_2O \underset{\text{cooling}}{\overset{\text{heating}}{\rightleftharpoons}} CuSO_4 + 5H_2O$$

(A)   anhy. copper sulphate

Colourless (B)

When water is added 'B' gives back A.

Question 3.
Will the cool drinks give more fizz at top of the hills or at the foot? Explain.
Answer:
At hilltops, the temperature will become less and pressure also decreases. Because temperature and pressure are directly proportional to each other. At low-pressure carbonate, cool drinks will give less fizz and give more fizz at the foot.