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Course Code: 102
Examination committee:

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Answer All the Following Questions

1. Choose the correct answer:

(30 marks)

1- In a super saturated solution, the amount of solute is — in comparison to saturated solution.

- (a) less (b) More (c) Equal to. (d) None of these.

2- Mole fraction, X_A , of solution is defined as

- (a) $X_B = \frac{n_B}{n_A + n_B}$ (b) $X_B = \frac{n_A}{n_A + n_B}$ (c) $X_B = \frac{n_A}{n_A + n_B}$ (d) $X_B = \frac{n_B}{n_B + n_B}$

3- The solubility or concentration of a gas in a given solvent is increased with

- (a) Decreases of pressure. (b) Increase of concentrations.
(c) Decreases of concentrations (d) Increase of pressure.

4- When the attraction between molecules A to molecules B is greater than the attraction between molecules A to molecules A or the between molecules B to molecules.

- (a) The P_{vapour} of the solution will be less than that given by Raoult's Law and positive deviation is obtained.
(b) The P_{vapour} of the solution will be less than that given by Raoult's law and negative deviation is obtained.
(c) The P_{vapour} of the solution will be less than that given by Dalton's law and negative deviation is obtained.
(d) The P_{vapour} of the solution will be greater than that given by Dalton's law and negative deviation is obtained.

-If we have aqueous solution of H_2O , that pH of this solution = 7,

) If we added one ml of 0.1 N hydrochloric acid to one liter water, the pH value of water is altered to 4.

) If we added one ml of 0.1 N NaOH alters the pH value to 10.0 .

The addition of slight amounts of dilute acids or dilute bases to water, its pH values will be affected.

All of these.

the catalyst accelerates the forward reaction only, without affecting the backward reaction.

- the catalyst is said to be positive catalyst. (b) The catalyst is said to be negative catalyst.
the catalyst is said to be neutral catalyst. (d) The catalyst is said to be little catalyst.

- 7-In alkaline solutions : (a) $\text{pH} = 10^{-7}$ (b) $\text{pH} < 7$ (c) $\text{pH} > 7$ (d) All of these.
- 8-The Henry's law is applicable if:
 (a) The temperature and pressure are moderate.
 (b) The solubility of the gas in the solvent is low.
 (c) The gas does not react with the solvent to form a new species.
 (d) All of these.
- 9-It known that, acetic acid (CH_3COOH) and sodium acetate (CH_3COONa), as buffer solutions. If we added a small amounts of H^+ ions to such a solution; it will combined with:
 (a) The acetate ions (from acetic acid). (b) The acetate ions (from sodium acetate).
 (c) Sodium ion (from sodium acetate) (d) OH^- (from ionization of water).
- 10-If the concentration of $[\text{H}^+]$ for the solution is 10^{-3}M , so $[\text{pOH}]$ is equal:
 (a) 4.0 M. (b) 8.0 M. (c) 10.0 M. (d) 11.0 M.
- 11-If we have a weak alkaline electrolyte in equilibrium, when we added a strong electrolyte having an ion in common to this solution. The resulting equilibrium
 (a) Shifted to the right. (b) Shifted to the left.
 (c) Will be unaffected. (d) Will be stopped.
- 12- Calculate the molarity of solution of sodium chloride in water, if 0.8 mol. is dissolved in quantity of water until the volume of the solution becomes 1600 mL .
 (a) 0.80 mol (b) 0.50 mol. (c) 0.90 mol (d) 1.00 mol.
- 13-If you have the following reaction: $3\text{NH}_4\text{CNS} + \text{FeCl}_3 \rightleftharpoons \text{Fe}(\text{CNS})_3$ (red color) + $3\text{NH}_4\text{Cl}$
 what happened when we added ammonium chloride to the reaction
 (a) An increase in intensity of the red color (b) Causes the color to become green.
 (c) An increase in intensity of the blue color (d) None of these.
- 14-The number of moles of a solute per kilogram of the solvent is called:
 (a) Mole fraction (b) Normality. (c) Molarity (d) Molality.
- 15-This mathematical relation between the dissociation degree and the volume of solution is known as
 (a) " Henry's law of Dilution". (b) "Ostwald Law of Dilution"
 (c) "Raoult's law of Dilution". (d) "Dalton's law of Dilution"
- 16-If we start with one gram molecules of acetic acid and one gram molecule of ethyl alcohol; we obtain in the equilibrium with resultants:
 (a) $2/3$ gram molecule of ethyl acetate and $2/3$ gram molecule of water .
 (b) $1/3$ gram molecule of ethyl acetate and $2/3$ gram molecule of water .
 (c) $2/3$ gram molecule of ethyl acetate and $1/3$ gram molecule of water .
 (d) $1/3$ gram molecule of ethyl acetate and $1/3$ gram molecule of water .
- 17-If the gases are partially miscible in liquids without any chemical reaction, forming
- (a) Non-ideal solutions. (b) Non real solutions.
 (c) Ideal solutions. (d) Real solutions.
- 18-A chemical system is at equilibrium:
 (a) When the rate of the forward reaction becomes zero.
 (b) When all of the reactants have been used up.
 (c) When the rates of the forward reaction and the reverse reaction are equal.
 (d) When the rates of the forward reaction and the reverse reaction are both zero

19- The Ostwald Law for Dilution can be writing as

$$(a) K_a = \frac{\alpha^2 v}{(1-\alpha)}$$

$$(b) K_a = \frac{\alpha^2}{(1-\alpha) v}$$

$$(c) K_a = \frac{\alpha^2}{(1-\alpha) v}$$

$$(d) K_a = \frac{\alpha^3}{(1-\alpha^2) v}$$

20-At constant temperature, the partial vapour pressure of any volatile constituent of solutions proportional to the mole fraction of this constituent in solution. The solution obeys

(a) Henry's law. (b) Raoult's law. (c) Dalton's law. (d) van't Hoff.

21-The inductive effect is related to :

a-Displacement of π electrons. b-Delocalization of π electrons.

c-Polarization of sigma bonds. d-Non of the above.

22-Which of the following group exerts a -I effect?

a- CH_3 b- C_2H_5 c- NO_2 d-OH

23-Which of the following groups shows a +M (positive mesomeric) :

a-CN b- NO_2 c-CHO d-OH

24-Which compound is most acidic ?

a- CH_3COOH b- CCl_3COOH c- $\text{CH}_3\text{CH}_2\text{COOH}$ d- CF_3COOH

25-The presence of -I group makes conjugate base :

a-More stable. b-Less stable. c-Unstable d-No effect.

26-Electron donating groups basicity:

a-Decrease b-Increase c-Remain the same. d-Sometimes decrease.

27-Which is more stable :

a-Primary carbocation. b-Secondary carbocation c-Tertiary carbocation. d-Non.

28-The compound that can be most readily sulphonated is:

a-Benzene. b-Toluene. c-Nitrobenzene. d-Chlorobenzene.

29-On increasing the number of alpha hydrogens ,the number of hyperconjugation structures :

a-Increase b-Decrease. c-Remains same. d-Non

30-Number of hyperconjugation structures in isopropyl radical is :

a-3 b-6 c-9 d-12

Mark the following statements as True or False: (10 marks.)

- Electronic geometry for molecules with formula AB_3 is tetrahedral.

-Water molecule is polar, and has some ionic bond character.

- The angle $\text{H}-\text{S}-\text{H}$ in H_2S is higher than angle $\text{O}-\text{C}-\text{O}$ in CO_2 .

- The energy of bonding molecular orbitals is higher than anti bonding molecular orbitals.

Repulsion force between bonded pair and lone pair of electrons is higher than that between lone pair and lone pair of electrons.

The number of regions of high electron density around A for AB_2U_2 molecules is four.

- 7- SO_2 molecule has a planar geometry.
- 8- The shape of PCl_5 is square planar.
- 9- The type of angles in PCl_5O is two.
- 10- Paramagnetic behavior is caused by the presence of Paired electron.

Essay Questions (20 Marks)

- 1-a- Describe molecular orbital theory and determine the bond order, magnetic properties for CO molecule. (5marks)
- b- Discuss the electronic and molecular geometry for the following compounds NH_3 and SF_6 according to Valence Bond Theory. (5marks)
- 2-Write short notes on the following : (10 Marks)
 - a-Substitution reactions.
 - b-Addition reactions.
 - c-Elimination reactions.

End of exam

Good luck

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