SURFACE CHEMISTRY

1. Adsorption is related with:
1) Accumulation of molecules of a substance on the surface of a liquid or solid
2) Uptake of a substance by some solid in its bulk
3) Uptake of a gas by a solid on its surface and in bulk
4) All of the above

2. Based on D.M. and D.P., colloidal solutions are of ……. Types.
1) 3 2) 5 3) 8 4) 9

3. Chemisorption is related with
1) 20-40 kJ mol^{-1} energy
2) 40-400 kJ mol^{-1} energy
3) 40-100 kJ mol^{-1} energy
4) above 400 kJ mol^{-1} energy

4. Gas makes use ……. As adsorbent.
1) silica gel 2) activated charcoal 3) graphite 4) any of these

5. 3g of activated charcoal was added to 50 mL of acetic acid solution (0.06N) in a flask. After an hour it was filtered and the strength of the filtrate was found to be 0.042 N. The amount of acetic acid adsorbed (per gram of charcoal) is:
1) 54 mg 2) 18 mg 3) 36 mg 4) 42 mg

6. According to Freundlich:
1) $\frac{x}{m} \propto P^{\frac{1}{n}}$ 2) $\frac{x}{m} \propto P^{n}$ 3) $\frac{m}{x} \propto P^{\frac{1}{n}}$ 4) $\frac{m}{x} \propto P^{n}$

7. The reaction of oxalic acid with acidic $KMnO_4$ becomes very fast after sometime. It forms an example of:
1) induced catalysis 2) auto catalysis 3) induced catalysis 4) none of these

8. Which of the following is incorrect with respect to a catalyst?
1) It remains unchanged in mass and chemical composition, after the reaction
2) It gives a new path to the reaction
3) It increases the extent of reaction
4) It cannot start a reaction

9. An anticatalyst poisons a catalyst because:
1) It is preferentially
2) It lowers the activation energy
3) It makes reactants react faster
4) it reacts with reactants

10. Which is not correctly matched for enzymatic reactions?
1) Invertase : Sucrose to glucose and fructose
2) Amylase : Starch to maltose
3) Pepsin : Protein to amino acids
4) Zymase : Glucose to ethanol

11. Which of the following is a shape selective catalyst?
1) ZSM-5 2) Zymase 3) $MnSO_4$ 4) Fe

12. If KI is added to excess of $AgNO_3$ to prepare colloidal solution of AgI, the colloidal particles will have:
1) No charge
2) Positive charge
3) Negative charge
4) may be positive or negative charge

13. Which of the following is a macromolecular colloid?
1) Enzyme 2) Gold sol 3) Sulphur sol 4) All of these

14. Smoke is an example of:
1) gel 2) sol 3) aerosol of liquid 4) acrosol of solid

15. Choose the correct reason(s) for the stability of the lyophobic colloidal particles.
1) Preferential adsorption of ions on their surface from the solution

2) Preferential adsorption of solvent on their surface from the solution
3) Attraction between different particles having opposite charges on their surface
4) Potential difference between the fixed layer and the diffused layer of opposite charges around the colloidal particles

16. Lyophilic sols are:
1) reversible sols
2) they prepared from inorganic compounds
3) coagulated by adding electrolyte
4) self stabilizing

17. Tails of comets are visible due to:
1) Brownian movement
2) Tyndall effect
3) fast motion of colloidal particles
4) none of these

18. Gold number of starch, gelatin and albumin are respectively 25, 0.01 and 0.15. Which of the following is the correct decreasing order of protective power?
1) Starch > gelatin>albumin
2) Starch > albumin>gelatin
3) Gelatin>albumin>starch
4) Data is insufficient to decide

19. Gold number of gelatin is 0.01. The amount of gelatin to be added to 100 mL of standard red gold sol to prevent coagulation by addition of 10 mL of 10% NaCl would be:
1) 0.01 mg
2) 0.001 mg
3) 0.10 mg
4) 1.00 mg

20. Alum helps in purifying water by:
1) forming Si complex with clay particles
2) sulphate part combines with dirt and removes it
3) aluminium which coagulates the the mud
4) making mud water soluble

21. Which of the following is correct w.r.t. lyophobic colloids?
1) Viscosity and surface tension both are higher than that of D.M.
2) Viscosity and surface tension both are lower than that of D.M.
3) Viscosity and surface tension both are equal to that of D.M.
4) Viscosity is higher but surface tension is lower than that of D.M.

22. An example of associate colloid is:
1) rubber
2) soap solution
3) vegetable oil
4) milk

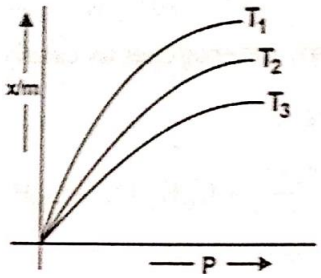
23. Which of the following is incorrect?
1) Hardy-Schulze rules are related with coagulation of lyophobic colloids
2) Gold number is the measure of protective power of a lyophilic colloid
3) Oil dag is the colloidal solution of graphite in oil
4) The size of colloidal particles is between 1 to 100 nm

24. Which of the following is incorrectly matched?
1) solid in liquid : Sol
2) liquid in solid : gel
3) gas in liquid : foam
4) gas in gas : acrosol

25. Which is an examples of autocatalysis?
1) Oxidation of SO_2 to SO_3
2) Oxidation of NO to NO_2
3) Oxidation of oxalic acid by acidified $KMnO_4$
4) Decomposition of $KClO_3$ to KCl and O_2

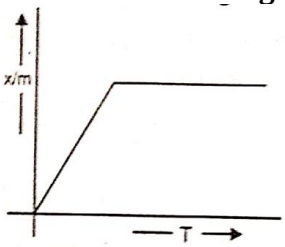
26. During dialysis:
1) Only solvent molecule can diffuse through animal membrane
2) solvent molecules, ions and colloidal particles can diffuse through animal membrance
3) all kind of particles can diffuse through the animal membrane
4) only ions can diffuse

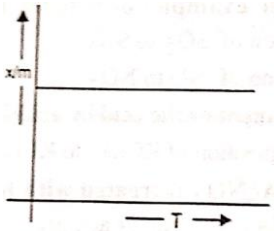
27. Three plots of extent of chemical adsorption v/s pressure are shown below. Which of the given choices is correct

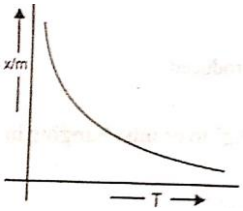


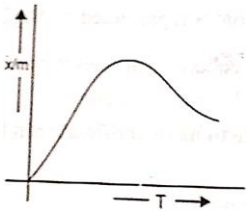
1) $T_1 > T_2 > T_3$ 2) $T_1 = T_2 = T_3$ 3) $T_3 > T_2 > T_1$ 4) $T_1 > T_2 < T_3$

28. Which of the following isobars, shows chemisorption?

1) 

2) 

3) 

4) 

29. A catalyst adsorb 100 mL of nitrogen gas at S.T.P. per gram of catalyst surface and forms a mono-molecular layer. The effective surface area occupied by one nitrogen molecule on the surface of catalyst is $0.16\times10^{-14}\,cm^2$. What is the total surface area occupied by nitrogen molecules per gram of catalyst?
(Given: Volume of gas at STP = 22.4 L)

1) $43.04\times10^{5}\,cm^2$ 2) $0.18\times10^{-15}\,cm^2$ 3) $42\times10^{5}\,cm^2$ 4) $0.19\times9^{-15}\,cm^2$

30. Chemisorption

1) involves the weak attractive interactions between adsorbent and adsorbate
2) is irreversible in nature
3) decreases with increase of temperature
4) involves multilayer formation of adsorbent on adsorbate

31. Bleeding is stopped by the application of ferric chloride. This is because:

1) The blood starts flowing in opposite direction 2) The blood reacts and forms a solid, which seals the blood vessel
3) The blood is coagulated and thus the blood vessel is sealed
4) The ferric chloride seals the blood vessel

32. Which of the following is less than zero during adsorption?

1) ΔG 2) ΔS 3) ΔH 4) ΔH & ΔS

33. and sol are examples of

1) Negativity charge sols 2) Positively charged sols
3) Positively and negatively charged sols respectively
4) Negatively and positively charged sols respectively

34. The coagulation of of Gold sol by 1 ml 10% NaCl solution is completely prevented by addition of 0.25 g of starch to it. The gold number of starch is

35. The mass adsorbed per gram of adsorbed O_2 having pressure 10 atm at 400K, if placed in contanct with solid surface is 2 g in one litre vessel. The pressure of O_2 after adsorption becomes 2 atom. Assume no change in temperature R = 0.08 L-atm. K^{-1} mol^{-1}.

36. How many of the statements are correct when H_2 is adorbved on Ni surface
(I) ΔH absorption is found to be negative.

(II) ΔS of adsorption is negative
(III) H-H bond breaks because of large size of Ni atoms
(IV) H-H bond breaking requires lot of heat.

37. How many of the given catalyst can be used in the manufacture of H_2SO_4 ?
(I) Oxides of nitrogen (II) V_2O_5 (III) Platinised asbestos (IV) Ni

38. How many of the following is(are) characteristic(s) of hydrophilic solution?
(I) High concentration of dispersed phase can be easily attained
(II) Coagulation is reversible
(III) Viscosity and surface tension are about the same as of water.
(IV) The charge of the particle depends on the pH value of the medium, it may be positive negative or even zero

39. How many of the following electrolyte will bring about the coagulation of a ferric hydroxide sol quickly and of least concentration?
I) NaCl II) $MgSO_4$ III) $Al_2(SO_4)_3$ IV) $MgCl_2$

40. By how many ways a lyophobic colloidal solution can be precipitated
(I) adding lyophilic colloid (II) Heating
(III) adding electrolyte (IV) adding oppositely charged colloid

41. The minimum number of phase in colloidal system are

42. How many of the following are correctly matched?
(I) Lyophilic colloids-reversible sols (II) Associated colloides – micelles
(III) Tyndall effect – scattering of light by colloidal particle.

43. How many of the given colloids are emulsions?

44. How many of the given are protective colloids? Gelatin, Haemoglobin, Gum, Starch, Ferric hydroxide sol, Gold sol.

SOLUTIONS

1. 0.002 molar solution of NaCl having degree of dissociation of 90% at 27^0C has osmotic pressure equal to
1) 0.94 bar 2) 9.4 bar 3) 0.094 bar 4) 9.4×10^{-4} bar

2. A 5% solution of cane sugar (mol.wt=342) is isotonic with 1% solution of substance x. The molecular weight of 'x' is?
1) 68.4 2) 34.2 3) 171.2 4) 136.2

3. The osmotic pressure of pure blood is 7.40 atm at 27^0C. The number of mol. Of glucose to be used per litre of an intravenous injection that is to have the same osmotic pressure as blood is
1) 0.1 2)0.3 3) 0.4 4) 0.2

4. Two solutions of KNO_3 and CH_3COOH are prepared separately. The molarity of both is 0.1 M and osmotic pressure is P_1 and P_2 respectively. The correct relationship between the osmotic pressure is
1) $P_2 > P_1$ 2) $P_1 = P_2$ 3) $P_1 > P_2$ 4) $\frac{P}{P_1+P_2} = \frac{P_2}{P_1+P_2}$

5. P^H of a 0.1 M monobasic acid is found to be 2. Hence, it's osmotic pressure at a given temperature 'T' K is
1) 0.7 RT 2) 0.11 RT 3) 1.1 RT 4) 0.01 RT

6. The partial pressure of ethane over a saturated solution containing $6.52\times10^{-2}g$ of ethane was 1 bar. If the solution contains $5\times10^{-2}g$ of ethane, what should be the partial pressure of the gas?
1) 0.532 bar 2) 1.23 bar 3) 0.762 bar 4) 1.79 bar

7. What amount of solute (Mol. Wt =60g/mol) is required to dissolve it in 180 g of water to reduce the vapour pressure to $\frac{4}{5}th$ of pure water?

1) 120g 2) 90 kg 3) 100 g 4) 150 g

8. Two liquids A and B show vapour pressures in the ratio of 1:2 at a certain temperature. Suppose we have an ideal solution of A and B in the mole fraction ratio A:B = 1:2, what would be the mole fraction of A in the vapour phase in equilibrium with the solution at a given temperature

1) 0.25 2) 0.20 3) 0.5 4) 0.33

9. Calculate the solubility of Nitrogen gas in 1L of water if the partial pressure of nitrogen is 0.98 bar. K_H of nitrogen = 76.5 K. bar

1) 6.05×10^{-3} moles/litre 2) 7.11×10^{-4} moles/litre

3) 6.75×10^{-4} moles/litre 4) 5×10^{5} moles/litre

10. At 293 K, the osmotic pressure of urea solution is 400 mm. The solution is diluted and the temperature is raised to 303K and the osmotic pressure is found to be 105 mm. Determine the extent of dilution of the solution

1) $\frac{1}{2}$ 2) The solution is diluted by 2 times

3) Solution is diluted by 4 times it's initial conc. 4) Diluted by 10 times it's initial conc.

11. An aqueous solution contains 5% by mass of urea and 10% by mass of glucose. Calculate the freezing point of this solution $\left(K_f = 1.86K\ kg\ mol^{-1}\right)$

1) -3.03^0C 2) -4.6^0C 3) $+4.6^0C$ 4) $+8.03^0C$

12. A certain substance "A" tetramerizes in water to the extent of 80%. A solution of 2.5g of A in 100g of water lowers the freezing point by 0.3^0C. The molar mass of "A" is

1) 120 2) 61 3) 60 4) 62

13. Two liquids A and B form an ideal solution. What will be the vapour pressure at 27^0C of a solution having 1.5 mol of A and 4.5 mol of B? The vapour pressure of A and B at 27^0C is 0.116atm and 0.140atm respectively?

1) 2.1 2) 0.001 3) 0.134 4) 0.6

14. On mixing 10 ml of acetone with 40 ml of chloroform, the total of the solution is

1) <50 ml 2) >50 ml 3) =50 mnl 4) can not be predicted

15. Equimolal solutions A and B show depression in freezing point in the ratio 2:1. "A" remains in the normal state in solution. "B" will be

1) Normal in solution 2) Dissociated in solution

3) Associated in solution 4) Hydrolysed in solution

16. Dry air was passed successively through a solution of 5g of a solute in 180 g of water and then through water. The loss in weight of solution was 2.50 g and that of pure solvent 0.04 g. The molecular weight of the solute is

1) 31.25 2) 312.5 3) 3.125 4) 0.3125

17. A mixture of volatile components A and B has total vapour pressure (in torr) $P = 254 - 119\chi_A$ **where χ_A is the mole fraction of A in mixture. Hence P_A^0 and P_B^0 are (in torr)**

1) 254,119 2) 119,254 3) 135,254 4) 154,119

18. Each pair forms ideal solution except

1) C_2H_5Br and C_2H_5I 2) C_6H_5Cl and C_6H_5Br

3) C_6H_6 and $C_6H_5.CH_3$ 4) C_2H_5I and C_2H_5OH

19. The relative lowering of the vapour pressure of an aqueous solution containing a non-volatile solute is 0.0125. The molality of the solution is

1) 0.80 2) 0.50 3) 0.70 4) 0.40

20. How much ethyl alcohol must be added to 1.0 Litre of water so that the solution will not freeze at -4^0F ?

1) 216 g 2) 495 g 3) 104 g 4) 198 g

21. If the density of methanol is 0.793 g/ml, what is it's volume needed for making 2.5L of it's 0.25M solution?

1) 252 ml 2) 25.22 ml 3) 281 ml 4) 400 ml

22. Which of the following liquid pairs show a +ve deviation from Raoult's law?

1) Water + HCl 2) Benzene + Methanol 3) $H_2O + HNO_3$ 4) Acetone + Chloroform

23. The molarity of a solution obtained by mixing 750 ml of 0.5 M HCl with 250 ml of 2M HCl will be?

1) 1.75 M 2) 0.875 M 3) 0.975 M 4) 1.00 M

24. An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution to increase ?

1) Addition of NaCl 2) Addition of Na_2SO_4

3) Addition of 1.00 molal KI 4) Addition of water

25. A 0.02 m aq. Solution of an ionic compound $Co(NH_3)_5(NO_2)Cl$ freezes at -0.00732^0C. **Number of moles of ions which 1 mol of ionic compound produces on being dissolved in water will be** $(K_f = 1.86 Km^{-1})$

1) 3 2) 4 3) 1 4) 2

26. 1 Mole of heptane (V.P = 92 mm of Hg) was mixed with 4 mole of octane (V.P=31 mm of Hg). The vapour pressure of resulting ideal solution is?

1) 46.2 mm of Hg 2) 40.0 mm of Hg 3) 43.2 mm of Hg 4) 38.4 mm of Hg

27. The solubility of CO_2 **in water at** 25^0C **and 1 atm is 0.034 mol/L. What is the solubility under atmospheric conditions. Assume that** CO_2 **obeys Henry's law. (The partial pressure of** CO_2 **in air is 0.0003 atm)**

1) 2×10^{-4} mol/L 2) 1.02×10^{-5} mol/L 3) 4.02×10^{-4} mol/L 4) 5×10^{-5} mol/L

28. What volume of 96% H_2SO_4 **solution (density 1.83 g/ml) is required to prepare 4 litres of** $3M\ H_2SO_4$ **soltluion?**

1) 69 ml 2) 6.6 ml 3) 669 ml 4) 6.0 Lit

29. How many grams of conc. HNO_3 solution should be used to prepare 250 ml of 2.0 M HNO_3? The conc. Acid is 70% HNO_3.

1) 45.0gm conc. HNO_3 2) $90.0g\ conc.\ HNO_3$ 3) $70g\ conc.\ HNO_3$ 4) $54.0g\ conc.\ HNO_3$

30. Calculate the molal depression constant of a solvent which has freezing point 16.6^0C **and latent heat of fusion** $180.75\ Jg^{-1}$?

1) $1.26\ K.kgmol^{-1}$ 2) $0.53\ K.kgmol^{-1}$ 3) $3.86\ K.kgmol^{-1}$ 4) $2.2\ K.kgmol^{-1}$

31. Calculate the molality of 1 litre solution of 93% $H_2SO_1(w/v)$**. The density of the solution is 1.84 g/ml**

1) 10.43 2) 20.36 3) 12.05 4) 14.02

32. Which of the following is not correct for an ideal solution?

1) $\Delta S_{mix} = 0$ 2) $\Delta H_{mix} = 0$ 3) Obeys Raults's law 4) $\Delta V_{mix} = 0$

33. If osmotic pressure of a solution is 2 atm at 273 K, then at 546, the osmotic pressure is

1) 0.5 atm 2) 1 atm 3) 2atm 4) 4 atm

34. Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression?

1) $Al_2(SO_4)_3$ 2) K_2SO_4 3) KCl 4) $C_6H_{12}O_6$

35. When 20 g of napthoic aicd $(C_{11}H_8O_2)$ **is dissolved in 50 g of benzene** $(K_f = 1.72\ K\ kg\ mol^{-1})$**, a freezing point depression of 2k is observed. The Vant Hoff factor(i) is?**

1) 0.5 2) 1 3) 2 4) 3

36. The degree of dissociation (α) of a week electrolyte A_xB_y is related to Van't Hoff factor (i) by the expression

1) $\alpha = \frac{i-1}{(x+y-1)}$ 2) $\alpha = \frac{i-1}{x+y+1}$ 3) $\alpha = \frac{x+y-1}{i-1}$ 4) $\alpha = \frac{x+y+1}{i-1}$

37. If 0.15 g of a solute, dissolved in 15 g of solvent, is boiled at a temperature higher by 0.216^0C than that of the pure solvent. The molecular weight of the substance (molal elevation constant for solvent is 2.16^0C)

1) 10.1 2) 100 3) 1.01 4) 1000

38. Which of the following is correct for the reaction $3X \rightarrow X_3$?

1) $\alpha = \frac{3}{2}(1-i)$ 2) $\alpha = \frac{2}{3}(1-i)$ 3) $\alpha = 2\times 3(1-i)$ 4) $\alpha = 3(1-i)$

39. A solution is obtained by dissolving 12g of urea (mol.wt =60) in 1L of water. Another solution is obtained by dissolving 68.4 g of cane sugar (mol.wt = 342) in 1L of water at the same temperature. The lowering of vapour pressure in first solution is?

1) Same as that in second 2) $\frac{1}{5}$ of 2nd solution

3) double of 2nd solution 4) 5 times of 2nd solution

40. A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (mol. wt =60) in the same solvent. If the density of both the solutions are assumed to be equal to $1.0\ g.cm^{-3}$, the molar mass of the substance will be:

1) 115.0 $g\ mol^{-1}$ 2) 105 $g\ mol^{-1}$ 3) 210 $g\ mol^{-1}$ 4) 90 $g\ mol^{-1}$

41. 0.2 molal aq. Solutions of each of NaCl, $BaCl_2$ and $AlCl_3$ have boiling points T_1, T_2 and T_3 respectively. Which of the following is correct?

1) $T_1 > T_2 > T_3$ 2) $T_3 > T_2 > T_1$ 3) $T_2 > T_1 > T_3$ 4) $T_1 > T_3 > T_2$

42. The density of a 2.03 M solution of acetic acid (mol. wt=60) in water is 1.017 g/ml. calculate the molality of the solution?

1) 1.67 m 2) 2.26 m 3) 4.0 m 4) 6.2 m

43. The normal freezing point of nitrobenzene($C_6H_5NO_2$) is 278.82 K. A 0.25 molal solution of a certain solute in nitrobenzene causes a freezing point depression of 2 degrees. Calculate the value of K_f for nitrobenzene

1) 6 2) 1 3) 8 4) 2

44. Decinormal solution of NaCl developed an osmotic pressure of 4.6 atmosphere at 300K. Calculate is's degree of dissociation (S=0.0821 litre atm K^{-1} mol^{-1})

1) 87 2) 78 3) 88 4) 86

45. Ethylene di bromide $(C_2H_4Br_2)$ and 1,2 - di bromopropane $\left(\overset{Br}{\underset{|}{C}}H_2 - \overset{Br}{\underset{|}{C}}H - CH_3\right)$ form an ideal solution. At 85^0C, the vapour pressure of these liquids are 173 and 127 torr respectively. What would be the mole fraction of ethylene dibromide in a solution at 85^0C equilibrated with 1:1 molar mixture in the vapour?

1) 42.3 2) 4.23 3) 0.423 4) 342.0

46. A sample of 500g ink contains 0.2g blue pigment. Calculate concentration of the ink in ppm.

1) 100 2) 200 3) 400 4) 300

47. At 10^0C, the osmotic pressure of urea solution was found to be 500mm. The solution is diluted and temperature is raised to 25^0C. When osmotic pressure was noticed to be 105.3 mm, determine the extent of dilution

1) 0.5 2) 5 3) 55 4) 555

48. Arrange the following solutions in the increasing order of the osmotic pressures ?

1) a < c < b < d 2) a < d < b < c 3) b < a < d < c 4) d < b < a < c

49. **Henry's law constant for the molality of methane in benzene at 298 K is 4.27×10^5 mm. Hg. Calculate the solubility of methane in benzene at 298 K under 760 mm Hg.**

1) 1.0×10^{-4} 2) 2.69×10^{-3} 3) 1.779×10^{-3} 4) 5×10^6

50. **Calculate the amount of ice that will separate out on cooling a solution containing 50 g ethylene glycol in 200g water to -9.3^0C . $\left(K_f = \text{for water is } 1.86K \text{ kg mol}^{-1}\right)$**

1) 38.7 2) 1.6 3) 24 4) 86.4

SOLID STATE

1. **In closest packing of A type of atoms (radius, r_A) the radius of atom 'B' that can be filled octahedral void is**

1) $0.155\,r_A$ 2) $0.125\,r_A$ 3) $0.414\,r_A$ 4) $0.732\,r_A$

2. **How many unit cells are present in a cube shaped ideal crystal of $NaCl$ of mass 1.00g?**

1) 2.57×10^{21} Unit cells 2) 5.14×10^{21} unit cells

3) 1.28×10^{21} Unit cells 4) 1.71×10^{21} unit cells

3. **Edge length of a cubic unit cell is 400pm. Its face diagonal would be.**

1) 600 pm 2) 200 pm 3) 566 pm 4) 692 pm

4. **Body diagonal of a cube is 866 Pm. Its Edge length would be**

1) 408 pm 2) 1000 pm 3) 500 pm 4) 600 pm

5. **The radius of Na^+ is 95 pm and that of $C\ell^-$ is 181 pm. The edge length of unit cell in $NaCl$ would be (pm)**

1) 181 2) 95 3) 276 4) 552

6. **A solid has a BCC structure. If the distance of closest approach between the two atoms is $1.73A^0$ the edge length of the cell is.**

1) 200 pm 2) $\frac{\sqrt{3}}{\sqrt{2}}\,pm$ 3) $142.2\,pm$ 4) $\sqrt{2}\,pm$

7. **The composition of a sample of wursite is $Fe_{0.93}0_{1.00}$ percentage of iron present in the form of iron (III) is nearly**

1) 85 2) 15 3) 7.00 4) 93.00

8. **The metal calcium crystallises in FCC unit cell with $a = 600\ pm$ .The density of metal if it contains 0.2% Schottkey defects.**

1) 2.05 g/cc 2) 5 g/cc 3) 20 g/cc 4) 50 g/cc

9. **Copper crystallizes in to a FCC lattice with edge length $3.61\times10^{-8}cm$ .The calculated density is**

1) 8.97 gm/cc 2) 10.9 gr/cc 3) 5.45 gm/cc 4) 6.02 gm/cc

10. **The limiting radius ratio of the complex $\left[Ni(CN)_4\right]^{-2}$**

1) 0.225-0.414 2) 0.414-0.732 3) 0.155-0.225 4) None

11. **For a cubic crystal, the face diagonal is $4.25A^0$ Calculate its face length**

1) $3.01A^0$ 2) $8.50A^0$ 3) $2.125A^0$ 4) $2.01A^0$

12. **An element with molar mass $27g\ mol^{-1}$ forms a cubic unit cell with edge length $4.05\times10^{-8}cm$ .If its density is $2.7g\ cm^{-3}$, what is the nature of the unit cell?**

1) BCC 2) FCC 3) Simple cubic 4) End centered

13. **In a crystalline solid, anions Y^- are arranged in hcp. Cation X^+ are equally distributed between octahedral and tetrahedral voids. If all the octahedral voids are occupied, what is the formula of the compound?**

1) XY_2 2) X_2Y 3) X_3Y_2 4) X_2Y_3

14. In a solid, oxide ions are arranged in CCP. One sixth of the tetrahedral voids are occupied by cations A and one third of the octahedral voids are occupied by the cations 'B' what is the formula of the compound?

1) ABO 2) A_3BO_2 3) ABO_3 4) A_2B_1,C_2

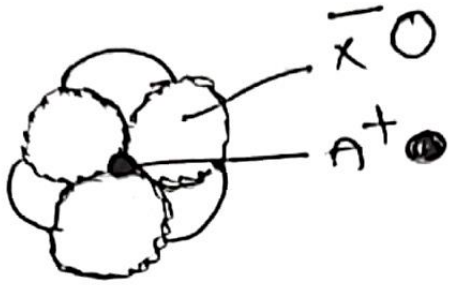
15. Element $'B'$ forms CCP structure and 'A' occupies half of the octahedral voids, while oxygen atoms occupy all the tetrahedral voids. The structure of bimetallic oxide is

1) A_2BO_4 2) AB_2O_4 3) A_2B_2O 4) A_4B_2O

16. A metal crystallises in a face centered cubic structure. If the edge length of its unit cell is 'a' the closest approach between two atoms in metallic crystal will be

1) $2a$ 2) $2\sqrt{2}a$ 3) $\sqrt{2}a$ 4) $\frac{a}{\sqrt{2}}$

17. The arrangement of X^- ions around A^+ ion in sold AX is given in the figure (not drawn to scale) If the radius of X^- is 250 pm. The radius of A^+ is



1) 104 pm 2) 125 pm 3) 183 pm 4) 57 pm

18. A compound M_pX_q has cubic close packing (ccp) arrangement of 'X' its unit cell structure is shown below the empherical formula of the compound is

1) MX 2) MX_2 3) M_2X 4) M_5X_{14}

19. What type of crystal defects is indicated in the diagram below?

$Na^+\ Cl^-\ Na^+\ Cl^-\ Na^+\ Cl^-$

$Cl^-\quad Cl^-\ Na^+\quad Na^+$

$Na^+\quad Na^+\ Cl^-\quad Cl^-$

$Cl^-\ Na^+\ Cl^-\ Na^+\ Cl^=\ Na^+$

1) Frenkel defect 2) Schottkey defect
3) Interstitial defect 4) Frenkel and Schottkey defect

20. In rock salt structure (edge length $= a$) the distance between centres of cation and anion is

1) a 2) $\frac{a}{2}$ 3) $\left(\frac{\sqrt{3}}{2}\right)a$ 4) $\frac{a}{\sqrt{2}}$

21. In the compound $Fe_{0.85}O$ the percentage of iron existing as $Fe(III)$ is

1) 25.3% 2) 30.3% 3) 35.3% 4) 40.3%

22. In face centered lattice, atom A occupies the corner positions and atom 'B'' occupies the face centre position. If one atom of 'B' is missing from one of the face-centered points, the formula of the compound is

1) A_2B_5 2) A_2B 3) AB_2 4) A_2B_3

23. Sodium metal crystallises in a body centered cubic lattice with a unit cell edge of $4.29A^0$ .The radius of sodium atom is approximately.

1) $1.86A^0$ 2) $3.22A^0$ 3) $5.72A^0$ 4) $0.93A^0$

24. Diamond has the structure similar to zinc bende. The number of carbon atoms per unit cell will be.

1) 2 2) 4 3) 6 4) 8

25. **If a monoclinic unit cell. The relation of sides and angles are respectively**
1) $a = b \neq c$ *and* $\alpha = \beta = \gamma = 90^0$ 2) $a \neq b \neq c$ *and* $\alpha = \beta = \gamma = 90^0$
3) $a \neq b \neq c$ *and* $\alpha = \gamma = 90^0 \beta \neq 90^0$ 4) $a \neq b \neq c$ *and* $\alpha \neq \beta \neq \gamma \neq 90^0$

26. **If the radius of bromide ion is** $0.182\ nm$ how large a cation can fit in each of the tetrahedral hole is $a \times 10^{-2}\ nm$ then a =

27. **A unit cell of sodium chloride has four formula units. The edge length of the unit cell is 0.564nm what is the density of sodium chloride?**

28. **A metal crystallizes into two cubic phases FCC and BCC whose unit cell length are 3.5 and** $3.0A^0$ respectively. Calculate the ratio of density of FCC and BCC

29. **KCl crystallises in the same type of lattice as does** $NaCl$ .Given that $\frac{r_{Na}+}{r_{cl}-} = 0.55$ and $\frac{r_k+}{r_{cl}-} = 0.74$ calculate the ratio of the side of the unit cell for KCl to that of $NaCl$.

30. **In FCC crystal lattice. Edge length of the unit cell is 400 pm. Find the diameter of the greatest sphere which can be filled in the interstitial void without distortion of lattice?**

31. **If** $NaCl$ is doped with 10^{-3} mol percent of $Srcl_2$. If the concentration of cation vacancy is $a \times 10^{18}\ vacanies\ per\ mole$ then a =

32. **If the distance between** $Na^+\ and\ ci^-$ ions in NaCl crystal is 265 pm, then edge length of the unit cell will be

33. **A metal crystallises face-centered cubic lattice with edge length of 450 pm. Molar mass of the metal is** $50\ gmol^-$ .The density of metal will be

34. **Copper has the FCC crystal structure. Assuming an atomic radius of 130 pm for copper atom** $(cu = 63.54)$.
(a) If the length of unit cell of cu is $a \times 10^{-8}\ cm$ then a =
(b) What is the volume of the unit cell $b \times 10^{-24}\ cm^3$ then b =
(c) How many atoms belong to the unit cell ?
(d) Find the density of cu ?

35. **Calcium metal crystallises in a face-centered lattice with edge length of 0.556 nm. Calculate the density of the metal if it contains**
(i) 0.5% Frenkel defects
(ii) 0, 2% Schottky defects.

36. **Edge length of** M^+X^- (FCC structure) is $7.2A^0$ assuming $M^+ - X^-$ contact along the cell edge radius of X^- ion is $(r_M +) = 1.6A^0$

37. **How many kinds of space lattices are possible in a crystal?**

38. **The number of octahedral sites per sphere in FCC structure is:**

39. **The No.of space lattices possible for the crystallographic dimensions** $\alpha \neq \beta \neq \gamma$

40. **The fraction of the total volume occupied by the atoms present in a simple cube is.**

ELECTRO CHEMISTRY

1. **In metallic conductors the current is conducted by.**
1) Ions 2) atoms 3) Electrons 4) molecules

2. **In electrolytes in the fused state, the electric current is conducted by**
1) Ions 2) atoms 3) Electrons 4) all the three

3. **Which of the following is a non-electrolyte?**

1) $HClO_4$ 2) CH_3COOH 3) NH_4OH 4) Urea

4. During electric conduction, the composition of which of the following is unchanged?

1) Graphite 2) zinc. Wire 3) Copper wire 4) all

5. Conduction of which of the following is high?

1) Aq.solution of CH_3COOH 2) Aqueous solution of glucose

3) $NaCl$ In the fused state 4) $NaCl$ aq. Solution

6. during electrolysis of fused $CuCl_2$ at Pt. electrodes the products formed at the electrodes ar

1) Cu^2, Cl 2) Cu, Cl 3) Copper and chlorine 4) Cu^{2+}, Cl_2

7. Electrolysis of aqueous solution of KNO_3 between platinum electrodes gives

1) K at the cathode. NO_2 At the anode 2) H_2 at the cathode, an O_2 at the anode

3) H_2 At the cathode, and NO_2 at the anode 4) K at the cathode, and O_2 at the anode

8. Products formed at the platinum cathode and at the platinum anode during the electrolysis of aqueous solution of $CuSO_4$ between platinum electrodes?

1) Cu, NO_2 2) Cu, O_2 3) H_2, O_2 4) H_2, NO_2

9. During electrolysis of which of the following substances, H_2 gas is obtained at the anode

1) *aq NaCl* 2) *HCl* 3) *aq KOH* 4) *fused NaH*

10. The weight in Gms of O_2 formed at Pt. anode during the electrolysis of aq K_2SO_4 solution for the passage of one coulomb of electricity is

1) $\frac{16}{96500}$ 2) $\frac{8}{96500}$ 3) $\frac{32}{96500}$ 4) $\frac{64}{96500}$

11. The amount of current in coulombs passing through electrolytic cell in the electrolysis of aq $CuSO_4$ solution if $0.3177\,gms$ of copper was deposited at the cathode $(At.Wt\ of\ Cu = 63.54)$.

1) 965 2) 96500 3) 1930 4) 3860

12. During electrolysis of aq $NaCl$ solution for 6 hours 11.2 litres of Cl_2 gas at STP evolved at anode. The current in amperes passing through the cell during electrolysis is

1) 5 2) 10 3) 2.23 4) 4.46

13. The number of electrons participating in the electrode reaction when one atomic weight of a bivalent metal was deposited at the cathode

1) 9.65×10^{23} 2) 0.6×10^{23} 3) 12.04×10^{23} 4) 3.01×10^{23}

14. The ratio of volumes of the gases liberated at STP at the cathode and the anode when water acidulated with H_2SO_4 is electrolyzed

1) 2:1 2) 1:2 3) 1:1 4) 1:8

15. KCl is used in the construction of salt bridge because

1) K^+, Cl^- Are isoelectronic 2) KCl is an ionic substance

3) K^+, Cl^- Have unit charges 4) K^+, Cl^- move with equal mobilities

16. The EMF of the cell in which one of the electrodes is standard hydrogen electrode is 1.2volts.The potential of the other electrode is

1) $\pm1.2\,V$ 2) $+1.2\,V$ 3) $0\,V$ 4) $0.2\,V$

17. The EMF of the cell constructed from the electrodes with E^0 values - $-0.46V$ **and** -0.74 **volts respectively is**

1) $-1.2V$ 2) $1.2V$ 3) $0.28V$ 4) $-0.28V$

18. The standard electrode potentials of electrodes used in the construction of the Daniel cell are $-0.76V$ **and** $+0.34V$ **respectively. The EMF of the cell is**

1) $0.42\,V$ 2) $1.10\,V$ 3) $-0.42\,V$ 4) $-1.10\,V$

19. What will happen when iron wire is placed in an aqueous solution of $AgNo_3$ for sufficiently long time?

1) Iron goes into solution 2) silver is precipitated

3) Fe displaces Ag from $AgNo_3$ 4) all the three

20. A reversible galvanic cell is connected to an external battery. If the EMF of the battery is less than EMF of the galvanic cell, current

1) Will not pass through 1N circuit 2) Flows from the battery into the galvanic cell
3) Flows from the galvanic cell in to the battery 4) All the three may take place

21. The time required (approx. to remove electrolytically one half from 0,2liters of 1M $AgNO_3$ solution by a current of lamp is

1) 320min 2) 80min 3) 160min 4) 40min

22. During the electrolysis of aq HCI solution $1.008g$ of H_2 at the cathode and $35.5g$ of CI_2 at the anode are liberated, the quantity of current passing through the cells is

23. When $aq\,AgNO_3$ are electrolyzed using Pt. electrodes 3.2 of O_2 is liberated at the anode, the amount of Ag that will be deposited at the cathode in grams is (at. Wt. of $Ag = 108$).

24. Two electrolysis cells. Containing aq solutions of $CuSO_4$ and $AgNO_3$ respectively are out. If $0.54g$ of Ag deposited in one of the cells how much copper is deposited in the other cell $(at\ wts\ of\ Cu, Ag\ are\ 63.54,108\ respectively)$

25. The potential of the Cu electrode $CuCu^{2+}(aq)(0.1M)$ is if $E^0Cu^{2+}/Cu\ is + 0.34V$

26. The potential of the electrode $H_2(g.(1\,atm))H^+(0.01M)$ is

27. Number of coulombs of quantity of current required to convert completely 1molof MnO_4^- ions in acid medium to one mole of Mn^{2+} ions electrolytically is

28. In the electrolysis of alkaline water a total of 2 moles of gases are evolved. The amount of water electrolyzed is

CHEMICAL KINETICS

1. After how many seconds will the concentration of the reactant in a first order reaction be halved, if the rate constant is $1.155\times10^{-3}\,\text{sec}^{-1}$

1) 600 2) 100 3) 60 4) 10

2. The time required for 90% completion of first order reaction is‘t’ .The time required for 99.9% completion.

1) $2t$ 2) $3t$ 3) $2.5t$ 4) $1.5t$

3. If the temperature coefficient of reaction is 2 between 30^0c - 40^0c, the activation energy value of reaction is in the range of

1) $20-30\,kj$ 2) $30-40\,kj$ 3) $50-55\,kj$ 4) $60-70\,kj$

4. The product of rate constant and half-life period of a first order rate is equal to

1) $2.303\times\frac{1}{2}$ 2) $2.303\times\log 20$ 3) 2.303×2 4) $2.303\log 2$

5. The rate constant of a reaction at 300k is $1.6\times10^{-3}\,\text{sec}^{-1}$ and at 310 k and 3.2×10^{-3} The activation energy of the reaction approximately in Kcals is

1) 12-13 2) 20-25 3) 30-40 4) 40-50

6. The half-life period of a first order reaction is 50 minutes. How much time is needed for concentration of the reactions to be equal to 1/8 of the initial concentration?

1) 100 min 2) 150 min 3) 200 min 4) 50 min

7. The value of activation for radioactive decay is

1) High 2) Low 3) Almost zero 4) moderate

8. 20% Decomposition of H_2O_2 in presence of an acid requires 5 min. The time required for 50% decomposition in minutes is

1) 15.52 2) 1.552 3) 0.1552 4) 7.76

9. The initial concentration of the reactant of a first order reaction is 0.2M. After 100 minutes, the concentration of the reactant left is 0.02M. The value of the rate constant is

1) 2.303 2) $2.303\times10^{-2}\,\text{min}^{-1}$ 3) $2.303\times10^{-3}\,\text{min}^{-1}$ 4) $1.152\times10^{-2}\,\text{min}^{-1}$

10. The product of half-life period (t_{12}) and the initial concentration of the reactant (a) is constant. The order of the reaction is

1) 1 2) 2 3) 0 4) 3

11. The half-life time of a first order disintegration reaction, if 87.5% of the initial amount disintegrated in 90 minutes

1) 45 2) 90 3) 30 4) 60

12. In the reaction $A+B\rightarrow$ products, the rate of reaction is doubled on doubling the concentration of A and is trebled (3 times) when concentration of B is increased by 9 times. The rate equation is

1) $rate=k[A][B]$ 2) $rate=k[A][B]^3$ 3) $rate=k[A]^2[B]$ 4) $rate=k[A][B]^{1/2}$

13. The rate of first order reaction is $8\times10^{-5}\,moles/lit.$ the concentration of the reactant at that times is 4×10^{-3} moles/lit. The value of k is

1) $2\times10^{-2}\,\text{sec}^{-1}$ 2) $100\,\text{sec}^{-1}$ 3) $3.2\times10^{-2}\,\text{sec}^{-1}$ 4) $500\,\text{sec}^{-1}$

14. The rate constant of a reaction increases by 3 times for every 10^0c rise of temperature uniformly in the range 20 to 80^0c. If the rate constant at 30^0c is k, what is its value at 60^0c

1) 9k 2) 27k 3) 6k 4) 81k

15. In the reaction 4 $NH_3+5O_2\rightarrow4NO+6H_2O$, the rate of formation of NO is $1\times10^{-3}\,moles\,lit^{-1}.\text{sec}^{-1}$. The rate of disappearance of O_2 is

1) 4×10^{-3} 2) 5×10^{-3} 3) 1.25×10^{-3} 4) 0.8×10^{-3}

16. In the reaction $A\rightarrow B$ rate is increased by 4 times, When the concentration of A is doubled. The order of the reaction is

1) 2 2) 1 3) 0.5 4) 4

17. The hydrolysis of ethyl acetate in acid medium $CH_3COOC_2H_3+H_2O\rightarrow CH_3COOH+C_2H_2OH$ is

1) 1^{st} *order* 2) 2^{nd} *order* 3) 3^{rd} *order* 4) *zero order*

18. The rate constant value of amongst the following which indicates the reaction occurs to the greatest extent

1) 100 2) 10 3) 0.1 4) 1

19. For the reaction of which order the half-life period is independent of initial concentration of the reactions

1) First 2) Zero 3) Second 4) Third

20. For which order reaction the half-life time is inversely proportional to the initial concentration of the reactants

1) First 2) Zero 3) Second 4) Third

21. The rate constant of a first order is 0.693 sec^{-3}. the half-life period is

1) 0.693sec 2) 1 sec 3) $\frac{1}{0.693}\text{sec}$ 4) $\frac{0.693}{2}\text{sec}$

22. The relation between the order (n), $(t_{1/2})$, and the concentration (a) of a recantant is

1) $t_{1/2}\alpha\frac{1}{a}$ 2) $t_{1/2}\alpha\frac{1}{a^{(n-1)}}$ 3) $t_{1/2}\alpha\frac{1}{a^{(n+1)}}$ 4) $t_{1/2}\alpha\frac{1}{a^n}$

23. In hours' time of reaction the concentration of the reaction of a first order reaction is reduced to 1/16 of the initial concentration the half-life of the reactions is

1) 60 min 2) 90 min 3) 30 min 4) 45 min

24. If the total order of a reaction between A & B is 3, the rate equation for the reaction is

1) $r = K[A]^2[B]^1$ 2) $r = K[A]^1[B]^2$ 3) $r = K[A]^{1.5}[B]^{1.5}$ 4) all

25. The units of the rate constant of a reaction depends on its

1) Molecularity 2) Temperature of the reaction
3) Concentration of the reactions 4) Order of the reaction

26. In the relation between the reactants A and B the order w.r.t 'A' is one and w.r.t 'B' is two the rate equation as

1) $rate = K[A][B]$ 2) $rate = K[A][B]^2$ 3) $rate = K[A]^2[B]$ 4) $rate = K[A][B]^2$

27. In the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ the value $\frac{d[NH_3]}{dt}$ is also equal to

1) $\frac{d[N_2]}{dt}$ 2) $\frac{d[H_2]}{dt}$ 3) $\frac{2}{3}\frac{d[H_2]}{dt}$ 4) $\frac{3}{2}\frac{d[H_2]}{dt}$

28. The dimensions of the rate constant of a first order reaction is

1) $time^{-1}$ 2) $time^{-1} \times concentration^{-1}$
3) $concentration^{-1} \times time^{-3}$ 4) $time^{-1}$

29. The value of the rate constant of a reaction does not depend on

1) Time 2) activation energy 3) Temperature 4) half-life value

30. The rate constant of a reaction is equal to the rate of the reaction if the concentration of the reactants are

1) Low 2) high 3) Equal to unity each 4) very low

31. The rate of reaction increases in presence of catalyst. This is due to

1) Increase in activation energy 2) Increase in threshold energy
3) Decrease in activation energy 4) Decrease in average energy of the reactants

32. The value of the temperature coefficient of a reaction is generally in the range

1) 0 to 1 2) 2 to 3 3) 3 to 4 4) 4 to 5

33. The fraction of the fruitful collisions in the total number of collisions is given by the expression

1) $\frac{1}{2^n}$ 2) $A.e_n^{-Ea/RT}$ 3) $e^{-Ea/RT}$ 4) half

34. Slowest reaction among the following under identical conditions is

1) $NaOH + HCI \rightarrow NaCI + H_2O$ 2) $H^+ + OH \rightarrow H_2O$
3) $2NO - O_2 \rightarrow 2NO_2$ 4) $CH_2 - 2O_2 \rightarrow CO_2 + 2O_2$

35. The rate expression for a reaction $A + B \rightarrow$ products is $k[A]^3/[B]$. The order is

36. The rate equation of reaction is rate $= k[A]^{0.5}[B][C]^{1.5}$ the total order is

37. The half-life period for a reaction at initial concentration of 0.1 M and 0.01 M are 5 and 50 respectively; the order of the reaction is

38. Decomposition of N_2O_5 if first order reaction Time required for 87.5% completion of the reaction is 72 min at the end of 2 hours after the start of the decomposition the percentage of oxide left is