Karnataka

Chemistry 2018

Instruction:

(1) The question paper has four parts. All parts are compulsory
(2) Part-A carries 10 marks. Each question carries two marks.
Part-B carries 10 marks. Each question carries two marks.
Part –C carries 15 marks. Each question carries three marks.
Part-D carries 35 marks. Each question carries five marks.
(3) Write balanced chemical equations and draw diagrams wherever necessary.
(4) Use log tables and simple calculator if necessary.

PART-A

I. Answer all the questions. Each question carries one mark.

1. State henry's law.

Sol: The solubility of a gas in a liquid is directly proportional to the partial pressure of the gas present above the surface of the liquid or solution.

2. Van's Hoff's factor for a solution is less than one, what is the conclusion drawn from it.

Sol: Solute undergoes association.

3. How many Faraday of electricity is required to reduce 1 mole of MnO_4^- ions to Mn^{2+} **ions?**

Sol: 5 or 5F

4. If the unit of rate constant of a reaction is $mol^{-1}LS^{-1}$ **the mention its order.**

Sol: Second order.

5. Name a metal refined by Van Arkel method.

Sol: Zirconium or Titanium

6. Complete the following equation.

$XeF_6 + H_2O \rightarrow .... + 2HF$

Sol:

$XeF_6 + H_2O \rightarrow XeFO_4 + 2HF$

7. What is an ambidentate ligand?

Sol: Ligand which can ligate through two different atoms.

8. Name the following reaction.

$H_3C-Br+AgF \rightarrow H_3C-F+AgBr$

Sol: Swartz reactions

9. Ethanal (CH_3CHO) undergoes aldol condensation reaction. Give reason.

Sol: Alpha- hydrogen present

10. Deficiency of which vitamin causes the didease"Rickets".

Sol: Vitamin-D

PART- B

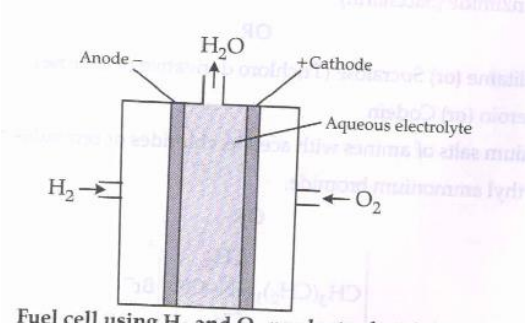
II. Answer any five of the following. Each question carries 2 marks.

11. What is Frenkel defect? How does it affect density of the solid?

Sol: Dislocation of smaller ion from its normal site to terestitial site. Density is not affected.

12. Draw a neat labeled diagram of H_2-O_2 fuel cell. Write the reaction occurs at cathode of the cell.

Sol:



Fuel cell using H_2 and O_2 products electricity

Cathode: $O_2+2H_2O+4e^- \rightarrow 4OH^-$

13. A first order reaction is found to have a rate constant, $K = 5.5 \times 10^{-14} S^{-1}$.

Sol:

$$t_{1/2} = \frac{0.693}{K}$$

$$t_{1/2} = \frac{0.693}{55 \times 10^{-14} S^{-1}}$$

$$= 1.26 \times 10^{13} S$$

Unit is compulsory.

14. Give reason:

(a) Cerium (Ce) exhibits+4oxidation state.

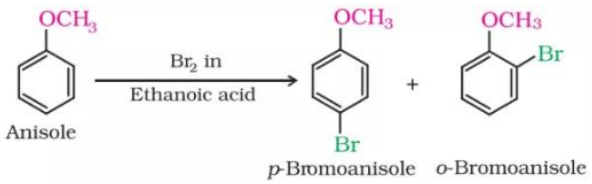
Sol: Attaining extra stability of empty f orbital

(b) Actioned contraction is greater from element too element than lanthanide contraction.

Sol: Poor shielding by 5f electrons.

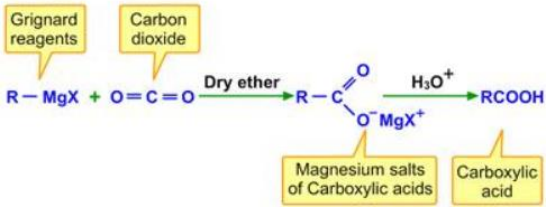
15. How anisole reacts with bromine in ethanoic acid? Write the chemical equation for the reaction.

Sol: Anisole undergoes bromination with bromine in ethanoic acid to form a mixture of ortho and para bromo anisole.



16. Explain the preparation of carboxylic acid from Grignard reagent. Give reason.

Sol: Grignard reagent reacts with solid CO_2 to form salts of carboxylic acids which on acidification with mineral acid forms carboxylic acid.



17. Give example each for

(a) Artificial sweetening agents

Sol: Ortho-sulphobenzimide

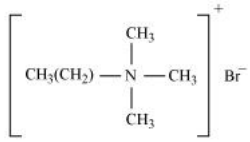
(b) Narcotic analgesic.

Sol: Morphine or heroin or codein.

18. What are cationic detergent? Give an example.

Sol: Cationic detergents are quaternary ammonium salts of acetates, chlorides, or bromides. These are called cationic detergents because the cationic part of these detergents contains a long hydrocarbon chain and a positive charge on the N atom.

For example: cetyltrimethylammonium bromide



Cetyltrimethylammonium bromide

PART- C

III. Answer any five of the following. Each question carries 3 marks:

19. Explain the process of obtaining "blister copper" from "copper matte" with equations.

Sol: Copper matter is charged into silica lined convertor. Some silica is also added and hot air blast is blown to convert the remaining Fes, FeO and $\frac{Cu_2s}{Cu_2O}$ to the metallic copper.

Following reaction takes place.

$$2FeS + 3O_2 \rightarrow 2FeO + 2SO_2$$
$$FeO + SiO_2 \rightarrow FeSiO_3$$
$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$
$$2Cu_2O + Cu_2s \rightarrow 6Cu + SO_2$$

The solidified copper obtained has blistered appearance due to the evolution of SO_2 and so it is called copper.

20. Write the equations involved in the manufacture of nitric acid by Ostwalds process by maintaining reaction conditions.

Sol:

$$4NH_3 + 5O_2 \xrightarrow[500k,9bar]{Pt/Rh\ guuaze} 4NO + 6H_2O$$
$$2NO + 2O_2 \rightleftarrows NO_2$$
$$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$$

b

21. (a) How is organized oxygen prepared in the laboratory? Give equation.

Sol: When a slow dry stream of oxygen is passed through a silent electrical discharge, conversation of oxygen to ozone the product is known as ozonized oxygen.

$$3O_2 \rightarrow 2O_3$$

(b) Explain linkage isomerism with example

Sol: Linkage isomers are two or more coordination compounds in which the donor atom of at least one of the ligands is different (i.e., the connectivity between atoms is different).

This type of isomerism can only exist when the compound contains a ligand that can bond to the metal atom in two (or more) different ways. Some ligands that can form linkage isomers are: CN^-, NO_2^-.

22. (a) $2NAOH + Cl_2 \rightarrow NaCl + ...H_2O$

Sol: $NaOCl$

(b) $2NAOH + Cl_2 \rightarrow NaCl + ...H_2O$

Sol: SO_2

(c) $Cl_2 + 3F_2 \xrightarrow{573K} ...$

Sol: $2ClF_3$

23. How is potassium permagnet $\left(KMnO_4\right)$ **prepared from** MnO_2? **Write the equation**

Sol: By fusion of MnO_2 with an alkali metal hydroxide and an oxidizing agent KNO_3 gives K_2MnO_4 which one acidification gives permanganate.

$MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$

$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

$3MnO_2 \xrightarrow[Oxidised \text{ witha air}]{Fused \text{ with KOH}} MnO_4^{2-}$

$MnO_4^{2-} \xrightarrow[In \text{ alkaline solution}]{Electrolytic \text{ oxidation}} MnO_4^-$

24. (a) Why 3d-series of elements acts as good catalyst?

Sol: Transition metals and their compounds exhibit catalytic activity due to

(i) Ability to adopt to multiple oxidation states.

(ii) Transition metals can form complexes with reactant molecules using vacant d- orbitals. This lowers the energy of activation of the reaction and increases rate of the reaction.

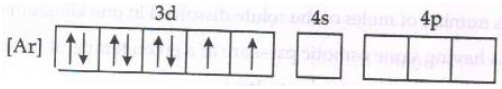
(iii) Due to the presence of large surface area in finely divided state.

(b) Give reason: Ti^{4+} **salts are colorless whereas** Cr^{3+} **salts are colored.**

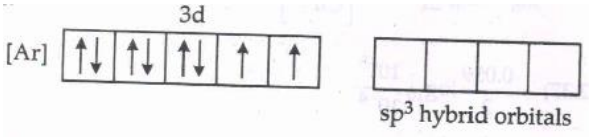
Sol: Due to d^0 configuration of Ti^{4+} it is colorless where Cr^{3+} has d^3 configuration facilating d-d transition.

25. With the help of Valence Bond Theory, explain hybridization, geometry and magnetic property of $\left[NiCl_4\right]^{2-}$.

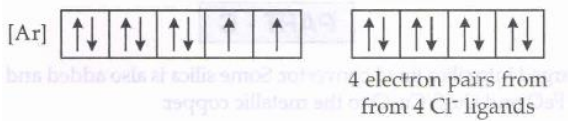
Sol: The central metal is present in this complex is $Ni(II)$ *or* Ni^{+2} Atomic number of Nickel is Electronic configuration of $Ni^{2+0} is \left[Ar\right]3d^8 4s^0$



One vacant 4s- orbital and three vacant 4p- orbitals hybridized to give four equivalent SP^3 hybrid orbitals, oriented tetrahedrally in space.



Each Cl^- ligand donates a pair of electron to form a tetrahedral complex.



26. (a) write the IUPAC name of : $\left[Co\left(NH_3\right)_4\left(H_2O\right)Cl\right]Cl_2$.

Sol: Tetraammineaquachloridocobalt(III) chloride

(b) Explain linkage isomerism with example.

Sol: Coordination compounds having same molecular formula but differing in the mode of attachment to the central metal ion or atom is called Linkage isomerism.

$\left[CO\left(NH_3\right)_5\left(NO_2\right)\right]C_{12} and\ \left[Co\left(NH_3\right)_5\left(ONO\right)\right]CL_2$

PART-D

IV. Answer any three of the following

27. (a) Calculate packing atomic efficiency in a simple cubic lattice.

Sol: In simple cubic unit cell, atoms are located only at the corners of the cube. The particles touch one another along the edge.

If the edge length of the cube=a, and radius of each particle is r the a is related to r as, $a = 2r$

The volume of the cubic unit cell $= a^3 = (2r)^3 = 8r^3$ since, t=a simple cubic unit cell contains only 1 atom.

The volume of the occupied space $= \frac{4}{3}\pi r^3$

$$Packing \text{ Efficiency} = \frac{Volume \text{ of space occupied by atom}}{Volume \text{ of cubic unit cll}} \times 100$$

$$= \frac{\frac{4}{3}\pi r^2}{8r^2} \times 100$$

$$= \frac{4\pi r^3}{3 \times 8r^3} \times 100$$

$$= \frac{\pi}{6} \times 100$$

$$= 52.36\%$$

(b) An element having atomic mass 107.9 u has FCC lattice. The edge length of its unit cell is 408.6pm. Calculate density of the unit cell. Given $N_A = 6.022 \times 10^{23} mol^{-1}$

Sol:

$$d = \frac{z.M}{a^3 \cdot N_A}$$

$$= \frac{4 \times 107.9 \times 10^3}{\left(408.6 \times 10^{-12}\right)^3 \times 6.022 \times 10^{23}}$$

$$= 10.5 \times 10^3 kgm^{-3}$$

28. (a) The boiling point of benzene is 353.23K when 1.80g of non-volatile, non –ion sable solute was dissolved in 90g of benzene the boiling point raised to 354.11K. Calculate molar mass of the solute [K_b for benzene is $2.53 KKgmol^{-1}$ **].**

Sol:

$$M_2 = \frac{K_b \times W_2 \times 1000}{\Delta T_b W_1} \Delta T = 354.11 - 353.23 = 0.88$$

$$M_2 = \frac{253 \times 1.8 \times 100}{0.88 \times 90}$$

$$= 58 gmol^{-1}$$

(b) Define:

(i) Molality of a solution

Sol: It is defined as number of moles of the solute dissolved in one kilogram (1000g) of solvent.

(ii) Isotonic solution

Sol: Two solution having same osmotic pressure at a given temperature are called isotonic solution.

29. (a) Calculate e.m.f of the cell for the reaction:

$Mg + Cu^{2+}(0.0001M) \rightarrow Mg^{2+} + Cu$

Given that : $\mathrm{E}^0 \dfrac{Mg^{2+}}{Mg} = -2.37V$

$\mathrm{E}^0 \dfrac{Cu^{2+}}{Cu} = +0.34$

Sol:

$$E_{cell} = \mathrm{E}^0 \frac{Cu^{2+}}{Cu} - \mathrm{E}^0 \frac{Mg^{2+}}{Mg}$$

$$= \frac{RT}{2F} \log_{10} \frac{\left[mg^{2+}\right]}{\left[Cu^{2+}\right]}$$

$$E_{cell} = \left(0.34 - (-2.37) - \frac{0.059}{2} \log g_{10} \frac{10^{-3}}{10^{-4}}\right)$$

$$E_{cell} = 2.71 - \frac{0.059}{2} \log_{10} 10$$

$$= 2.68V$$

(b) (i) State Kohlrausch law.

Sol: Limiting molar conductivity f an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte.

(ii) What is meant by limiting molar conductance.

Sol: When concentration approaches zero, the molar conductance is known as limiting molar conductance.

30. (a) Derive an integrated rate equation for rate constant of first order reaction.

Sol: Consider na general first order reaction, $R \rightarrow P$

The differential rate equation for he above reaction can be written as

$$Rate = \frac{-d[R]}{R} = k[R]^1$$

$$\Rightarrow \frac{d[R]}{R} = -k \times dt$$

Integrating both sides then we get,

$$\int \frac{d[R]}{R} = -k \times \int dt$$

$$\ln[R] = -kt + I \quad ....(1)$$

At time t is equal to 0, the concentration of the reactant

$R = [R]_0$,*Where* $[R]_0$ is the initial concentration of the reactant.

Put in equation 1

$$\ln [R] = -kt + \ln[R]_0$$

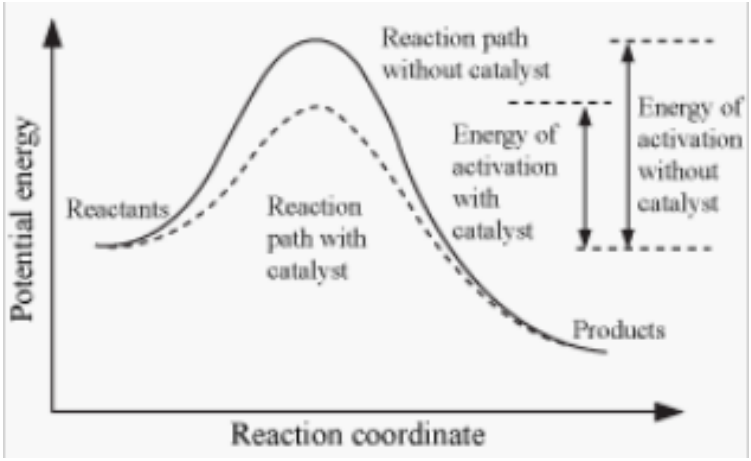
$$kt = \ln[R]_0 - \ln [R]$$

$$= \frac{\ln[R]_0}{[R]}$$

$$\Rightarrow k = \frac{2.303}{t} \times \frac{\ln[R]_0}{[R]}$$

(b) Draw a graph of potential energy V/S reaction co-ordinates showing the effect of catalyst on activation energy (E_a) of a reaction

Sol:



31. (a) Wrire any two differences between Iyophilic and lyophobic collides.

Sol:

Lyophilic sol	Iyophobic sol
Dispersed phase has high affinity to the dispersion medium.	Dispersed phase has low affinity to the dispersion medium
Easily formed by direct mixing or on heating	Cannot be prepared directly. Prepared by special methods only.
Reversible n nature	Irreversible in nature

(b) What is the heterogeneous catalysis? Give an example

Sol: Heterogeneous catalysis is a process where the reacting substance and the catalyst are in different phase.

$$2SO_2 + O_2 \xrightarrow{pT \text{ catalyst}} 2SO_3$$

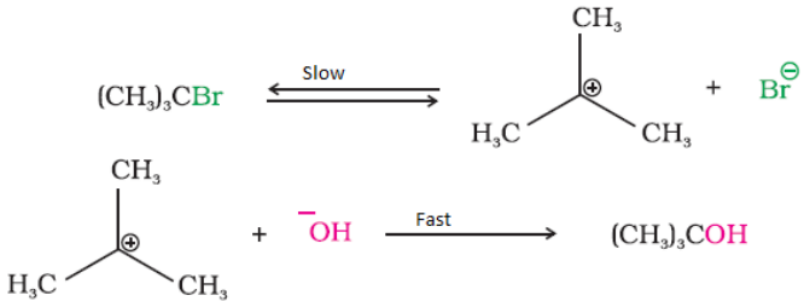
(c) Give an expression for Freundlich adsorption isotherm.

Sol: $\frac{x}{m} = kp\frac{1}{x}$

V. Answer any four of the following. Each question carries 5 marks.

32. (a) Write the equations for the steps in S_N1 mechanism of the conversion of tert-Butyl bromide into tert-Butyl alcohol.

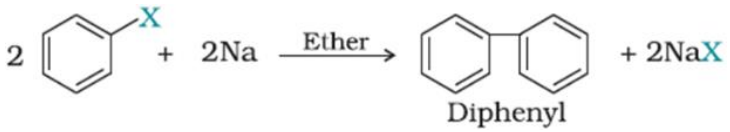
Sol:



(b) Explain Fitting reaction

Sol:

When aryl reacts with sodium metal in dry ether, it forms diphenyl.



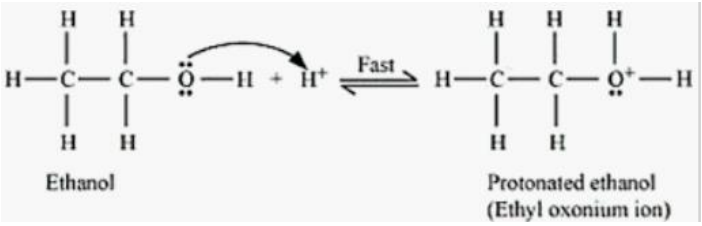
(c) Name the reagent used in the dehydrohalogenation of halo alkanes.

Sol: Alcoholic potassium hhydroxide.

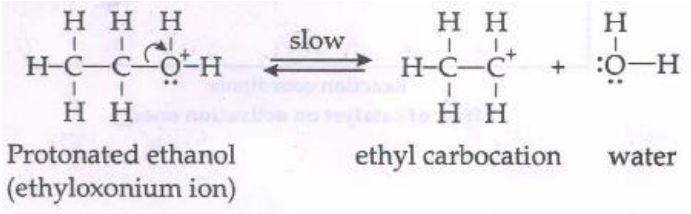
33. (a) Write the mechanism of acid catalyzed dehydration of ethanol ethane.

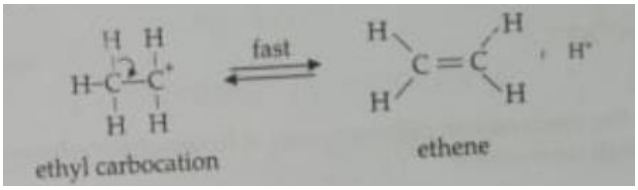
Sol: The mechanism of dehydration of ethanol involves the following steps.

Formation of protonated alcohol.



Formation of carbocation, it is the slowest step and hence, the rate determining the reaction.



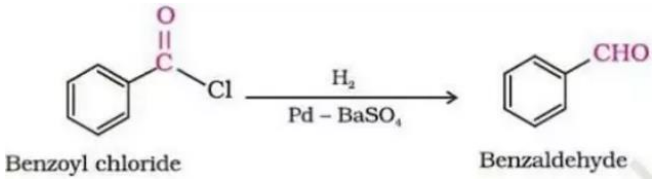


(b) Between phenol and alcohol which is more acidic? Why?

Sol: Phenol is more acidic than alcohol.

34. (a) Explain Rosenmund reduction with equation.

Sol: Benzoyl chloride is hydrogenated over catalyst, palladium on barium sulphate. This reaction is called Rosenmund reduction.



(b) How does propanone (CH_3COCH_3) reacts with hydrazine? Give equation.

Sol: When hydrazine is treated with acetone in the presence of acid as catalyst, propanone (acetone), acetone hydrazine formed.

(c) Name the oxidizing agent used in Etard's reaction.

Sol: Chromyl chloride.

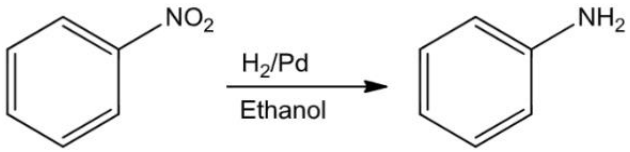
35. (a) Explain carbyl amine reaction with equation.

Sol: Aliphatic and aromatic primary amins on heating with chloroform and ethanolic potassium hydroxide from isocynides or carbylamines. This reaction is known as carbylamines reaction.

$$R-NH_2+CHCl_3+3KOH \xrightarrow[\Delta]{} R-NC+3KCl+3H_2O$$

(b) How does nitrobenzene is reduced to aniline? Give equation.

Sol: Nitrobenzene is reduced to aniline by passing hydrogen gas in the presence of finely divided nickel, palladium of platinum



(c) Write the IUPAC name of

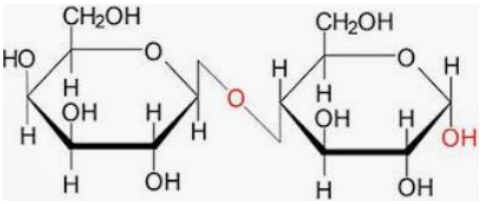
$$C_6H_6-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{N}}-CH_3$$

Sol:

N, N-dimethylaniline

36. (a) Write Haworth structure of "Lactose".

Sol:



(b) i) What are non-essential amino acids?

Sol: These are the amino acids where are synthesized in our body and need not be supplied through diet.

ii) Write Zwitter ionic structure of "glycine"

Sol: $NH_3 - CH_2 - COO^-$

(c) Name the nitrogenous base present in RNA but not in DNA.

Sol: Nylon 6,6

37. (a) Explain the preparation of Nylon-6,6 with equation.

Sol: It is obtained by the condensation polymerization of hexamethylenediamine with adipic acid under high pressure and at high temperature

$$nHOOC-\left(CH_4\right)-COOH+nH_2N-\left(CH_4\right)-NH_2 \xrightarrow[high\ \text{pressure}]{533k} \left[\begin{array}{l} H \\ | \\ N-\left(CH_2\right)_6-N- \\ \end{array}\begin{array}{l} H \\ | \\ C- \\ \end{array}\begin{array}{l} O \\ \| \\ \left(CH_2\right)_4-C \\ \end{array}\right]_n$$

(b) What are thermoplastic polymers? Give an example.

Sol: These are the linear or slightly branched long chain molecules capable of repeatedly softening on heating and hardening on cooling.

(c) Write the structure of isoprene (2-methyl-1,3-butadiene)

Sol: $CH_2 = \begin{array}{l} C \\ | \\ CH_3 \end{array} - CH = CH_2$