

## Chapter 9....Solutions

### SHORT QUESTIONS WITH ANSWER

Q.1 Binary solution can be homogenous or heterogeneous explain?

Ans.

The solutions which contain two components only are called as binary solution. If binary solution has single phase, it is called homogenous solution e.g. glucose in water. If binary solutions has more than one phase it is called heterogeneous solution e.g. oil in water.

Q.2 What is phase?

Ans.

Every sample of matter with uniform properties and fixed composition is called phase.

Q.3 Define molarity.

Ans.

Molarity is the number of moles of solute dissolved per dm<sup>3</sup> of solution.

Q.4 What is molarity?

Ans.

Molarity is the no. of moles of solute in 1000 gm (1 kg) of the solvent.

Q.5 Explain mole fraction (x).

Ans.

The mole fraction of any component in a mixture is the ratio of the number of moles of it to the total number of moles of all the components present.

Q.6 Define PPM?

Ans.

It is defined as number of parts (by weight or volume) of a solute per million parts (by weight or volume) of the solution.

Q.7 Like dissolve like. Explain.

Ans.

The inter-Ionic forces of attraction are very strong in Ionic solids, so equally strong polar solvents are needed to dissolve them. such solids cannot be dissolved by moderately polar solvents e.g. acetone.

Q.8 What is critical solution or upper consolute temperature?

Ans.

The temperature at which two conjugate solutions merge into one another is called critical solution temperature.

Q.9 What is difference between ideal and non-ideal solution.

Ans.

IDEAL SOLUTION		NON-IDEAL SOLUTION	
1.	Ideal solution obeys the Raoult's law.	1.	Non-Ideal solution does not obey Raoult's law.
2.	It has zero enthalpy change as their heat of solution $\Delta H = 0$ .	2.	It has exothermic or endothermic enthalpy change as their heat of solution $\Delta H \neq 0$
3.	Volume of solution is sum of volume of solvent and solute and change in volume is zero $\Delta v = 0$ .	3.	Volume of solution is not sum of the volume of solute and solvents and change in volume $\Delta V \neq 0$ .
4.	Examples (i) Benzene – ether (ii) Chlorobenzene–bromobenzene	4.	Example (i) Alcohol – water (ii) Water HCl

Q.10 Define Zeotropic and Azeotropic mixture.

Ans.

The liquid mixture which boils at constant temperature and distills over without change in composition at any pressure like a chemical compound is called azeotropic mixture e.g. water HCl system, water–ethanol system. The liquid mixture which can be distilled over with a change in composition is called zeotropic mixture e.g. Benzene–ether system.

Q.11 How can you relate the dynamic equilibrium with recrystallization?

Ans.

When some solute is added to the solvent, the force of attraction between the solute particles breakdown. This process is called dissolution. Some particles of solute may combine again and converted to a solid substance. This process is called recrystallization when a saturated solution is prepared there is an equilibrium b/w dissolution and recrystallization.

Q.12 Prove that HCl form an Azeotropic mixture with water?

Ans.

HCl form an azeotropic mixture with water boiling at 110o and containing 20.24% of acid. This pair of liquids showing positive deviation has azeotropic mixture with boiling point in comparison with pure components.

Q.13 What are conjugate solutions?

Ans.

As the mutual solubilities are limited, the liquids are only partially miscible on shaking equal volumes of water and ether, two layers are formed. Each liquid layer is a saturated solution of the other liquid. Such solution are called conjugate solutions.

Q.14 State Raoult's law in different way.

Ans. 1st statement:

The vapour pressure of a solvent above a solution is equal to the product of the vapour pressure of pure solvent and the mole fraction of solvent in solution.

2nd statement:

The lowering of vapour pressure is directly proportional to the mole fraction of solute.

3rd statement:

The relative lowering of vapour pressure is equal to the mole fraction of solute.

Q.15 The relative lowering of v.p is better than lowering of v.p why?

Ans.

The relative lowering of v.p:

- (i) is independent of temp.
- (ii) depends upon the conc. of solute.
- (iii) is constant when equimolar proportions of different solutes are dissolved in the same mass of same solvent.

Q.16 What is positive deviation?

Ans.

If a graph is plotted b/w composition and vapour pressure of a solution the total vapour pressure curve rises to maximum, which is above the vapour pressure of either of the pure components, shows positive deviation from Raoult's law.

Q.17 What is negative deviation?

Ans.

If the vapour pressure show a minimum. When vapour pressure of solution becomes less than either of component the solution will show negative deviation from Raoult's law.

Q.18 Define solubility?

Ans.

It is defined as the concentration of solute in the solution when it is in equilibrium with the solid substance at a particular temperature.

Q.19  $\text{Ce}_2(\text{SO}_4)_3$  shows exceptional behaviour toward solubility.

Ans.

$\text{Ce}_2(\text{SO}_4)_3$  shows exceptional behaviour whose solubility decreases with the increase in temperature becomes constant from  $40^\circ\text{C}$  onwards. Anyhow, it shows continuous solubility curve.

Q.20  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  and  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$  show discontinuous solubility curves?  
Ans.

Sometimes the solubility curves show sudden changes of solubilities and these curves are called discontinuous solubility curves. Actually these curves are combination of many curves. At the break a new solid phase appears and another solubility curve of new phase begins.

Q.21 What are colligative properties of solution?  
Ans.

The colligative properties are properties of solution that depend on the no. of solute and solvent molecules or ions. Some of the more important such properties are as follows:

- (i) Lowering of vapour pressure.
- (ii) Elevation of boiling point.
- (iii) Depression of freezing point.

Q.22 What are practical application of colligative properties?  
Ans.

It has following applications.

- (i) Methods of molecular mass determination.
- (ii) Contributed to the development of solution theory.
- (iii) Use of  $\text{NaCl}$  or  $\text{KNO}_3$  to lower the melting point of ice, this freezing mixture of ice and salt is used in ice cream machine.
- (iv) It protects automobile's radiator when antifreeze glycol is added in the radiators.

Q.23 What are ebullioscopic and cryoscopic constants?  
Ans.

The elevation in boiling point when one mole of solute is dissolved to the one kg. of solvent is called molar boiling point constant or ebullioscopic constant.

The depression in freezing point when one mole of solute is dissolved in 1 kg. Of solvent is called molar freezing point constant or cryoscopic constant.

Q.24 Colligative properties are obeyed when solutions are dilute, explain.  
Ans.

When solution is concentrated, Raoult's law is not obeyed when concentration of solute is high then these molecules may associate or combine with each other and all colligative properties show non-ideality.

Q.25 Boiling point of solvent increases due to the pressure of solutes or impurities?  
Ans.

Boiling point of a substance depends upon the external pressure and v.p of liquid. When some solute is added to the solvent, the vapour pressure of solvent lowers. Lowering of v.p depends upon the concentration of solution.

Q.26 what are hydration energy and solvation?

Ans.

The enthalpy change when one mole of solute is dissolved in specific amount of water at given temp. is called hydration energy. The enthalpy changes when one mole of solute is dissolved in specific amount of solvent at given temp. is called energy of solvation.

Q.27 Explain why lattice energy of ionic solids is always higher than molecular solids?

Ans.

Lattice energy of ionic solid is large due greater force attraction between the -ve and +ve ions. In case of molecular solid, less amount of energy is required to separate the molecules, because they have less intermolecular forces.

Q.28 What are hydrates?

Ans.

Those substances which have some water of crystallization in them, are called as hydrates e.g.,  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ .

Q.29 Colligative properties are obeyed when the solute is non-electrolyte

Ans.

Colligative properties depend upon the no. of particles. In the case of electrolytes, ions are produced and so the number of particles of the solutions increase and amount of colligative properties also increase. If the electrolyte is not 100% dissociated then the amount of colligative properties have to assessed according to their degree of dissociation.

Q.30 Relative lowering of v.p is independent of temperature.

Ans.

The formula for the relative lowering of vapour pressure and mole fraction of solute is

$$= x_2$$

Vapour pressure depends upon temperature and lowering of v.p also depends upon temp. So when the temp of a solution is increased both the factors increase in such a way that the ratio remains the same.

Think! Why molal Solution is more dilute than Molar solution?

How sum of all mole fraction is unity?