Class XII Session 2023-24
Subject - Chemistry
Sample Question Paper - 9

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

Read the following instructions carefully.

1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. **All questions are compulsory.**
8. **Use of log tables and calculators is not allowed.**

Section A

1. Which of the following compounds has the highest boiling points? **[1]**

a) $CH_3CH_2CH_2Cl$ b) $CH_3CH_2CH_2CH_2Cl$

c) $(CH_3)_3Cl$ d) $CH_3CH(CH_3)CH_2Cl$

2. Glucose is: **[1]**

a) Aldopentose b) Ketopentose

c) Aldohexose d) Ketohexose

3. Which of the following is most acidic? **[1]**

a) Cyclohexanol b) Phenol

c) m – Chlorophenol d) Benzyl alcohol

4. What compound is produced when cyclohexene is treated with concentrated $KMnO_4$? **[1]**

a) Succinic acid b) Adipic acid

c) Hexanoic acid d) Cyclohexanecarboxylic acid

5. Why is the minimum energy needed for an effective collision? **[1]**

a) Enough energy is needed to give off heat in a reaction. b) Energy is needed to break bonds.

c) A minimum energy is needed, so that the particles will collide many times per second. d) Energy is needed to orient the particles correctly.

6. Match the item given in Column I with expression given in Column II. **[1]**

Column I	Column II
(a) Osmotic Pressure	(i) $p = K_H . \chi_B$
(b) Relative lowering of vapour pressure	(ii) $\frac{\triangle P}{P^o{}_A} = \chi_B$
(c) Henry Law	(iii) $\triangle T_b = K_b . m$
(d) Elevation in boiling point	(iv) p = iCRT

a) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i).
b) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i).
c) (a) - (iii), (b) - (i), (c) - (ii), (d) - (iv).
d) (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii).

7. Racemisation occurs in: **[1]**

a) S_N1 reaction
b) S_N2 reaction as well as S_N1 reaction
c) Neither S_N2 nor S_N1 reactions
d) S_N2 reaction

8. DMG test is used for the detection of **[1]**

a) Cu
b) Ti
c) Co
d) Ni

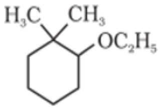
9. The rate law for the reaction: RCl + NaOH → ROH + NaCl is given by;rate = k[RCl]. The rate of this reaction is: **[1]**

a) is unaffected by change in temperature
b) is halved by doubling the concentration of NaOH
c) is doubled by doubling the concentration of NaOH
d) is halved by half by reducing the concentration of RCl

10. The reagent which does not react with both acetone and benzaldehyde. **[1]**

a) Sodium hydrogensulphite
b) Phenyl hydrazine
c) Fehling’s solution
d) Grignard reagent

11. Give IUPAC names of the following compound: **[1]**



a) 1 - Ethoxy - 2, 2 - dimethylcyclohexane
b) 6 - Ethoxy – 6, 6 - dimethylcyclohexane
c) 2 - Ethoxy - 1, 1 - dimethylcyclohexane
d) 1 - Ethoxy - 6, 6 - dimethylcyclohexane

12. Which of the following reagents would not be a good choice for reducing an aryl nitro compound to an amine? **[1]**

a) Fe and HCl
b) $LiAlH_4$ in ether
c) Sn and HCl
d) H_2 (excess)/Pt

13. **Assertion (A):** Albumin is a globular protein. **[1]**

Reason (R): Polypeptide chain coils around to give a straight chain.

a) Both A and R are true and R is the correct
b) Both A and R are true but R is not the

explanation of A.   b) correct explanation of A.

c) A is true but R is false.   d) A is false but R is true.

14. **Assertion:** p-O_2N - $C_6H_5COCH_3$ is prepared by Friedel Crafts acylation of nitrobenzene. **[1]**

Reason: Nitrobenzene easily undergoes electrophilic substitution reaction.

a) If both Assertion & Reason are true and the reason is the correct explanation of the assertion.

b) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion.

c) If Assertion is true statement but Reason is false.

d) If both Assertion and Reason are false statements.

15. **Assertion (A):** 2-Chloro-3-methylbutane on treatment with alcoholic potash gives 2-methylbut-2-ene as major product. **[1]**

Reason (R): The reaction occurs according to Saytzeff rule.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

16. **Assertion (A):** PhMgBr on reaction with $\mathrm{CH_3} - \overset{O}{\overset{||}{\mathrm{C}}} - \mathrm{Cl}$ followed by hydrolysis give 3° alcohol. **[1]**

Reason (R): Reaction of PhMgBr with $\mathrm{CH_3} - \overset{O}{\overset{||}{\mathrm{C}}} - \mathrm{Cl}$ is elimination addition reaction.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

17. Name a ligand which is bidentate and give an example of the complex formed by this ligand. **[2]**

18. What is lanthanoid contraction? What is its effect on the chemistry of the elements which follow the lanthanoids? **[2]**

19. **Answer the following:** **[2]**

(i) A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of the reaction? **[1]**

(ii) Why can’t the molecularity of any reaction be equal to zero? **[1]**

20. A 0.2% aqueous solution of a non-volatile solute exerts vapour pressure of 1.004 bar at 100^0 C. What is the molar mass of the solute? **[2]**

OR

What are Hypertonic and Hypotonic solutions?

21. Complete the following reactions: **[2]**

1. $\mathrm{CH_3COCH_3 + CH_3MgBr} \xrightarrow{H_2O}$
2. $\mathrm{CH_3COCH_2CH_3} \xrightarrow[H_2O]{NaBH_4}$
3. $R - \mathrm{COCl} \xrightarrow[Pd-BaSO_4]{H_2}$

Section C

22. Determine the value of equilibrium constant (K_c) and ΔG^θ for the following reaction. **[3]**

$Ni(s) + 2Ag^+(aq) \rightarrow Ni^{2+}(aq) + 2Ag(s)$

$E^\theta = 1.05\,V\ (1\,F = 96500\,C\,mol^{-1})$

23. In a reaction between A and B, the initial rate of reaction was measured for different initial concentrations of A and B as given below: **[3]**

$A/mol\,L^{-1}$	**0.20**	**0.20**	**0.40**
$B/mol\,L^{-1}$	0.30	0.10	0.05
$r_0/mol\,L^{-1}s^{-1}$	5.07×10^{-5}	5.07×10^{-5}	1.43×10^{-4}

What is the order of the reaction with respect to A and B?

24. Write the reaction and the conditions involved in the conversion of: **[3]**

i. Propane to 1-propanol
ii. Phenol to salicylic acid

OR

How the following conversions can be carried out?

i. Ethanol to propanenitrile
ii. Aniline to chlorobenzene
iii. 2-Chlorobutane to 3, 4-dimethylhexane

25. An organic compound A on treatment with ethyl alcohol gives a carboxylic acid Band compound C. Hydrolysis of C under acidified conditions gives B and D. Oxidation of D with $KMnO_4$ also gives B. B on heating with $Ca(OH)_2$ gives E having molecular formula C_3H_6O. E does not give Tollen's test and does not reduce Fehling's solution but forms a 2,4-dinitrophenylhydrazone. Identify A, B, C, D and E. **[3]**

26. Calculate the cell emf and $\Delta_r G$ for the cell reaction at 25°C. **[3]**

$Zn(s)\,|Zn^{2+}(0.1M)||Cd^{2+}(0.01M)|\,Cd(s)$; [Given, $E^\circ_{Zn^{2+}/Zn}$ = -0.763 V, $E^\circ_{Cd^{2+}/Cd}$ =- 0.403 V; 1F = 96500 C mol^{-1},R = 8.314 $JK^{-1}mol^{-1}$].

27. Explain the following with the help of suitable examples: **[3]**

a. Swarts reaction
b. Finkelstein reaction

28. A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of Ni is deposited at the cathode? **[3]**

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Transition metal oxides are generally formed by the reaction of metals with oxygen at high temperatures. The highest oxidation number in the oxides coincides with the group number. In vanadium, there is a gradual change from the basic V_2O_3 to less basic V_2O_4 and to amphoteric V_2O_5. V_2O_4 dissolves in acids to give VO^{2+} salts. Potassium dichromate is a very important chemical used in the leather industry and as an oxidant for the preparation of many azo compounds. Dichromates are generally prepared from chromate. Sodium dichromate is more soluble than potassium dichromate. The latter is, therefore, prepared by treating the solution of sodium dichromate with potassium chloride. Sodium and potassium dichromates are strong oxidising agents; sodium salt has a greater solubility in water and is extensively used as an oxidising agent in organic chemistry. Potassium dichromate is used as a primary standard in volumetric analysis.

(i) Which of the 3d series of the transition metals exhibits the largest number of oxidation and why?

OR

MnO is basic whereas Mn_2O_7 is acidic in nature. Give reason.

(ii) A transition metal exhibits highest oxidation state ih oxides and fluorides. Give reason.

(iii) How would you account for the increasing oxidising power in the series:

$VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$?

30. **Read the text carefully and answer the questions:** **[4]**

The solutions which boil at a constant temperature like a pure liquid and possess the same composition in liquid, as well as vapour state are called azeotropes. The components of azeotropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of azeotrope is never equal to the boiling points of any of the components of the azeotrope.

(i) The azeotropic solutions of two miscible liquids show what type of deviation from Raoult's law?

(ii) The azeotropic mixture of water & HCI boils at $108.5^\circ C$. What type of deviation is shown by the solution? Does this solution behave as ideal or non-ideal?

(iii) Do ideal solutions form azeotropes?

OR

Out of pure liquid and azeotrope showing positive deviation, Which one has a higher boiling point?

Section E

31. **Attempt any five of the following:** **[5]**

(i) Write uses of B-Complex. **[1]**

(ii) Name the disaccharide which on hydrolysis gives two molecules of glucose. **[1]**

(iii) What are polypeptides? **[1]**

(iv) Which of the two components of starch is water soluble? **[1]**

(v) Name the enzyme which convert surcrose into glucose and fructose. **[1]**

(vi) Name the deficiency disease resulting from lack of vitamin A and E in the diet. **[1]**

(vii) Define native state in reference to proteins. **[1]**

32. List various types of isomerism possible for coordination compounds, giving an example of each. **[5]**

OR

Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory.

a. $[Fe(CN)_6]^{4-}$

b. $[FeF_6]^{3-}$

c. $[Co(C_2O_4)_3]^{3-}$

d. $[CoF_6]^{3-}$

33. i. Tert-Butylamine cannot be prepared by the action of NH_3 on tert-butyl bromic. Explain why? **[5]**

ii. Suggest a convenient method for the preparation of tert-butylamine.

OR

Draw structure for the following compounds:

a. p-toluidine
b. N-isopropylaniline
c. t-butylamine
d. p-fluoroaniline
e. P-tert-butylaniline

Solution

Section A

1.

(b) $CH_3CH_2CH_2CH_2Cl$

Explanation: The forces of attraction between the molecules of a compound get stronger as they get bigger in size and have more electrons. Also, for a straight-chain compound, the points of interaction between the molecules are more than for a branched compound having the same molecular formula. Thus $CH_3CH_2CH_2CH_2Cl$ has the highest melting point since it is the longest chain compound among the given options.

2.

(c) Aldohexose

Explanation: Glucose is an aldohexose. It has an aldehyde group. It is a six membered sugar so the term hexose.

3.

(c) m – Chlorophenol

Explanation: In cases of halogen derivatives of phenols or aniline or benzoic acid etc, it is very helpful to understand that all halogens, when attached to benzene ring, exerts -I as well as +R effect.

In case of Cl, Br and I, the +R effect has almost no effect on reactivity, acidic character or basic character of the benzene ring. It is due to very less effective overlapping involving 2p of carbon and 3p or 4p or 5p of halogen.

Hence, only -I effect becomes the deciding factor, which is most dominant from ortho-position and least effective from para-position. So m chlorophenol is most acidic.

4.

(b) Adipic acid

Explanation: Conc. $KMnO_4$ will cause oxidative ozonolysis and ring-opening forming adipic acid.

Cyclohexene + conc. $KMnO_4 \rightarrow HOOC(CH_2)_4COOH$

5.

(b) Energy is needed to break bonds.

Explanation: Energy is needed to break bonds. This energy, used to initiate the reaction, is called the activation energy.

6.

(d) (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii).

Explanation: (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii).

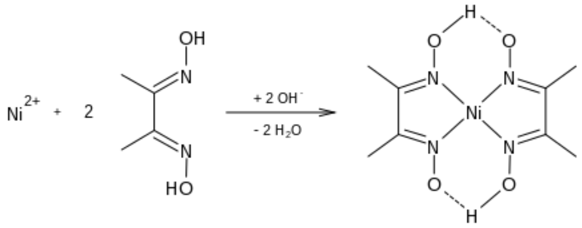
7. **(a)** S_N1 reaction

Explanation: Racemisation occurs in S_N1 reaction not in S_N2 reaction because in case of S_N1 a group (base/nucleophile) attack from (in front and back side) both sides.

8.

(d) Ni

Explanation: Ni^{2+} reacts with DMG to form a red color complex. The reaction can be shown as below:



9.

(d) is halved by half by reducing the concentration of RCl

Explanation: since rate of reaction = $k[RCl]^1$

so if conc. of RCl is halved the rate of reaction will also become half. As the rate is directly proportional to the concentration of RCl.

10.

(c) Fehling's solution

Explanation: Fehling's solution oxidises aliphatic aldehydes very easily but does not react with acetone and aromatic aldehyde; benzaldehyde.

11.

(c) 2 - Ethoxy - 1, 1 - dimethylcyclohexane

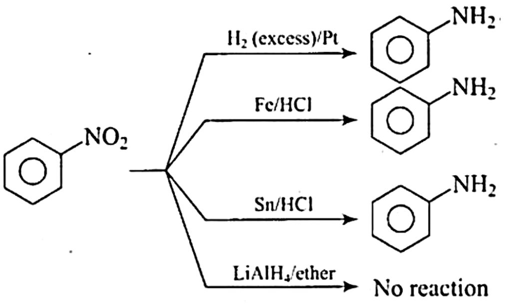
Explanation: Lowest set of locants: The lowest set of locants is defined as the set that, when compared term by term with other locant sets, each cited in order of increasing value, has the lowest term at the first point of difference.
With regard to numbering of locants, simple prefixes (simple substituent groups consisting of just one part that describes an atom, or group of atoms as a unit, for example methyl and ethoxy) are considered together with equal seniority:
Therefore, the given compound is named as 2-ethoxy-1,1-dimethylcyclohexane rather than 1-ethoxy-2,2-dimethylcyclohexane since the locant set '1, 1, 2' is lower than '1, 2, 2'.

12.

(b) $LiAlH_4$ in ether

Explanation:

Aryl nitro compound cannot be converted into amine using (lithium aluminium hydride) $LiAlH_4$ in ether.



13.

(c) A is true but R is false.

Explanation: Albumin is a globular protein polypeptide chain contain 17 intra-chain.

14.

(d) If both Assertion and Reason are false statements.

Explanation: In an electrophilic substitution reaction, the nitro group strongly deactivates the benzene ring. Nitrobenzene does not undergo Friedel Craft acylation reaction.

15. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Both A and R are true and R is the correct explanation of A.

16.

(c) A is true but R is false.

Explanation: A is true but R is false.

Section B

17. Ethylene diamine (en) is bidentate ligand $[Co(en)_3]^{3+}$. Its IUPAC name is tris (ethylene diamine) cobalt (III) ion.
18. The decrease in atomic and ionic size with increase in atomic number among lanthanoids is called lanthanoid contraction. The elements after lanthanoids closely resemble with the elements exactly above them due to similar ionic size for example Zr and Hf have similar sizes.
19. Answer the following:
    (i) First order.
    (ii) Molecularity of a reaction means the number of molecules of the reactants taking place in an elementary reaction. Since at least one molecule must be present, so that molecularity will be at least one.
20. According to Raoult's law

$$\frac{p^\circ - p}{p^\circ} = X_B = \frac{n_B}{n_A + n_B}$$

$= \frac{n_B}{n_A} = \frac{w_B \times M_A}{M_B \times w_A}$

(for dilute solution, $n_B <<< n_A$)

Molar mass of the solute M_B is given as

$M_B = \frac{w_B \times M_A}{w_A} \cdot \frac{p^\circ}{p^\circ - p}$

W_B= mass of the solute = 0.2g

M_A= molar mass of water = 18g/mol

W_A= mass of water = 100-0.2 = 99.8g

P^0= Vapour pressure of water =1.013bar

P= vapour pressure of solution = 1.004bar

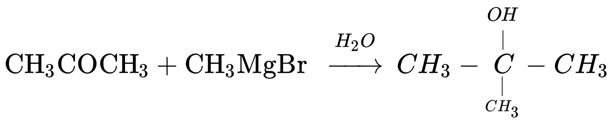
$= \frac{0.2 \times 18}{99.8} \times \frac{1.013}{1.013 - 1.004}$

= 4.06g mol^{-1}

OR

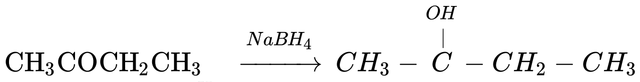
Hypertonic solution has higher concentration than body fluids whereas hypotonic solution has lower concentration than body fluids. That is if a solution has more osmotic pressure than some other solution, it is called hypertonic. On the other hand, a solution having less osmotic pressure than the other solution is called hypotonic. For example Pure NaCl solution with salt concentration less than 0.91%(m/v) is said to be hypotonic. So red blood cells placed in this solution would swell or burst as water flows into the cells. But if the concentration of NaCl is more than 0.91%(m/v), the solution is hypertonic. Here the red blood cells placed in this solution would shrink as water flows out of the cell.

21. 1.



$\mathrm{CH_3COCH_3 + CH_3MgBr} \xrightarrow{H_2O} CH_3 - \underset{CH_3}{\overset{OH}{C}} - CH_3$

2.



$\mathrm{CH_3COCH_2CH_3} \xrightarrow{NaBH_4} CH_3 - \overset{OH}{C} - CH_2 - CH_3$

3. $R - \mathrm{COCl} \xrightarrow[Pd-BaSO_4]{H_2} R - CHO + HCl \quad (Rosenmund\ Reduction)$

Section C

22. We have,

$Ni(s) + 2Ag^+(aq) \to Ni^{2+}(aq) + 2Ag(s)$

For the reaction n = 2,E^θ_{cell} = 1.05 V

$\Delta G^\theta = -nFE^\theta$

$\Delta G^\theta = -2 \times 96500\, C \times 1.05\, V$

$\Delta G^\theta = -202.65\, kJ\, mol^{-1}$

For Equilibrium constant, we have,

$\Delta G^\theta = -2.303\, RT \log K_c$

$\log K_c = -\frac{\Delta G^\ominus}{2.303 RT}$

$= -\frac{202650}{2.303 \times 8.314 \times 298}$

$K_c = \text{Antilog}(35.5161)$

$K_c = 3.284 \times 10^{35}$

23. Consider the order of the reaction with respect to A is x and with respect to B is y.

Therefore, $r_0 = k[A]^x[B]^y$

$5.07 \times 10^{-5} = k[0.20]^x[0.30]^y$ ..... (i)

$5.07 \times 10^{-5} = k[0.20]^x[0.10]^y$ ..... (ii)

$1.43 \times 10^{-4} = k[0.40]^x[0.05]^y$ ..... (iii)

Dividing equation (i) by (ii), we obtain

$\frac{5.07 \times 10^{-5}}{5.07 \times 10^{-5}} = \frac{k[0.20]^x[0.30]^y}{k[0.20]^x[0.10]^y}$

$1 = \frac{[0.30]^y}{[0.10]^y} \left(\frac{0.30}{0.10}\right)^0 = \left(\frac{0.30}{0.10}\right)^y$

y = 0

Dividing equation (iii) by (ii), we obtain

$\frac{1.43 \times 10^{-4}}{5.07 \times 10^{-5}} = \frac{k[0.40]^x[0.05]^y}{k[0.20]^x[0.30]^y}$

$\frac{1.43\times10^{-4}}{5.07\times10^{-5}} = \frac{[0.40]^y}{[0.20]^y}$ $[Since\, y = 0,\ [0.05]^y = [0.30]^y = 1]$

$2.821 = 2^x$

$\log 2.821 = x \log 2\ (Taking\ \log\ on\, both\ sides) x = \frac{\log 2.821}{\log 2}$

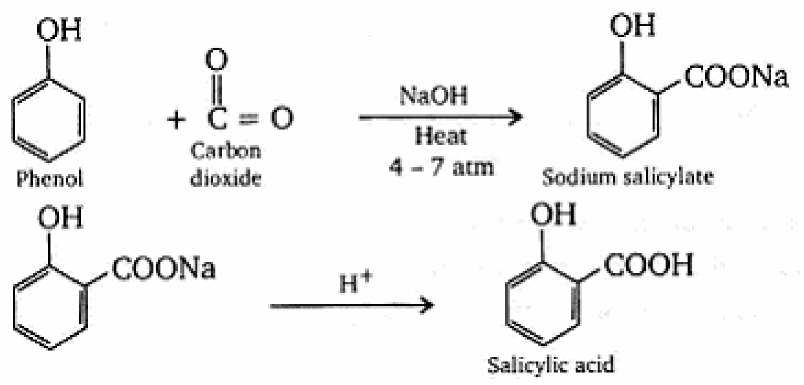
= 1.496

= 1.5 (approximately)

Hence, the order of the reaction with respect to A is 1.5 and with respect to B is 0.

24. i. $CH_3CH = CH_2 \xrightarrow[\text{(ii) } H_2O_2\ /\ OH]{\text{(i) } R_2H_2} \underset{\text{1 - Propanol}}{CH_3CH_2CH_2OH}$

ii.



OR

i. Ethanol to propanenitrile

   a. P, I_2I_2 heat

   b. alc KCN

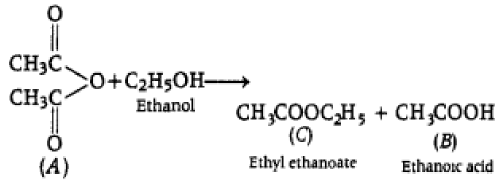
ii. Aniline to chlorobenzene

   a. $NaNO_2$, $HCl_{273\text{-}278\ K}$,

   b. CuCl, HCl sandmeyer reaction

iii. 2-Chlorobutane to 3, 4-dimethylhexane

   Na wurtz reaction

25. 

$$\underset{(C)}{CH_3COOC_2H_5} + H_2O \xrightarrow{H^+} \underset{(B)}{CH_3COOH} + \underset{(D)}{CH_3CH_2OH}$$

$$\underset{(D)}{CH_3CH_2OH} \xrightarrow{KMnO_4} \underset{(B)}{CH_3COOH} \xrightarrow[Dry\ distillation]{Ca(OH)_2} \underset{(E)}{CH_3COCH_3} + CaCO_3$$

E does not give Tollen's reagent test and does not reduce Fehling's solution as it is ketone. But it forms a 2,4-dinitophenylhydrazone.

A =  , B = CH_3COOH, C = $CH_3COOC_2H_5$, D = CH_3CH_2OH, E = CH_3COCH_3

26. For the given cell; $Zn(s)\left|Zn^{2+}(0.1M)\right|\left|Cd^{2+}(0.01M)\right| Cd(s)|$

Given, $E^\circ_{Zn^{2+}/Zn}$ = -0.763 V < $E^\circ_{Cd^{2+}/Cd}$ = - 0.403 V

Therefore, $E^o_{cell} = E^\circ_{right} - E^\circ_{left}$ = -0.403 - (-0.763) = 0.36 V.

By applying Nernst equation, we have

$E_{cell} = E^\circ_{cell} - \frac{0.059}{n} \log \frac{[Zn^{2+}(aq)]}{\left[Cd^{2+}(aq)\right]}$

$E_{cell} = 0.36 - \frac{0.059}{2} \log \frac{0.1}{0.01}$

E_{cell} = 0.36 - 0.0295 log 10

$E_{cell} = 0.36 - 0.0295 \times 1 = 0.3305V$

Also, We know that : $\Delta_r G = -nFE_{\text{cell}} = -2 \times 96500 \times 0.33$

$\Delta_r G$ = -63786.5J mol^{-1} = -63.79 kJ mol^{-1}

27. Swarts reaction: The synthesis of alkyl fluorides is best accomplished by heating an alkyl chloride/bromide in the presence of a metallic fluoride such as AgF, Hg_2F_2 or SbF_3. The reaction is termed as Swarts reaction.

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

    Finkelstein reaction: When alkyl bromide reacts with NaI in presence of acetone as solvent, alkyl iodide is formed.

    $C_2H_5Br + NaI \xrightarrow{Acetone} C_2H_5I + NaBr$

28. given that Quantity of electricity passed $= 5A \times 20 \times 60s$

    = 6000 C time = 20 min

    $Ni^{2+} + 2e^- \rightarrow Ni$

    Thus, 2 F, i.e. $2 \times 96500\,C$ deposit Ni = 1 mole i.e. 58.7 g

    (at mass of Ni = 58.7)

    Thus 2 F i.e. $2 \times 96500\,C$ deposit Ni = 1 mole

    6000 C will deposit Ni

    $= \frac{58.7}{2 \times 96500} \times 6000g$ = 1.825 g

Section D

29. **Read the text carefully and answer the questions:**

    Transition metal oxides are generally formed by the reaction of metals with oxygen at high temperatures. The highest oxidation number in the oxides coincides with the group number. In vanadium, there is a gradual change from the basic V_2O_3 to less basic V_2O_4 and to amphoteric V_2O_5. V_2O_4 dissolves in acids to give VO^{2+} salts. Potassium dichromate is a very important chemical used in the leather industry and as an oxidant for the preparation of many azo compounds. Dichromates are generally prepared from chromate. Sodium dichromate is more soluble than potassium dichromate. The latter is, therefore, prepared by treating the solution of sodium dichromate with potassium chloride. Sodium and potassium dichromates are strong oxidising agents; sodium salt has a greater solubility in water and is extensively used as an oxidising agent in organic chemistry. Potassium dichromate is used as a primary standard in volumetric analysis.

    (i) Manganese (Z = 25) shows maximum number of O.S. This is because its outer EC is $3d^5 4s^2$. As 3d and 4s are close in energy, it has maximum number of e-1 s to loose or share. Hence, it shows O.S. from +2 to +7 which is the maximum number.

    OR

    When a metal is in a high oxidation state, its oxide is acidic and when a metal is in a low oxidation state its oxide is basic.

    (ii) A transition metal exhibits higher oxidation states in oxides and fluorides because oxygen and fluorine are highly electronegative elements, small in size and strongest oxidising agents.

    (iii)This is due to the increasing stability of the lower species to which they are reduced.

30. **Read the text carefully and answer the questions:**

    The solutions which boil at a constant temperature like a pure liquid and possess the same composition in liquid, as well as vapour state are called azeotropes. The components of azeotropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of azeotrope is never equal to the boiling points of any of the components of the azeotrope.

    (i) The azeotropic solutions of two miscible liquids may show positive or negative deviation from Raoult's law.

    (ii) The solution is a non-ideal solution and shows a negative deviation from Raoult's law.

    (iii)No, ideal solutions don't form azeotropes. Only the non-ideal solution form azeotrope.

    OR

    The boiling point of a pure liquid is higher as compared to azeotrope showing positive deviation.

Section E

31. Attempt any five of the following:

    (i) It is required for making red blood cells, muscles.

    (ii) The disaccharide which gives two molecules of glucose on hydrolysis is maltose.

    (iii)Polypeptides are formed when several molecules generally more than ten of α-amino acids are joined together by a peptide bond.

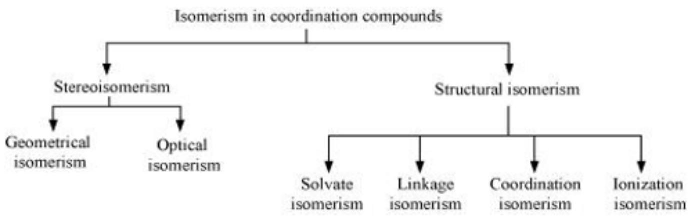
    (iv)A starch has two components: amylose and amylopectin. Amylose is water soluble.

(v) Invertase

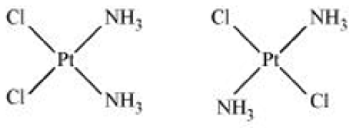
(vi)Deficiency of A cause Xerophthalmia and E causes muscular weakness.

(vii)Native state of protein is the sequence in which the amino acids are linked together with the help of peptide bond.

32.

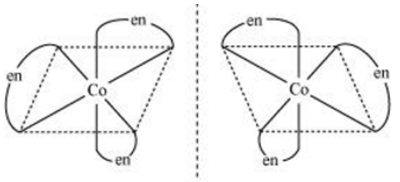


i. Geometric isomerism: This type of isomerism is common in heteroleptic complexes. It arises due to the different possible geometric arrangements of the ligands. For example:



Cis–isomer Trans–isomer

ii. Optical isomerism: This type of isomerism arises in chiral molecules. Isomers are mirror images of each other and are non-superimposable.



$[Co(en)_3]^{3+}$ (dextro) Mirror $[Co(en)_3]^{3+}$ (Laevo)

iii. Linkage isomerism: This type of isomerism is found in complexes that contain ambidentate ligands. For example: $[Co(NH_3)_5(NO_2)]Cl_2$ and $[Co(NH_3)_5(ONO)Cl_2$

Yellow form Red form

iv. Coordination isomerism:

This type of isomerism arises when the ligands are interchanged between cationic and anionic entities of different metal ions present in the complex.

$[Co(NH_3)_5ONO]^{2+}$ and $[Co(NH_3)_5NO_2]^{2+}$

v. Ionization isomerism:

This type of isomerism arises when a counter ion replaces a ligand within the coordination sphere. Thus, complexes that have the same composition, but furnish different ions when dissolved in water are called ionization isomers. For e.g., $Co(NH_3)_5SO_4Br$, and $Co(NH_3)_5BrSO_4$

vi. Solvate isomerism:

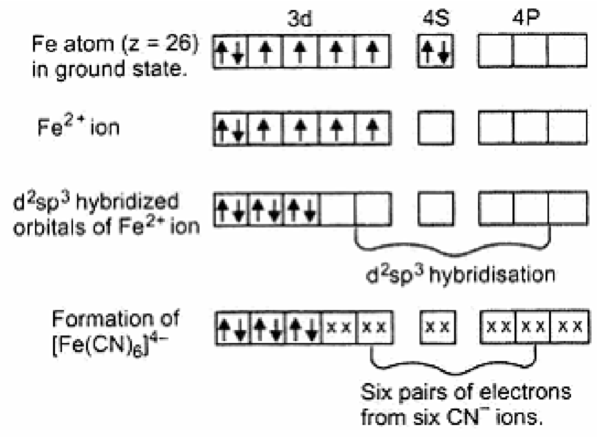
Solvate isomers differ by whether or not the solvent molecule is directly bonded to the metal ion or merely present as a free solvent molecule in the crystal lattice.

$[Cr(H_2O)_6]Cl_3$ $[Cr(H_2O)_5Cl]Cl_2.H_2O[Cr(H_2O)_5Cl_2$ $Cl.2H_2O$

Violet Blue-green Dark green

OR

a. In $[Fe(CN)_6]^{4-}$



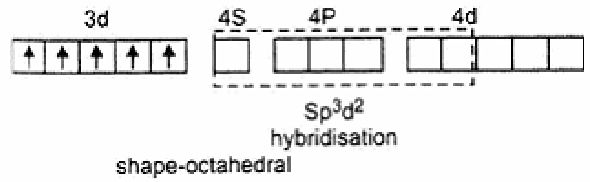
Hence, the geometry of the complex is the octahedral shape and the complex is diamagnetic.

b. In $[FeF_6]^{3-}$: $[Ar]\ 4s^2\ 3d^6$

Fe^{3+} : $[Ar]\ 4s^0\ 3d^5$

F^- is a weak ligand, does not cause the pairing of electrons.

$FeF_6]^{3-}$



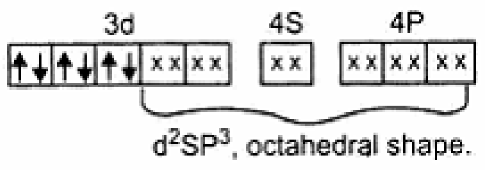
Hence, the geometry of the complex is the octahedral shape and the complex is paramagnetic.

c. $[Co(C_2O_4)_3]^{3-}$

Co (27) : $[Ar]\ 4s^2\ 3d^7$

Co^{3+} : $[Ar]\ 4s^0\ 3d^6$

$C_2O_4^{2-}$ is strong field ligand causes pairing of electrons.



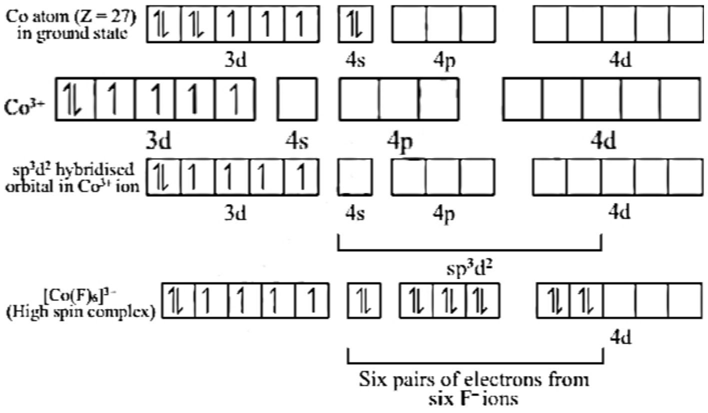
Hence, the geometry of the complex is the octahedral shape and the complex is diamagnetic.

d. $[CoF_6]^{3-}$

Co (27) - $[Ar]\ 4s^2\ 3d^7$

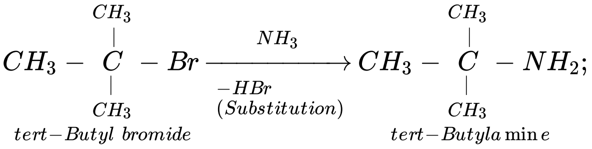
Co^{3+} - $[Ar]\ 4s^0\ 3d^6$

F^- is a weak ligand, does not cause pairing of electrons.

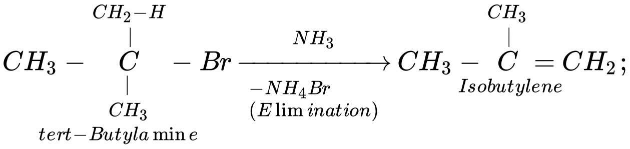


Hence, $[CoF_6]^{3-}$ is sp^3d^2 hybridised and it is octahedral in shape.

33. i. Tert.-Butyl bromide being a 3° alkyl halide on treatment with a base (i.e., NH_3) prefers to undergo elimination rather than substitution. Therefore, the product is isobutylene rather than tert-butylamine.

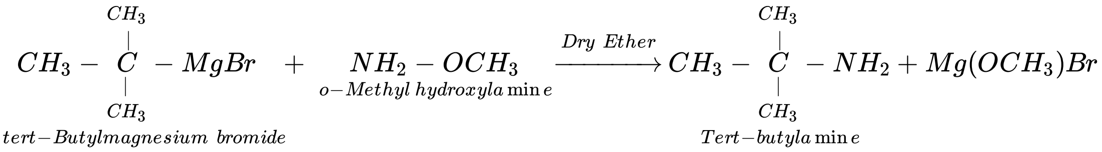


$$\underset{tert-Butyl\ bromide}{CH_3-\overset{CH_3}{\underset{CH_3}{C}}-Br}\xrightarrow[-HBr\ (Substitution)]{NH_3}\underset{tert-Butylamine}{CH_3-\overset{CH_3}{\underset{CH_3}{C}}-NH_2};$$



$$\underset{tert-Butylamine}{CH_3-\overset{CH_2-H}{\underset{CH_3}{C}}-Br}\xrightarrow[-NH_4Br\ (Elimination)]{NH_3}\underset{Isobutylene}{CH_3-\overset{CH_3}{C}=CH_2};$$

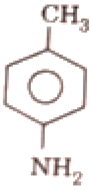
ii. 1° amines containing tert-alkyl groups can be prepared by action of suitable Grignard reagents and o-methylhydroxylamine. For example,



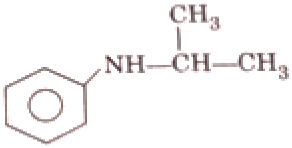
$$\underset{tert-Butylmagnesium\ bromide}{CH_3-\overset{CH_3}{\underset{CH_3}{C}}-MgBr}+\underset{o-Methyl\ hydroxylamine}{NH_2-OCH_3}\xrightarrow{Dry\ Ether}\underset{Tert-butylamine}{CH_3-\overset{CH_3}{\underset{CH_3}{C}}-NH_2}+Mg(OCH_3)Br$$

OR

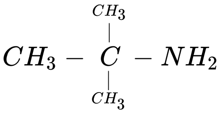
a. p-toluidine



b. N-isopropylaniline

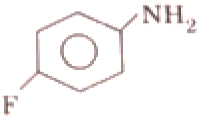


c. t-butylamine



$$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-NH_2$$

d. p-fluoroaniline



e. P-tert-butylaniline