Class XII Session 2025-26
Subject - Chemistry
Sample Question Paper - 5

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. Clemmensen reduction of a ketone is carried out in the presence of which of the following? **[1]**

a) $LiAlH_4$
b) Zn – Hg with HCl
c) H_2 and Pt as catalyst
d) Glycol with KOH

2. When a haloalkane with β – hydrogen atom is heated with alcoholic solution of potassium hydroxide then: **[1]**

a) elimination of hydrogen atom from β– carbon
b) All of these
c) alkene is formed as a product
d) elimination of halogen atom from α – carbon

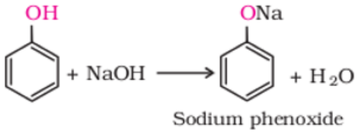
3. Which one is not the essential amino acid in the ones given below? **[1]**

a) Proline
b) Valine
c) Leucine
d) Arginine

4. The reagent which can be used to distinguish acetophenone from benzophenone is: **[1]**

a) 2, 4-dinitrophenyl hydrazine
b) Benedict solution
c) aqueous solution of $NaHSO_3$
d) I_2 and Na_2CO_3

5. In the reaction **[1]**



a) Cleavage of O - H bond

b) Phenols are acidic in nature.

c) All of these

d) They can donate a proton to a stronger base

6. Match the items given in column I with that in column II: **[1]**

Column I	**Column II**
(a) Urea	(i) i < 1
(b) $FeCl_3$	(ii) i = 1
(c) Benzoic acid in Benzene	(iii) i = 2
(d) $MgSO_4$	(iv) i = 4

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

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

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

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

7. The rate law for a particular reaction is given as rate = $k[A][B]^2$. **[1]**

How is the rate of reaction affected if we double the concentration of B?

a) becomes half $\left(\frac{1}{2}\right)$

b) four times

c) three times

d) two times

8. Ethylidene chloride is a/an _________. **[1]**

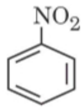
a) gem-dihalide

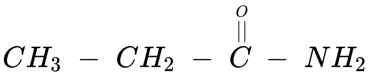
b) vic-dihalide

c) vinylic halide

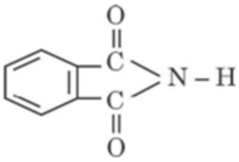
d) allylic halide

9. Hoffmann Bromamide Degradation reaction is given by: **[1]**

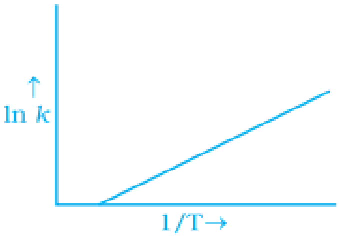
a) 

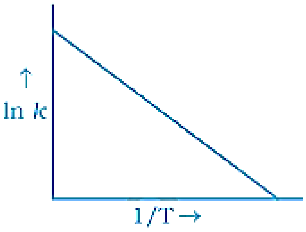
b) 
$CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - NH_2$

c) $CH_3 - C \equiv N$

d) 

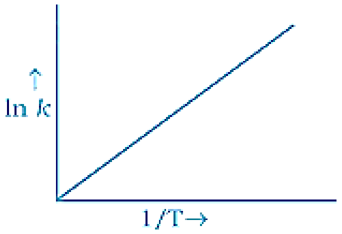
10. According to the Arrhenius equation rate constant k is equal to $Ae^{-E_a/RT}$. Which of the following options represents the graph of ln k vs $\frac{1}{T}$? **[1]**

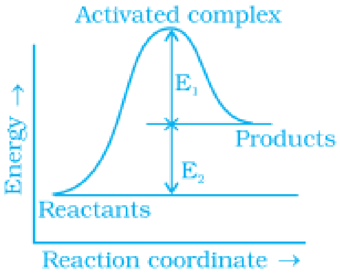
a) 

b) 

c)

d)





11. One of the following alcohols do not undergo oxidation reaction: **[1]**

a) Tertiary alcohol
b) Primary alcohol and Secondary alcohol
c) Secondary alcohol
d) Primary alcohol

12. The incorrect statement about interstitial compounds is: **[1]**

a) They have high melting point.
b) They retain metallic conductivity.
c) They are chemically reactive.
d) They are very hard.

13. **Assertion (A):** D (+)-Glucose is dextrorotatory. **[1]**

Reason (R): Symbol 'D' represents its dextrorotatory nature.

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.

14. **Assertion (A):** In comparison to ethyl chloride it is difficult to carry out nucleophilic substitution on vinyl chloride. **[1]**

Reason (R): Vinyl group is electron-donating.

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.

15. **Assertion (A):** Phenol gives 2,4,6-trinitrophenol on treatment with concentrated HNO_3 and concentrated H_2SO_4. **[1]**

Reason (R): -OH group in phenol is m-directing.

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):** RMgX on reaction with CO_2 gives $R-\overset{\overset{O}{||}}{C}-OH$ **[1]**

Reason (R): RMgX on reaction with carbonyl compounds give alcohols.

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. Give some example showing importance of complexes in biological system? **[2]**

18. Draw the structural formula of hex-2-en-4-ynoic acid. **[2]**

19. State Henry's law. Calculate the solubility of CO_2 in water at 298 K under 760 mm Hg. (K_H for CO_2 in water at 298 K is 1.25×10^6 mm Hg) **[2]**

OR

Define the term: Molality.

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

(a) Define rate of reaction? **[1]**

(b) For a reaction R → P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. What is the order of reaction? **[1]**

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

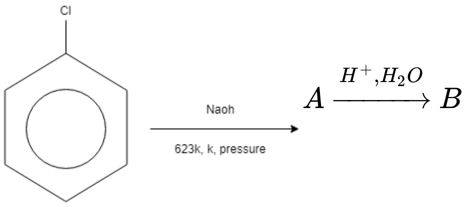
a. $MnO_2 + KOH + O_2 \longrightarrow$

b. $I^- + MnO_4^- + H^+ \longrightarrow$

c. $Cr_2O_7^{2-} + Sn^{2+} + H^+ \longrightarrow$

Section C

22. Complete the following reaction: **[3]**



$A \xrightarrow{H^+,H_2O} B$

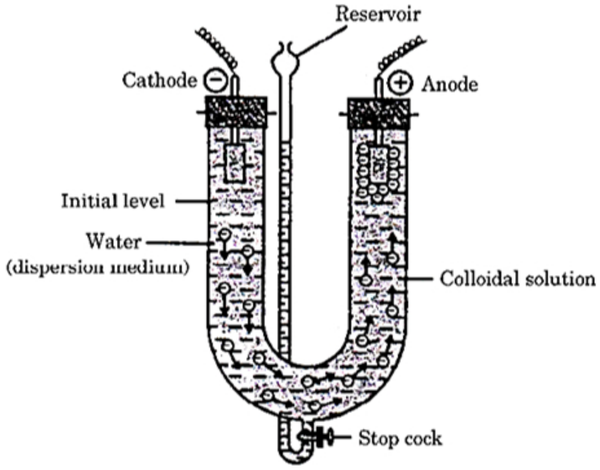
23. In a pseudo first order hydrolysis of ester in water, the following results were obtained: **[3]**

t/s	0	30	60	90
[Ester] $molL^{-1}$	0.55	0.31	0.17	0.085

i. Calculate the average rate of reaction between the time interval 30 to 60 seconds.

ii. Calculate the pseudo first order rate constant for the hydrolysis of ester.

24. Answer the following questions on the basis of the given figure: **[3]**



a. Define the process depicted in the above figure.

b. Can this process be used in the coagulation of the lyophobic sols?

c. What is coagulation?

25. Calculate the emf of the cell Mg(s) || Mg^{2+}(0.1 M) || Cu^{2+} (1×10^{-3} M) | Cu(s) **[3]**

Given : $E^0(Cu^{2+}/Cu) = +0.34V$

$E^0(Mg^{2+}/Mg) = -2.37V$

26. What is an electrochemical series? How does it help in calculating the e.m.f of a standard cell? **[3]**

27. Complete the following reaction: **[3]**

$$CH_3CHO + CH_3CH_2CHO \xrightarrow[(ii)\ Heat]{(i)\ dil\ NaOH}$$

28. Write the mechanism of the reaction of HI with methoxymethane. **[3]**

OR

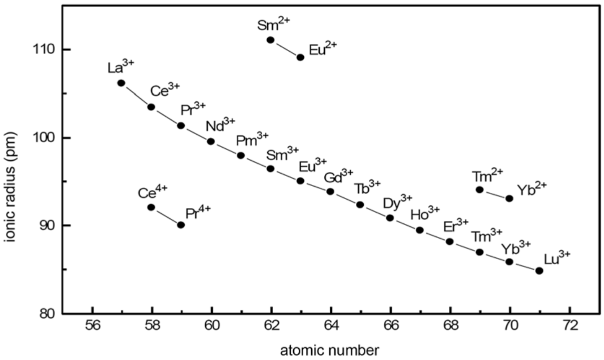
Name the reagents used in the following reactions:

i. Oxidation of a primary alcohol to carboxylic acid.
ii. Oxidation of a primary alcohol to an aldehyde.
iii. Bromination of phenol to 2, 4, 6-tribromophenol.

Section D

29. **Read the text carefully and answer the questions:** **[5]**

The f-block consists of the two series, lanthanoids (the fourteen elements following lanthanum) and actinoids (the fourteen elements following actinium). Because lanthanum closely resembles the lanthanoids. The chemistry of the actinoids is much more complicated. The complication arises partly owing to the occurrence of a wide range of oxidation states in these elements and partly because their radioactivity creates special problems in their study. The overall decrease in atomic and ionic radii from lanthanum to lutetium (the lanthanoid contraction) is a unique feature in the chemistry of the lanthanoids. In the lanthanoids, La(II) and Ln(III) compounds are predominant species.



(a) Which metal in the first transition series (3d series) exhibits +1 oxidation state most frequently and why?

OR

The transition metals (with the exception of Zn, Cd and Hg) are hard and have high melting and boiling points. Give reason.

(b) Both O_2 and F_2 stabilize high oxidation states of transition metals but the ability of oxygen to do so exceeds that of fluorine. Give reason.

(c) The atomic radii of the metals of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the second (4d) series. Give reason.

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

Many chemical and biological processes depend on osmosis, the selective passage of solvent molecules through the porous membrane from a dilute solution to a more concentrated one. The osmotic pressure π depends on molar concentration of the solution (π = CRT). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic. Osmosis is the major mechanism, for transporting water upward in the plants. Transpiration is the leaves supports the transport mechanism of water. The osmotic pressure of seawater is about 30 atm; this is the pressure that must be applied to the seawater (separated from pure water using a semi-permeable membrane) to get drinking water.

(a) What will happen if a plant cell kept in a hypertonic solution?

(b) Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing in 1.2% sodium chloride solution?

(c) What happens when the external pressure applied becomes more than the osmotic pressure of solution?

OR

Which mechanisms helps in the transportation of water in a plant?

Section E

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

(a) State a use of streptokinase in protein. **[1]**

(b) What are any two good sources of vitamin A? **[1]**

(c) What are heterocyclic bases? **[1]**

(d) What is the information given by primary structure of proteins? **[1]**

(e) Deficiency of which vitamin causes night-blindness. **[1]**

(f) Give an example of fibrous protein. **[1]**

(g) Write the product obtained when D-glucose reacts with H_2N-OH. **[1]**

32. I. Give reasons: **[5]**

i. Aniline on nitration gives good amount of m-nitroaniline, though -NH_2 group is o/p directing in electrophilic substitution reactions.

ii. $(CH_3)_2$ NH is more basic than $(CH_3)_3N$ in an aqueous solution.

iii. Ammonolysis of alkyl halides is not a good method to prepare pure primary amines.

II. Write the reaction involved in the following:

i. Carbyl amine test

ii. Gabriel phthalimide synthesis

OR

Give the reasons for the following:

i. Aniline does not undergo Friedel-Crafts reaction.

ii. $(CH_3)_2NH$ is more basic than $(CH_3)_3$.N in an aqueous solution.

iii. Primary amines have a higher boiling point than tertiary amines.

33. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration, and coordination number. Also, give stereochemistry and magnetic moment of the complex: **[5]**

a. $K[Cr(H_2O)_2\}(C_2O_4)_2].3H_2O$

b. $[Co(NH_3)_5Cl]Cl_2$

c. $CrCl_3(py)_3$

d. $Cs[FeCl_4]$

e. $K_4[Mn(CN)_6]$

OR

Write the IUPAC names of the following coordination compounds:

a. $[Pt (NH_3)_2 Cl(NO_2]$

b. $K_3 [Cr (C_2O_4)_3]$

c. $[CoCl_2 (en)_2]Cl$

d. $[Co(NH_3)_5 (CO_3)]Cl$

e. $Hg [Co (SCN)_4]$

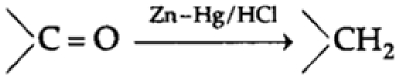
Solution

Section A

1.

(b) Zn – Hg with HCl

Explanation:



This is called as clemmensen reduction.

2.

(b) All of these

Explanation:

When a haloalkane with β-hydrogen atom is heated with an alcoholic solution of potassium hydroxide, there is an elimination of hydrogen atom from β-carbon and a halogen atom from the α-carbon atom. As a result, an alkene is formed as a product. Since the β-hydrogen atom is involved in elimination, it is often called β-elimination.

3. **(a)** Proline

Explanation:

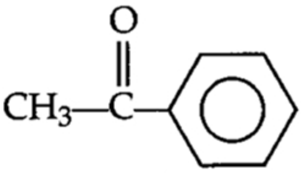
Those amino acids which cannot be synthesised in the body and must be obtained through diet, are known as essential amino acids. Proline is not an essential amino acid.

4.

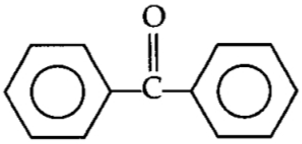
(d) I_2 and Na_2CO_3

Explanation:

Acetophenone ⇒



Benzophenone ⇒



Acetophenone contain $CH_3 - \underset{\underset{O}{||}}{C} -$ unit thus it well give haloform test and precipitate CHI_3 (yellow ppt). On other hand benzophenone does not form haloform.

5.

(c) All of these

Explanation:

Phenol reacts with sodium hydroxide solution to give a colourless solution containing sodium phenoxide. In this reaction, the hydrogen ion has been removed by the strongly basic hydroxide ion in the sodium hydroxide solution.

6.

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

Explanation:

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

7.

(b) four times

Explanation:

four times

8. **(a)** gem-dihalide

Explanation:

Gem-dihalides are dihaloalkanes that have two halogen atoms of the same type attached to the same carbon atom in a molecule. The common naming system of gem-dihalides (geminal halide) is alkylidene dihalides. Ethylidene dichloride thus is a gem-dihalide. The chemical formula of ethylidene dichloride is $C_3H_6Cl_2$.

9.

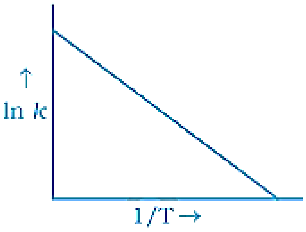
(b) $CH_3 - CH_2 - \overset{O}{\overset{||}{C}} - NH_2$

Explanation:

$$CH_3 - CH_2 - \overset{O}{\overset{||}{C}} - NH_2$$

10.

(b)



Explanation:

According to Arrhenius equation k = $Ae^{-E_a/RT}$

Taking log on both sides in $k = \ln\left(A \cdot e^{-\frac{E_2}{RT}}\right)$

$\ln k = \ln A - \frac{E_a}{RT}$

$\ln k = -\frac{-E_a}{R} \times \frac{1}{T} + \ln A$

y = mx + c

This equation can be related to the equation of a straight line.

From the graph, it is very clearly shown that the slope of the plot $= \frac{-E_a}{R}$ and intercept = ln A.

11. **(a)** Tertiary alcohol

Explanation:

The outcome of oxidation reactions of alcohol depends on the substituents on the carbinol carbon. In order for each oxidation step to occur, there must be H on the carbinol carbon.

- Primary alcohols can be oxidized to aldehydes or further to carboxylic acids. In aqueous media, the carboxylic acid is usually the major product. PCC or PDC, which are used in dichloromethane, allow the oxidation to be stopped at the intermediate aldehyde.
- Secondary alcohols can be oxidized to ketones but no further:
- Tertiary alcohols cannot be oxidized (no carbinol C-H).

12.

(c) They are chemically reactive.

Explanation:

Interstitial compounds are obtained when small atoms like H, B, C, resemble N, etc. fit into the lattice of other elements. They are chemically inert.

13.

(c) A is true but R is false.

Explanation:

A is true but R is false.

14.

(c) A is true but R is false.

Explanation:

$CH_2{=}CH{-}Cl$ has some partial double bond character between carbon and a chlorine atom. So, nucleophilic substitution is difficult to carry as it is difficult to break the partial double bond in vinyl chloride than ethyl chloride $CH_3CH_2{-}Cl$ where there is no double bond character.

The vinyl group is not electron-donating. The carbon halogen bond in vinyl halides has some double-bond character and thus a little difficult to break.

15.

(c) A is true but R is false.

Explanation:

A is true but R is false.

16.

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

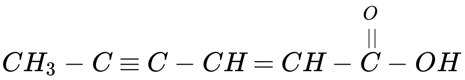
Explanation:

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

Section B

17. Examples of complexes in biological system.-

1. Chlorophyll is a complex of Mg.
2. Haemoglobin is a complex of iron.
3. Cyanocobalamine , Vitamin B_{12},is a complex of cobalt.

18. 

$CH_3 - C \equiv C - CH = CH - \overset{\overset{O}{||}}{C} - OH$

19. Henry’s Law states that “the partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution” and is expressed as:

$p = K_H\, x$

Here K_H is the Henry’s law constant.

Given, T = 298 K, $K_H = 1.25 \times 10^6$, p = 760 mm Hg

We know by Henry's Law, $p = K_H \times x$, where x is mole fraction of the gas in the solution.

$760 = 1.25 \times 10^6 \times x$

$x = \frac{760}{1.25 \times 10^6}$

$x = 6.08 \times 10^{-4}$

OR

Molality: Molality of a solution is defined as the number of moles of the solute dissolved in 1000 g (1 Kg) of the solvent. It is denoted as 'm'.

Molality (m) $= \frac{\text{Moles of solute}}{\text{Mass of solvent in Kg}}$ Unit of molality = mol/kg

For example, 1.00 mol Kg^{-1}(or 1.00 m) solution of KCl means that 1 mol of KCl dissolved in 1 Kg of water.

20. Answer the following:

(i) Rate of reaction is defined as change in concentration of reactants or products per unit time. For example, the reaction A →B has the rate expressed as:

rate of reaction $= \frac{dx}{dt} = \frac{-[dA]}{dt} = \frac{[dB]}{dt}$

(ii) For a reaction R → P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. Thus, it follows first order reaction.

21. a. $2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$

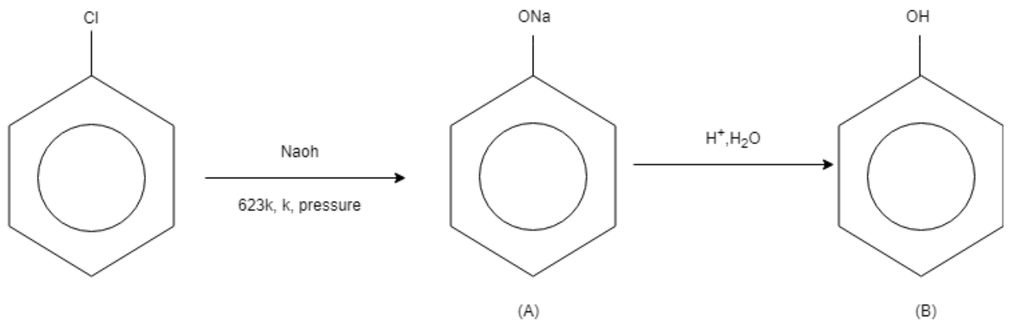
b. $10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5\,I_2$

c. $Cr_2O_7^{2-} + 14\,H^+ + 3\,Sn^{2+} \rightarrow 2\,Cr^{3+} + 3\,Sn^{4+} + 7\,H_2O$

Above mentioned reactions are complete reactions of given reations.

Section C

22.



23. i. Average rate of reaction between the time interval, 30 to 60 seconds, $= \frac{d[Ester]}{dt}$

$= \frac{0.31-0.17}{60-30} = \frac{0.14}{30} = 4.67 \times 10^{-3} mol\, L^{-1} s^{-1}$

ii. For a pseudo first order reaction,

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

For t= 30s, $k_1 = \frac{2.303}{30} \log \frac{0.55}{0.31} = 1.911 \times 10^{-2} s^{-1}$

For t= 60s, $k_2 = \frac{2.303}{60} \log \frac{0.55}{0.17} = 1.957 \times 10^{-2} s^{-1}$

For t= 90s,

$k_3 = \frac{2.303}{90} \log \frac{0.55}{0.085} = 2.075 \times 10^{-2} s^{-1}$

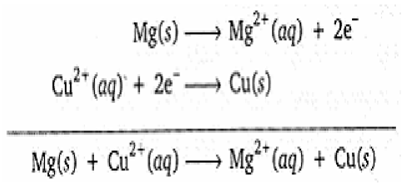
Then, average rate constant, $k = \frac{k_1 + k_2 + k_3}{3}$ = 1.981 X 10^{-2} s^{-1}

24. a. The movement of colloidal particles under an applied electric potential.

b. Yes this process be used in the coagulation of the lyophobic sols.

c. The process of settling colloidal particles is coagulation.

25.



$$Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$$

$$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$$

$$Mg(s) + Cu^{2+}(aq) \longrightarrow Mg^{2+}(aq) + Cu(s)$$

$E_{cell} = E^0_{cell} - \frac{0.0591}{2} \log \frac{[Mg^{2+}]}{[Cu^{2+}]}$

$E^0_{cell} = \left[E^0 \frac{(Cu^{2+})}{(Cu)} - E^0(Mg^{2+}/Mg)\right]$

$E_{cell} = [+0.34V - (-2.37V)] - \frac{0.0591}{2} \log 10^2$

= (0.271 V - 0.0591)V

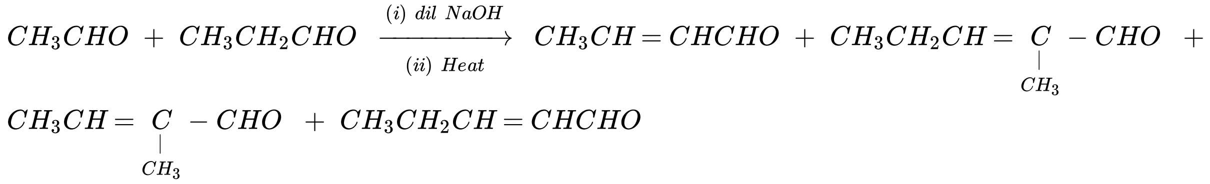
= 2.65 V

26. The series of elements which have been arranged on the basis of their electrode potential is called electrochemical series or activity series.

Standard EMF of the cell = [standard reduction potential of the right hand side electrode] - [Standard reduction potential of the left hand side electrode]

$emf = E^0_{cathode} - E^0_{anode}$

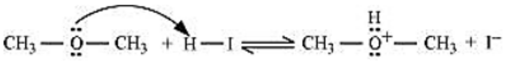
27. This is cross aldol condensation reaction.



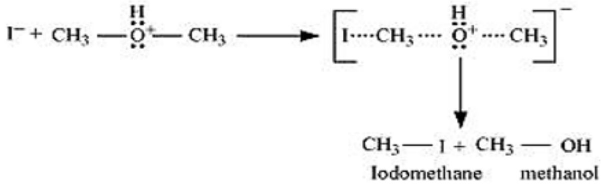
$$CH_3CHO + CH_3CH_2CHO \xrightarrow[(ii)\ Heat]{(i)\ dil\ NaOH} CH_3CH{=}CHCHO + CH_3CH_2CH{=}\underset{\substack{|\\ CH_3}}{C} - CHO + CH_3CH{=}\underset{\substack{|\\ CH_3}}{C} - CHO + CH_3CH_2CH{=}CHCHO$$

28. The mechanism of the reaction of HI with methoxymethane involves the following steps:

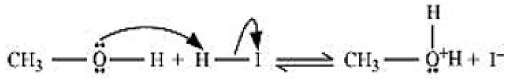
Step1: Protonation of methoxymethane:



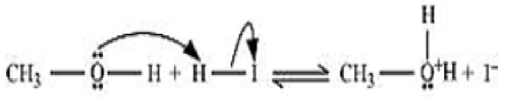
Step2: Nucleophilic attack of I$^-$:



Step3: When HI is in excess and the reaction is carried out at a high temperature, the methanol formed in the second step reacts with another HI molecule and gets converted to methyl iodide



$I^- + CH_3-\overset{+}{O}H_2 \longrightarrow CH_3-I + H_2O$



$I^- + CH_3 - OH_2 \longrightarrow CH_3 - I + H_2O$

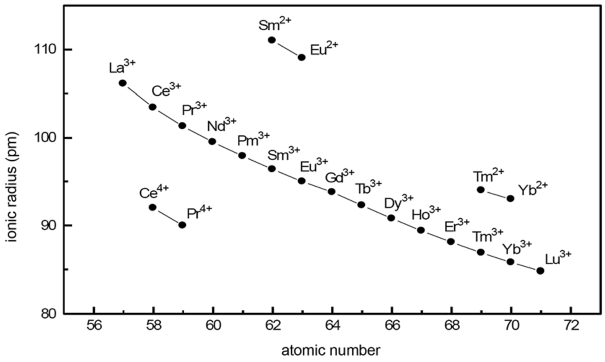
OR

i. $KMnO_4$/KOH(alkaline $KMnO_4$)
ii. Cu/573 K (Hot reduced copper)
iii. Br_2(aq)(Bromine water)

Section D

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

The f-block consists of the two series, lanthanoids (the fourteen elements following lanthanum) and actinoids (the fourteen elements following actinium). Because lanthanum closely resembles the lanthanoids. The chemistry of the actinoids is much more complicated. The complication arises partly owing to the occurrence of a wide range of oxidation states in these elements and partly because their radioactivity creates special problems in their study. The overall decrease in atomic and ionic radii from lanthanum to lutetium (the lanthanoid contraction) is a unique feature in the chemistry of the lanthanoids. In the lanthanoids, La(II) and Ln(III) compounds are predominant species.



(i) Copper exhibits +1 oxidation state more frequently i.e., Cu^{1+} because of its electronic configuration $3d^{10}4s^1$. It can easily lose $4s^1$ electron to give stable $3d^{10}$ configuration.

OR

Because of stronger metallic bonding and high enthalpies of atomization.

(ii) The ability of O_2 to stabilize higher oxidation states exceeds that of fluorine because oxygen can form multiple bonds with metals.

(iii) Due to lanthanoid contraction in second series after lanthanum, the atomic radii of elements of second and third series become almost same and hence show similarities in properties.

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

Many chemical and biological processes depend on osmosis, the selective passage of solvent molecules through the porous membrane from a dilute solution to a more concentrated one. The osmotic pressure π depends on molar concentration of the solution (π = CRT). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

Osmosis is the major mechanism, for transporting water upward in the plants. Transpiration is the leaves supports the transport mechanism of water. The osmotic pressure of seawater is about 30 atm; this is the pressure that must be applied to the seawater (separated from pure water using a semi-permeable membrane) to get drinking water.

(i) A plant cell gets shrink when it is kept in a hypertonic solution.

(ii) 1.2% sodium chloride solution is hypertonic with respect to 0.9% sodium chloride solution or blood cells. When blood cells are placed in this solution, water flows out of the cells and they shrink due to loss of water by osmosis.

(iii)When the external pressure applied becomes more than the osmotic pressure of the solution, then the solvent molecules from the solution pass through the semipermeable membrane to the solvent side. This process is called reverse osmosis.

OR

In an upward direction, osmosis helps in the transportation of water in a plant.

Section E

31. Attempt any five of the following:

(i) It dissolves blood clots and used in the treatment of heart diseases.

(ii) Milk, carrot

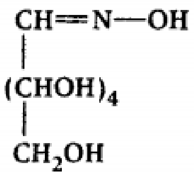
(iii)Cyclic compound containing element other than carbon i.e.,N, S, O at ring position are called heterocyclic bases.

(iv)Primary structure of proteins tells about the sequence in which various amino acids are linked with each other.

(v) Vitamin A

(vi)Keratin and Myosin

(vii)D-glucose on reaction with NH_2OH (hydroxylamine) yield glucose oxime.



$$\begin{array}{l} CH{=}N{-}OH \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array}$$

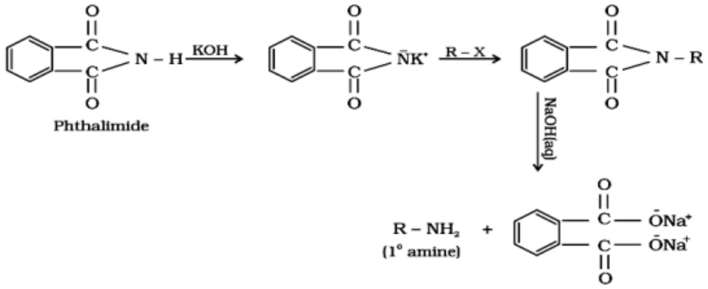
32. I. i. Aniline gets protonated and is deactivated/Aniline on protonation forms anilinium ion which is meta-directing therefore it give good amount of m-nitroaniline.

ii. Due to combination of inductive effect and solvation effect.

iii. Ammonolysis of alkyl halide is not a good method to prepare pure primary amine because it forms a mixture of amines that is difficult to separate.

II. i. $R - NH_2 + CHCl_3 + NaOH \rightarrow RNC + 3NaCl + H_2O$

ii.



OR

i. Aniline is a Lewis base and forms a salt with Lewis acid.

Aniline being a Lewis base reacts with Lewis acid ($AlCl_3$)to form a salt.

$$C_6H_5NH_2 + AlCl_3 \longrightarrow C_6H_5\overset{+}{N}H_2AlCl_3^-$$

As a result, N acquires a positive charge so, it acts as a strong deactivating group for electrophilic substitution reaction. Thus, aniline does not undergo Friedel-Crafts reaction.

ii. In aqueous solution, basic nature depends on + I-effect, H-bonding, and steric-effect.

The combined effect shows that $(CH_3)_2{\cdot}NH$ is more basic than $(CH_3)_3{\cdot}N$ as H-bonding is more in case of $(CH_3)_2{\cdot}NH$ than in $(CH_3)_3N$, which predominates over the stability due to +I- effect of three $-CH_3$ groups.

iii. Large pK_b value means a weak base

In aniline, the lone pair of electrons on N-atom is delocalized over the benzene ring. As a result, electron density on the nitrogen decreases and electrons are not available for donation. In contrast, in CH_3-NH_2, +I effect of -CH_3 group increases the electron density on the N-atom. Therefore, aniline is a weaker base than methylamine and hence, its pKb value is higher than that of methylamine.

33. a. $K[Cr(H_2O)_2\}(C_2O_4)_2].3H_2O$

The IUPAC name = Potassium diaquadioxalatochromate (III) trihydrate.

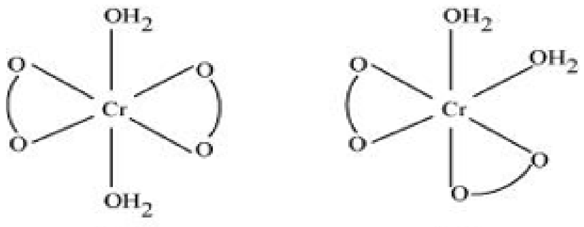
The Oxidation state of chromium = 3

Electronic configuration: $3d^3 : {t_{2g}}^3$

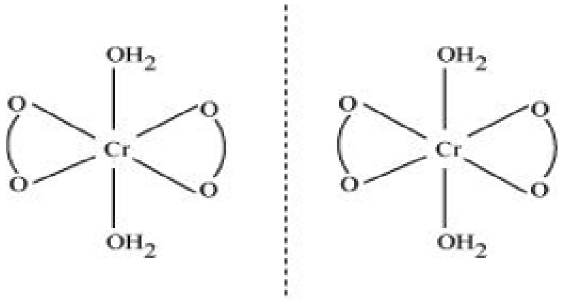
Coordination number od compound = 6

Shape: octahedral

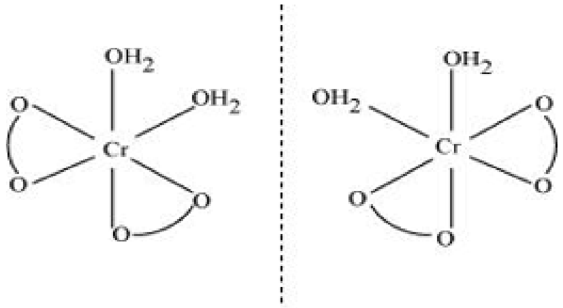
Stereochemistry:



Trans Cis



Trans is optically inactive



Cis is optically active

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

$= \sqrt{3\,(3+2)}$

$= \sqrt{15} \sim 3.87BM$

b. $[Co(NH_3)_5Cl]\,Cl_2$

The IUPAC name: Pentaamminechloridocobalt(III) chloride

The oxidation state of Co = +3

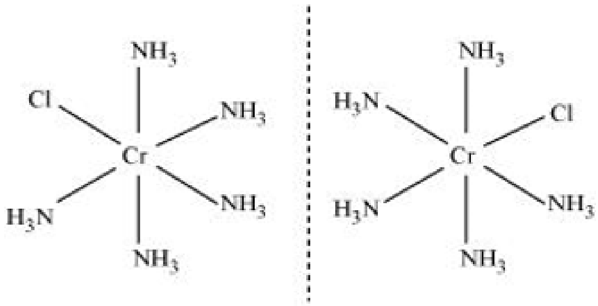
Coordination number of compound = 6

Shape: octahedral.

Electronic configuration:

$d^6 : {t_{2g}}^6$

Stereochemistry:



2 isomers

Magnetic Moment = 0

c. $CrCl_3(py)3$

The IUPAC name: Trichloridotripyridinechromium (III)

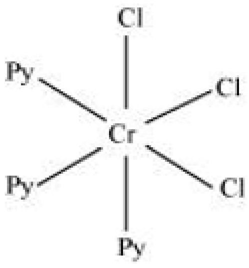
The oxidation state of chromium = +3

Electronic configuration for$d^3 = {t_{2g}}^3$

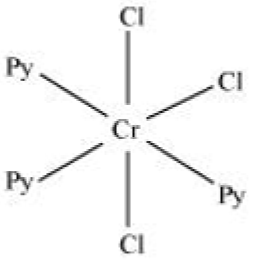
Coordination number of compound = 6

Shape: octahedral.

Stereochemistry:



Facial isomer



Meriodional isomer

Both isomers are optically active. Therefore, a total of 4 isomers exist. Magnetic moment,

$\mu = \sqrt{n\left(n+2\right)} = \sqrt{3\left(3+2\right)}$

$= \sqrt{15} \sim 3.87BM$

d. $Cs\left[FeCl_4\right]$

The IUPAC name : Caesium tetrachloroferrate (III)

The oxidation state of Fe = +3

Electronic configuration of $d^6 = {e_g}^2{t_{2g}}^3$

Coordination number of compound = 4

Shape: tetrahedral

Stereochemistry: optically inactive

Magnetic moment:

$\mu = \sqrt{n\left(n+2\right)} = \sqrt{5\left(5+2\right)}$

$= \sqrt{35} \sim 6BM$

e. $K_4[Mn(CN)_6]$

The IUPAC name = Potassium hexacyanomanganate (II)

The oxidation state of manganese = +2

Electronic configuration:$d^{5+} : {t_{2g}}^5$

Coordination number of compound = 6

Shape: octahedral.

Stereochemistry: optically inactive Magnetic moment,$\mu = \sqrt{n\left(n+2\right)}$

$= \sqrt{1\left(1+2\right)} = \sqrt{3}$

= 1.732

OR

a. The IUPAC name of $[Pt\ (NH_3)_2\ Cl(NO_2]$ is Diamminechloridonitrito-N-platinum(II).

b. The IUPAC name of $K_3\ [Cr\ (C_2O_4)_3]$ is Potassium trioxalatochromate(III).

c. The IUPAC name of $[CoCl_2(en)_2]Cl$ is Dichloridobis (ethane-1,2-diamine)cobalt(III) chloride.

d. The IUPAC name of $[Co(NH_3)_5(CO_3)]Cl$ is Pentaamminecarbonatocobalt(III) chloride.

e. The IUPAC name of Hg $[Co(SCN)_4]$ is Mercury (I) tetrathiocyanatocobaltate(III).