PART - A

I.   **Answer ANY TEN of the following questions**   10 X 1 = 10

1. **Name the type of crystalline solid, which is electrical insulator in solid state but conduct electricity in aqueous solution.**

   Ans: Ionic crystalline solid (NaCl)

2. **Mention one practical utility of reverse osmosis.**

   Ans: desalination of sea water

3. **At constant temperature, different gases have different K_H value. What does this statement suggest?**

   Ans: Henry's constant K_H is function of nature of gas (different gas will have different solubility)

4. **Give an example for inert electrode.**

   Ans: Platinum, Graphite electrode

5. **What is the order of reaction which has rate expression Rate=$K[A]^{-1}[B]^{5/3}$?**

   Ans: 2/3 or 0.66

6. **What is meant by selectivity of catalyst?**

   Ans: Ability of a catalyst to direct the yield of a particular product

7. **Give one example for heterogeneous catalysis.**

   Ans: FeO/ K_2O solid catalyst in the manufacturing of Ammonia by Haber's process.

8. **Name the method used for concentration of sulphide ore?**

   Ans: Froth flotation

9. **Which noble gas has lowest boiling point?**

   Ans: Helium

10. **Name the transition metal present in bronze alloy?**
    Ans: Cu

11. Define the term racemic mixture.

Ans: Equimolar mixture of d and l isomers.

12. Write IUPAC name of $CH_3-O-C_2H_5$.

Ans: methoxyethane

13. Aldehydes are more reactive than ketones towards Nucleophilic addition reaction. Give reason.

Ans: Due to steric hindrance of alkyl groups and decreased electrophilicity of carbonyl carbon due to (+I) inductive effect

14. What are copolymers?

Ans: Polymers obtained by condensation of two different monomers.

15. Mention the role of sodium benzoate in food.

Ans: Food preservative

PART-B

II.   Answer ANY FIVE of the following questions   **5 X 2 =10**

16. An element crystallises in FCC lattice. The edge length of unit cell is 556pm and its density 1.55g cm^{-3}. Calculate the atomic mass of the element. [Given: N_A = 6.022 X 10^{23}]

Ans: $d = \dfrac{Z \times M}{a^3 \times N_A}$

$$M = \dfrac{d \times a^3 \times N_A}{Z}$$

$$= \dfrac{1.55 \times (5.56 \times 10^{-8})^3 \times 6.022 \times 10^{23}}{4}$$

$$= \dfrac{1.55 \times 171.88 \times 6.022 \times 10^{-1}}{4}$$

$$= \dfrac{160.4}{4} = 40.1 g/mol$$

17. Define molarity [M]. How does molarity vary with temperature?

Ans: Number of moles of solute present in 1 dm^3 of solution.

As temperature increases molarity decreases. Temperature and molarity are inversely proportional.

18. Mention any two applications of Kohlrausch law.

Ans: i. To calculate the limiting molar conductivity of weak electrolyte

ii. To calculate dissociation constant of weak electrolyte

19. What is molar conductance? How is it related to concentration "C" molm^{-3} and conductivity "K" Sm^{-1}?

**Ans:** it is the conductance due to all the ions produced by 1 mol of an electrolyte in given volume of solution

Λ_m= K/C

20. What is the role of coke in the extraction of zinc from zinc oxide? Write the chemical equation.

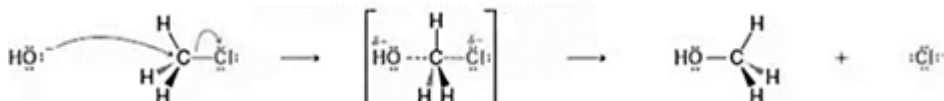**Ans:** reduction of ZnO ; equation- $ZnO + C \xrightarrow{coke,1673K} Zn + CO$

21. How do xenon fluorides react with fluoride ion donor like NaF? Give equation.

Ans: xenon fluorides react with fluoride ion donors to form fluroanions

$XeF_6 + NaF \rightarrow Na^+ + [XeF_7]^-$
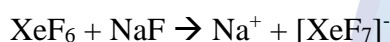
22. Write S$_N$2 mechanism for conversion of chloromethane to methanol.

Ans:

23. Complete the equation. $\underline{\quad} + HNO_2 \xrightarrow{NaNO_2 + HCl} \left[H_3CN_2^+Cl^- \right] \xrightarrow{H_2O} CH_3OH + \underline{\quad} + HCl$

Ans: $CH_3NH_2 + HNO_2 \xrightarrow{NaNO_2 + HCl} \left[H_3CN_2^+Cl^- \right] \xrightarrow{H_2O} CH_3OH + N_2 + HCl$

24. What are analgesics? Give an example for narcotic Analgesics.

Ans: Drugs which reduce pain without causing impairment of consciousness. Example for narcotic analgesic is Morphine

25. Why soap does not work in hard water?

Ans: calcium and magnesium ions present in hard water forms insoluble calcium and magnesium soaps and seperates out from water and form scum.
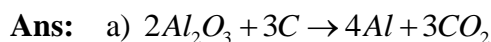
PART C

III.   **Answer ANY FIVE of the following question. Each question carries 3 marks   5 X 3 =15**

26. **In the extraction of Aluminum metal by Hall-Heroult process.**

   a) **Write overall cell reaction.**

   Ans: a) $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$

   b) **What is the role of Na₃AlF₆?**

   Ans: Lowers the melting point of the mix and increases conductivity.

   c) **On which electrode aluminum metal deposits.**
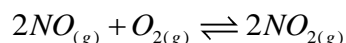
   Ans: Cathode

27. **With reaction conditions, write the balanced chemical equations for the manufacture of nitric acid by Ostwald's process.**
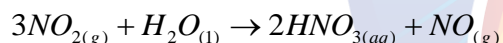
   Ans: Step 1: Catalytic oxidation of NH₃ by atmospheric oxygen.

   $$4NH_{3(g)} + 5O_{2(g)} \xrightarrow[500K.9bar]{Pt/Rh\,guage\ catalyst} 4NO_{(g)} + 6H_2O_{(g)}$$
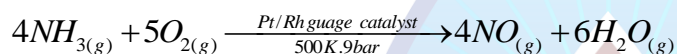
   Step 2: Nitric oxide combines with oxygen to give nitrogen dioxide.

   $$2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)}$$

   Step 3: Nitrogen dioxide dissolves in water to give nitric acid

   $$3NO_{2(g)} + H_2O_{(1)} \rightarrow 2HNO_{3(aq)} + NO_{(g)}$$

   NO thus formed is recycled and aqueous HNO₃ can be further concentrated by distillatin upto 68% by mass. Further it can concentrated upto 98% by dehydration with conc. H₂SO₄.

28. **Complete the following equations:**

   a) **CaO + H₂O →**

   Ans: Ca(OH)₂

   b) **SO₂ + H₂O →**

   Ans: H₂SO₃

   c) **Na₂SO₃ + H₂O + SO₂ →**

   Ans: 2NaHSO₃

29. **a) How is chlorine prepared in laboratory using KMnO₄?**

   Ans: a) On heating potassium permanganate with dil HCl chlorine is formed.

   $$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$$

   b) Why chlorine water on standing loses yellow colour?

   Ans: Due to formation of HCl and HOCl

30. a) Calculate spin only magnetic moment of ferric ion. [Given: Atomic number of iron is 26]

Ans: a) $Fe^{+3} = [Ar]\ 4s^0\ 3d^5$
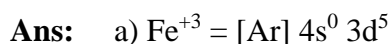
$n = 5$

$$\mu = \sqrt{n(n+2)}$$

$$= \sqrt{5(5+2)}$$

5.9 BM

b) Between Sc^{+3} and Cu^{+2} ions, which is colorless?

Ans: b) Sc^{+3} is colorless.

31. Write the balanced chemical equations in the manufacture of $K_2Cr_2O_7$ from chromite ore.

**Ans:** (i) Potassium dichromate is generally prepared from iron chromite ore.

The fusion of chromite ore ($FeCr_2O_4$) with sodium or potassium carbonate in presence of air.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \xrightarrow{1200K} 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

The yellow solution of sodium chromate is filtered and acidified with sulphuric acid to give a solution from which orange sodium dichromate, $Na_2Cr_2O_7 \cdot 2H_2O$ can be crystallized.

$$2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$$
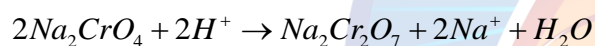
Sodium dichromate is more soluble than potassium dichromate. The latter is therefore, prepared by treating the solution of sodium dichromate with potassium chloride. Orange crystals of potassium dichromate crystallise out.

$$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$$
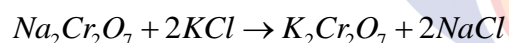
32. What is Lanthanoid contraction? Mention any two consequences of it.

Ans: The overall decrease in atomic and ionic radii from lanthanum to lutetium is called lanthanoid contraction.

Steady decrease in the size of lanthanoid elements with increase in atomic number is known as lanthanoid contraction.

1. Their occurrence together in nature.

2. Difficulty in separation of lanthanides.

3. Similarity in size of elements belonging to same group.

33. Draw cis-isomer and trans- isomer of [Co(en)₂Cl₂] complex. What is the co-ordination number of cobalt metal in this complex?
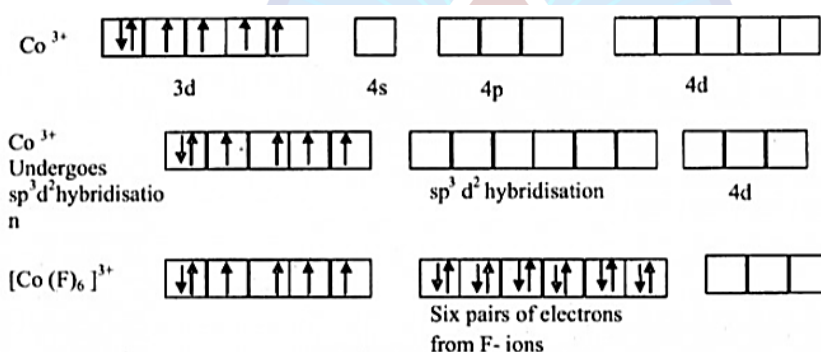
Ans:
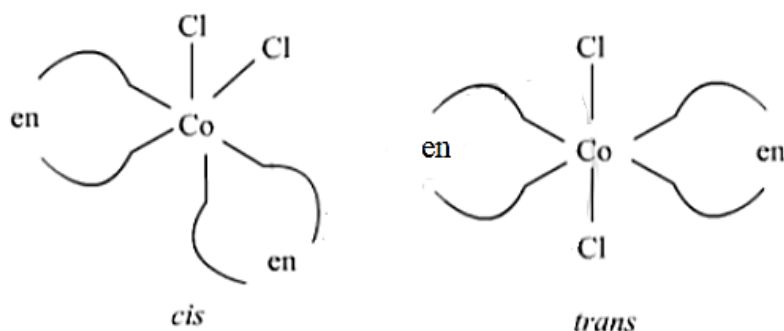
Coordination number of cobalt is 6.

34. Using valence bond theory [VBT], explain geometry, hybridization and magnetic property of [CoF₆]⁻³ ion. [Atomic Number of Cobalt is 27]

Ans: Co is in +3 oxidation state.

Orbitals of Co^{3+} ions,

There are 6 F⁻ ions, thus it can have octahedral geometry.

Since F⁻ is weak field, ligand there is no electron pairing in *3d*.

Hybridisation: sp^3d^2

Geometry: octahedral

Magnetic behaviour: paramagnetic

35. a) What are heteroleptic complexes? Give an example.

Ans: Complexes which contain more than one type or kind of ligands are called homoleptic complexes. Ex: $\left[Pt(NH_3)_3(H_2O)Cl_2\right]$.

b) If $\Delta_0 < P$, on the basis of Crystal Field Theory [CFT],write the electronic configuration of d⁴- ion in octahedral complexes.
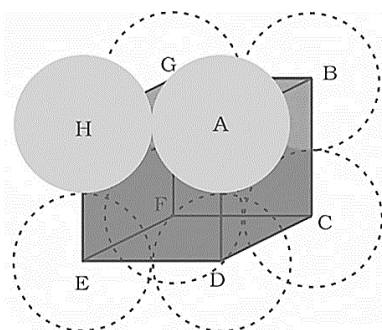
Ans: $t_{2g}^3 e_g^1$

PART D

IV. **Answer ANY THREE of the following questions.** 3 x 5 = 15

36. a) Calculate the packing efficiency in simple cubic crystal lattice.

Ans:

Packing efficiency in simple cubic structure: In simple cubic, atoms are located only on the corners of the cube. Hence the particles touches each other along the edges. Let the edge length of cube be 'a' and 'r' is the radius of sphere.

Volume of cubic unit cell = $a^3 = (2r)^3 = 8r^3$ ....(i)

Since a simple cubic unit cell contains only one atom or one sphere

Volume of one sphere = $\frac{4}{3}\pi r^3$ ....(ii)

Packing efficiency $= \dfrac{\text{volume of one sphere}}{\text{Volume of cubic unit cell}}$

$= \dfrac{4/3\pi r^3}{8r^3} \times 100 = \dfrac{\pi}{6} \times 100$

$= 52.4\%$

b) Calculate the number of particles [atoms] per unit cell in Body Centred Cubic[BCC] crystal lattice.

Ans: Body centred cubic lattice (BCC) contains 8 corners particles and one particle at the centre of the body. The contribution of corner atom to the unit cell is $\frac{1}{8}$.

The particle present at the body centre is not shared by other unit cell.

So, the contribution of body centred atom to the unit cell is 1.

Number of particles in the unit cell of bcc $= \left(8 \times \dfrac{1}{8}\right) + (1 \times 1) = 1 + 1 = 2$

37. a) On dissolving 3.46 g of non- volatile solute in 100 g of water, the boiling point of solution was raised to that of pure water by 0.12 K. Calculate the molar mass of non-volatile solute. (Given: K_b of water = 0.51 K Kg mol^{-1}).

Ans: $M_B = \dfrac{k_b \times w_B \times 1000}{\Delta Tb \times W_A}$
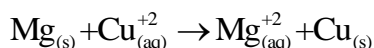
$$= \frac{0.51 \times 3.46 \times 1000}{0.12 \times 100}$$

$$= \frac{17.646}{0.12} = 147.05 \, g \, / \, mol$$

b) What type of deviation from Raoult's law is observed when equal volume of ethanol and acetone are mixed? Mention the reason for it.

Ans: Shows positive deviations because in pure ethanol molecules are hydrogen bonded. On adding acetone, its molecules get in between the ethanol molecules and break hydrogen bonds between them.

38. a) Calculate the value of ΔG^0 at 298 K for the cell reaction.

$$Mg_{(s)} + Cu^{+2}_{(aq)} \rightarrow Mg^{+2}_{(aq)} + Cu_{(s)}$$

Given: $E^0_{Mg^{+2}/Mg} = -2.37V$;

$E^0_{Cu^{+2}/Cu} = +0.34V$ and $F = 96500C$

Ans: $\Delta G^0 = -nFE^0$ $\qquad$ $E^0_{cu} = E^0_C - E^0_A$

$= -2 \times 96500 \times 2.71$ $\qquad$ $= 0.34 + 2.37$

$= 523.03 \, kJ$ $\qquad$ $= 2.71$

b) Suggest any two methods to prevent corrosion of metal.

Ans: Suggest ant two methods to prevent corrosion of metal.

      i. Painting

      ii. Galvanizing

      iii. Applying oil or grease

      iv. Electroplating

39. a) Derive integrated rate equation for the rate constant of a zero-order reaction.

Ans: When the rate of the reaction is independent of the concentration of the reactants, the reaction is known as zero order reaction. In zero order reaction, the concentration of reactant remains unaltered during the course of reaction.

It means rate $= -d[R] / dt = k[R]^0 = k$

$d[R] = - k \, dt$ $\qquad$ ---- (1)

On integration of this equation, we get

$[R] = - kt + I$ $\qquad$ --- (i)

Since $[R] = [R]_0$

When $t = 0$

Thus, $[R]_0 = -k \times 0 = I$

$I = [R]_0$

Put the value of I in eqn. (i), we get

$[R] = - kt + [R]_0$ ----- (ii)

Hence, $k = \dfrac{[R]_0 - [R]_t}{t}$

b) Mention any two factors that affect the rate of a chemical reaction.

Ans: (i) Nature of the reactants   (ii) Temperature

     (iii) Concnetration of the reactants   (iv) Catalyst

      (v) Presence of light photochemical reactions.

40. a) What is effective collision? Write any two factors responsible for effective collision.

Ans: Collision between activated molecules having proper orientation.

1. Activation energy   2. Proper orientation

b) Show that half-life period of a first order reaction is independent of initial concentration of the reacting species.

Ans: The rate equation for a reaction of first order is expressed as:

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

When $t = t_{\frac{1}{2}}, [R] = \dfrac{[R_0]}{2}$

On substituting these values, we get

$$t_{\frac{1}{2}} = \frac{2.303}{k} \log \frac{[R]_0}{\dfrac{[R]_0}{2}}$$

$$t_{\frac{1}{2}} = \frac{2.303}{k} \log 2$$

$$t_{\frac{1}{2}} = \frac{2.303 \times 0.3010}{k}$$

$$t_{\frac{1}{2}} = \frac{0.693}{k}$$

41. a) Give any three differences between Lyophilic Colloid and Lyophobic Colloid.

Ans:

Lyophilic sols	Lyophobic sols.
1. Prepared easily by directly mixing with the liquid dispersion medium	1. Cannot be prepared directly prepared by special methods only.
2. They are quite stable	2. Less stable
3. They are highly hydrated	3. They are not much hydrated

4. Reversible | 4. Irreversible

5. Viscosity is much higher than that of dispersion medium | 5. Viscosity is almost the same as that dispersion of medium

b) Write the expression of Freundlich adsorption isotherm. In this isotherm, what is the value of "1/n" to show that adsorption is independent of pressure.
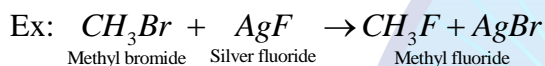
Ans: $\dfrac{x}{m} = kp^{1/n}$

Value of $1/n = 0$

V. Answer ANY FOUR of the following questions.   4 X 5 = 20

42. a) Explain Swarts reaction with an example.

Ans: Methyl fluoride can be prepared by treating the methyl chloride or methyl bromide with silver fluoride to form methyl fluoride.

Ex: $\underset{\text{Methyl bromide}}{CH_3Br} + \underset{\text{Silver fluoride}}{AgF} \rightarrow \underset{\text{Methyl fluoride}}{CH_3F} + AgBr$

b) What are Grignard reagents? Write its general formula.

**Ans:** Organo magnesium halide is known as Grignard reagents.

General formula - RMgX

c) Name the poisonous gas evolved when chloroform is oxidized by air in the presence of light.

Ans: $COCl_2$ or Phosgene.

43. a) Write three steps involved in the mechanism of acid catalyzed dehydration of ethanol to ethene.

Ans: Mechanism: The mechanism of dehydration of ethanol involves the following steps:
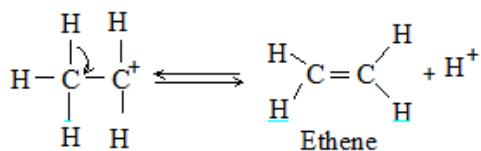
Step 1: Formation of protonated alcohol.

Ethanol   Protonated alcohol
(Ethyl oxoniumion)
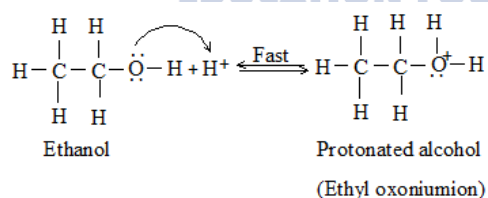
Step 2: Formation of carbocation: It is the slowest step and hence, the rate determining step of the reaction.
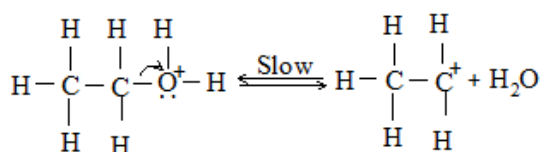
**Step 3:** Formation of ethene by elimination of a proton.

Ethene

b) What is Lucas reagent? Which class of alcohols does not produce turbidity with it at room temperature?

Ans: Mixture of concentrated HCl and anhydrous $ZnCl_2$.

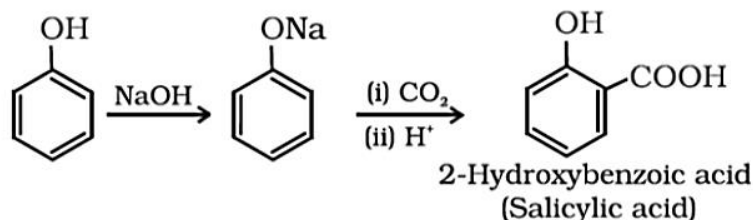Primary alcohols does not produce turbidity with it at room temperature.

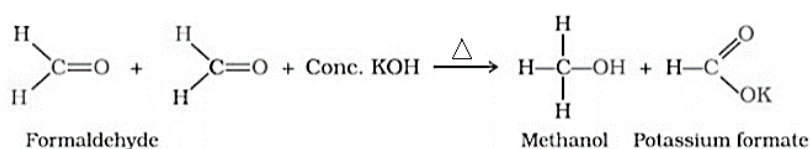**44. a) How is phenol manufactured by Cumene process?**

Ans:

Cumene   Cumene hydroperoxide   Phenol   Acetone
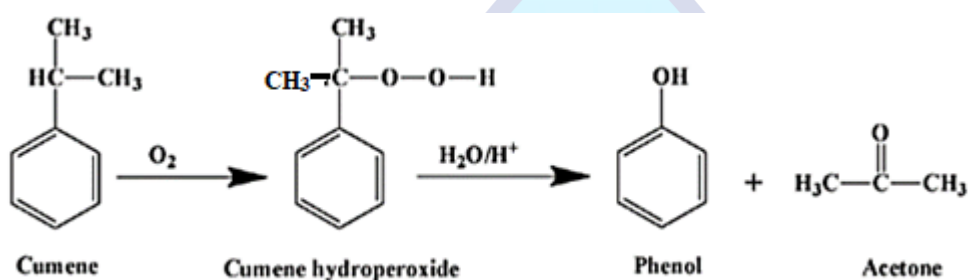
b) Explain Kolbe's reaction with equation.

Ans:

2-Hydroxybenzoic acid
(Salicylic acid)

45. a) How does formaldehyde reacts with concentrated alkali on heating? Name this reaction.

Ans:

Formaldehyde   Methanol   Potassium formate
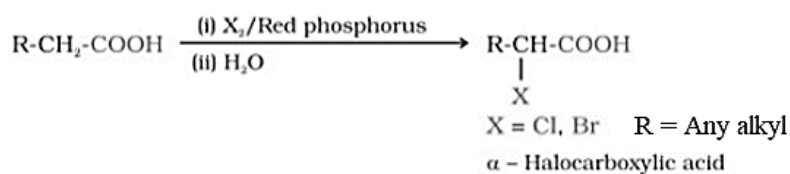
Cannizzaro reaction.

b) Identify the reagent "X" and "Y" used in the following conversion.
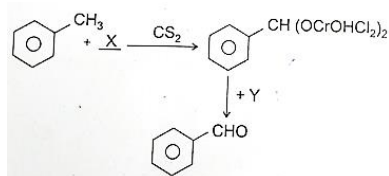
Ans: x = chromyl chloride CrO_2Cl_2 Y = H_3O^+

46. a) What type of carboxylic acids undergo Hell- Volhard- Zelinsky (HVZ) reaction. Explain this reaction with example

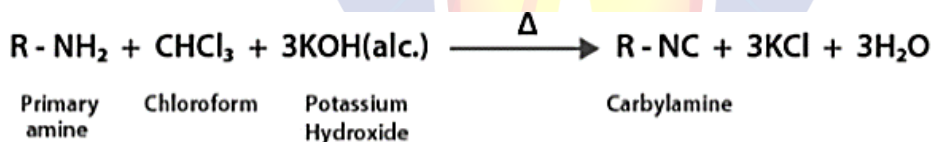**Ans:** Carboxylic acid containing alpha hydrogen will undergo HVZ reaction.

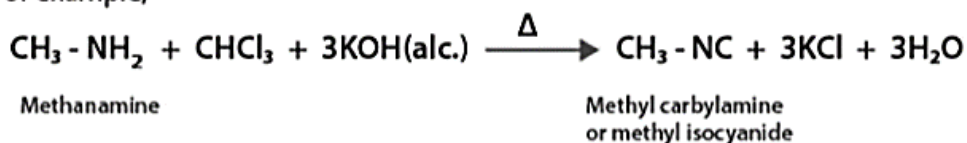**b) Among formic acid and acetic acid, which is weaker acid and why?**

Ans: Acetic acid. Because of due to +I effect of CH_3.

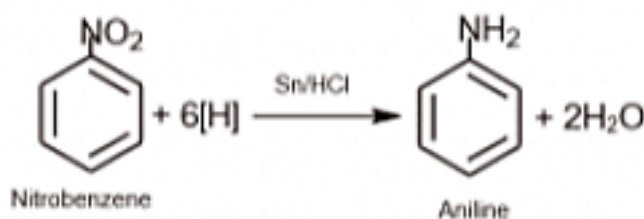**47. a) Explain Carbylamine reaction with equation.**

Ans:

b) How is aniline prepared from nitrobenzene?
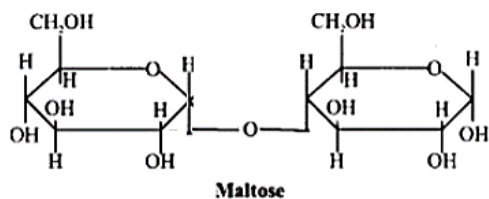
Ans:

c) Give the IUPAC name of trimethylamine.

Ans: N, N-dimethylmethanamine.

48. a) Write the Haworth structure of Maltose.

Ans:

Maltose

b) What are polysaccharides? Give an example.

Ans: Carbohydrates on hydrolysis produces many monosaccharides. Ex: Starch, cellulose

c) Name any one vitamin that is stored in liver and adipose tissues.

Ans: A, D, E, K

49. a) What are fibrous protein? Name the protein present in hair.

Ans: These are the fiber like structure held together by hydrogen and Disulphide bonds.

Ex: Keratin

b) Mention two hormones which regulates the glucose level in the blood.

Ans: Glucagon, Insulin

c) Write the name of the nitrogeneous base present only in DNA, but not in RNA.

Ans: Thymine

50. a) Name the two monomers present in Nylon – 6, 6.

Ans: Hexamethylenediamine and Adipic acid

b) Explain vulcanization of rubber.

Ans: Heating the natural rubber with calculated amount of sulphur at temperature range between

373 -415 K.

c) Write the name of the biodegradable polymer used in manufacture of orthopaedic devices.

Ans: PHB

****

DEPARTMENT OF CHEMISTRY

- ➢ Mr. Adarsha M K
- ➢ Mr. Vishwanath Math
- ➢ Mr. Yogisha
- ➢ Mr. Nagaraja H
- ➢ Mr. Mallikarjuna Rao G
- ➢ Mr. Veeresh S E
- ➢ Mr. Sujay B T

CREATIVE EDUCATION FOUNDATION MOODBIDRI (R)

www.creativeedu.in