

**Class XII Session 2024-25**  
**Subject - Chemistry**  
**Sample Question Paper - 6**

**Time Allowed: 3 hours**

**Maximum Marks: 70**

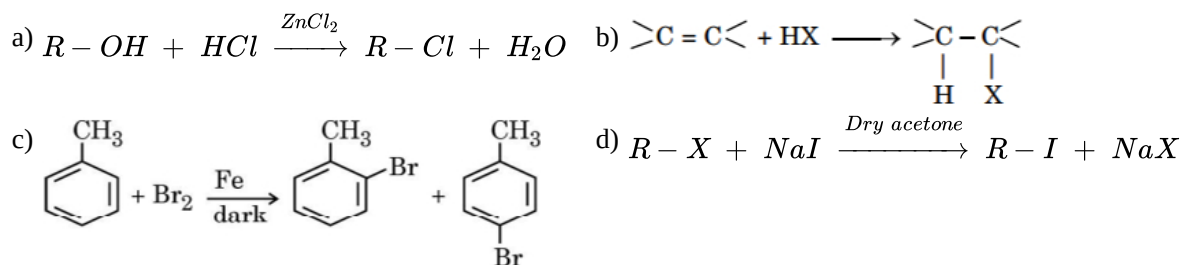
### General Instructions:

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 reactions is a halogenated exchange reaction:



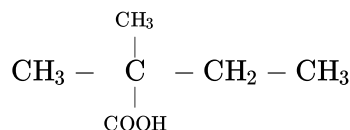
2. The major component of starch is:

- a) amylopectin                      b) water  
c) amylose                          d) glucose

3. An organic compound X is oxidized by using acidified  $\text{K}_2\text{Cr}_2\text{O}_7$ . The product obtained reacts with Phenylhydrazine but does not answer the silver mirror test. The possible structure of X is:

- a)  $(\text{CH}_3)_2\text{CHOH}$   
c)  $\text{CH}_3\text{CHO}$
- b)  $(\text{CH}_4)_2\text{CH}_3\text{OH}$   
d)  $\text{CH}_3\text{CH}_2\text{OH}$

4. What is the correct IUPAC name of the given compound?



- a) 2-Carboxyl-2-methylbutane      b) 2-Ethyl-2-methylpropanoic acid

c) 3-Methylbutane carboxylic acid

d) 2,2-Dimethylbutanoic acid

5. The slope in the plot of  $\log \frac{[R]_0}{[R]}$  vs. time for a first order reaction is [1]

a) -k

b)  $\frac{-k}{2.303}$ c)  $\frac{+k}{2.303}$ 

d) +k

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

Column I	Column II
(a) Osmotic Pressure.	(i) Cottrell's method.
(b) Relative lowering of vapour pressure.	(ii) Rast's method.
(c) Elevation in boiling point.	(iii) Ostwald and Walker's method.
(d) Depression in freezing point.	(iv) Berkeley and Hartley's method.

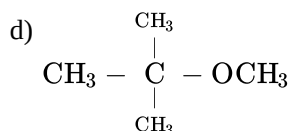
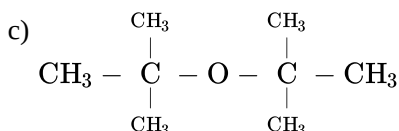
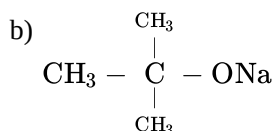
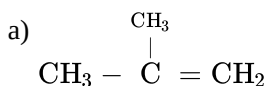
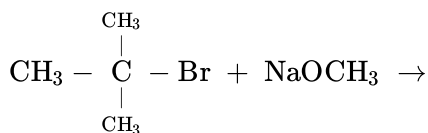
a) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii).

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

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

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

7. Major product formed in the following reaction [1]



8. The product of oxidation of  $\text{I}^-$  with  $\text{MnO}_4^-$  in acidic medium is: [1]

a)  $\text{I}_2$ b)  $\text{IO}_3^-$ c)  $\text{IO}^-$ d)  $\text{IO}_4^-$ 

9. When 10 g of radioactive isotope is reduced to 1.25 g in 12 years, the half life period of the isotope is [1]

a) 4 years

b) 24 years

c) 16 years

d) 8 years

10. Which of the following compounds will give butanone on oxidation with alkaline  $\text{KMnO}_4$  solution? [1]

a) Butan-2-ol

b) Both Butan-2-ol and Butan-1-ol

c) Butan-1-ol

d) Butan-3-ol

11. Which of the following alcohols will not undergo oxidation? [1]

a) Butan-2-ol

b) 2-Methylbutan-2-ol

c) Butanol

d) 3-Methylbutan-2-ol

12. When Benzene diazonium chloride reacts with phenol, it forms a dye. This reaction is called [1]

- a) Coupling reaction
- b) Diazotisation reaction
- c) Acetylation reaction
- d) Condensation reaction

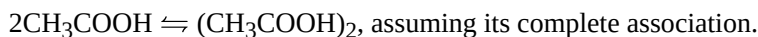
13. **Assertion (A):** Mg is not present in the enamel of human teeth. [1]  
**Reason (R):** Mg is an essential element for the biological functions of humans.
- a) Both A and R are true and R is the correct explanation of A.
  - b) Both A and R are true but R is not the correct explanation of A.
  - c) A is true but R is false.
  - d) A is false but R is true.
14. **Assertion (A):** Formaldehyde cannot be prepared by Rosenmund's reduction. [1]  
**Reason (R):** Acid chlorides can be reduced into aldehydes with hydrogen in boiling xylene using palladium or platinum as a catalyst supported on barium sulphate. This is known as Rosenmund's reduction.
- 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):** Boiling point of alkyl halides increases with an increase in molecular weight. [1]  
**Reason (R):** Boiling point of alkyl halides is in the order  $RI > RB > RCl > RF$ .
- 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):** With  $Br_2 - H_2O$ , phenol gives 2,4,6-tribromophenol but with  $Br_2 - CS_2$  it gives 4-bromophenol as the major product. [1]  
**Reason (A):** In water ionization of phenol is enhanced but in  $CS_2$ , it is greatly suppressed.
- 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. a. On the basis of crystal field theory, write the electronic configuration for  $d^4$  with a strong field ligand for which  $\Delta_0 > P$ . [2]  
 b. A solution of  $[Ni(H_2O)_6]^{2+}$  is green but a solution of  $[Ni(CO)_4]$  is colourless. Explain.  
 [Atomic number : Ni = 28]
18. Explain why do transition elements shows discrepancy in the variation of atomic radii. [2]
19. **Answer the following:** [2]
- (a) Why in the redox titration of  $KMnO_4$  versus oxalic acid do we heat oxalic acid solution before starting the titration? [1]
  - (b) What are the units of rate of a reaction? [1]
20. i. What is the relationship between Molarity and Normality? [2]  
 ii. One litre of water at N.T.P. dissolves 0.08 g of nitrogen. Calculate the amount of nitrogen that can be dissolved in four litres of water at  $0^\circ C$  and at a pressure of 1520 mm.

OR

a. Find the value of van't Hoff factor for acetic acid in benzene as per the given equation:



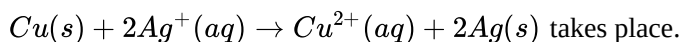
b. Osmotic pressure of a solution containing 3.5 g of dissolved protein in 0.05 L of a solution is 0.035 atm at 310 K.

Calculate the molar mass of the protein. ( $R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$ )

21. Compound A was prepared by oxidation of compound B with alkaline  $\text{KMnO}_4$ . Compound A on reduction with lithium aluminium hydride gets converted back to compound B. When compound A is heated with compound B in the presence of  $\text{H}_2\text{SO}_4$  it produces fruity smell of compound C to which family the compounds A, B and C belong to? [2]

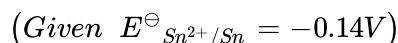
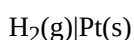
### Section C

22. a. Write the formulation for the galvanic cell in which the reaction [3]



Identify the cathode and the anode reactions in it.

b. Write Nernst equation and calculate the emf of the following cell:  $\text{Sn}(s) | \text{Sn}^{2+}(0.04\text{M}) || \text{H}^+(0.02\text{M}) |$



23. The decomposition of  $\text{NH}_3$  on platinum surface is zero order reaction. What are the rates of production of  $\text{N}_2$  and  $\text{H}_2$  if  $k = 2.5 \times 10^{-4} \text{ mol}^{-1} \text{ L s}^{-1}$ ? [3]

24. How can diethyl ether be prepared from [3]

i. ethyl iodide

ii. ethyl alcohol?

Why is the boiling point of an ether lower than that of the isomeric alcohols.

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 aldehyde.

iii. Bromination of phenol to 2,4,6-tribromophenol.

iv. Benzyl alcohol to benzoic acid.

v. Dehydration of propan-2-ol to propene.

vi. Butan-2-one to butan-2-ol.

25. An organic compound (A) (molecular formula  $\text{C}_8\text{H}_{16}\text{O}_2$ ) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but-1-ene. Write equations for the reactions involved. [3]

26. How long will it take an electric current of 0.15 A to deposit all the copper from 500 ml of 0.15 M copper sulphate solution? [3]

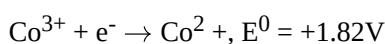
27. How the following conversions can be carried out? [3]

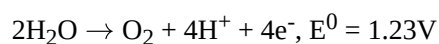
i. 2-Bromopropane to 1-bromopropane

ii. Chloroethane to butane

iii. Benzene to diphenyl

28. On the basis of the following data, explain why  $\text{Co}^{3+}$  is not stable in aqueous solution? [3]

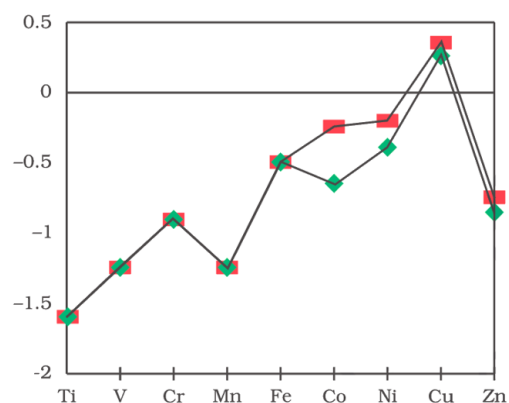




### Section D

29. Read the following text carefully and answer the questions that follow: [4]

The unique behaviour of Cu, having a positive  $E^\circ$  accounts for its inability to liberate  $\text{H}_2$  from acids. Only oxidising acids (nitric and hot concentrated sulphuric) react with Cu, the acids being reduced. The stability of the half-filled d sub-shell in  $\text{Mn}^{2+}$  and the completely filled  $d^{10}$  configuration in  $\text{Zn}^{2+}$  are related to their  $E^\circ$  values, whereas  $E^\circ$  for Ni is related to the highest negative  $\Delta_{\text{hyd}}H^\circ$ . An examination of the  $E^\circ_{(\text{M}^{3+}/\text{M}^{2+})}$  values the low value for Sc reflects the stability of  $\text{Sc}^{3+}$  which has a noble gas configuration. The comparatively high value for Mn shows that  $\text{Mn}^{2+}(d^5)$  is particularly stable, whereas a comparatively low value for Fe shows the extra stability of  $\text{Fe}^{3+}(d^5)$ . The comparatively low value for V is related to the stability of  $\text{V}^{2+}$  (half-filled  $t_{2g}$  level).



- Why Zn has high value for  $\text{M}^{3+}/\text{M}^{2+}$  Standard Electrode Potentials? (1)
- Transition metals, despite high  $E^\circ$  oxidation, are poor reducing agents. Justify. (1)
- Why is  $\text{Cr}^{2+}$  reducing and  $\text{Mn}^{3+}$  oxidising when both Cr and Mn have  $d^4$  configuration? (2)

OR

Why  $\text{Cu}^{2+}$  is more stable than  $\text{Cu}^+$ ? (2)

30. Read the following text carefully and answer the questions that follow: [4]

In order to overcome the scarcity of drinking water in a remote village in Gujarat, Arnav and Aariv two young entrepreneurs still in their high school, have developed a unique water purifier that is capable of converting sea water into drinking water. It works on the principle of concentration difference between two solutions.

- Name the phenomenon/process based on which this product is made? (1)
- How difference in concentration of solutions help in converting sea water into drinking water? (1)
- What arrangement they must have created in their product to covert sea water into drinking water? (2)

OR

Equimolar solutions of NaCl and glucose are not isotonic. Why? (2)

### Section E

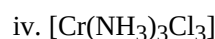
31. Attempt any five of the following: [5]

- Differentiate between [1]
  - Nucleotide and Nucleoside
  - Amylose and Amylopectin
- Write a reaction which shows that all the carbon atoms in glucose are linked in a straight chain. [1]
- Write two differences between DNA and RNA. [1]
- Amino acids can be classified as  $\alpha$ -,  $\beta$ -,  $\gamma$ -,  $\delta$ - and so on depending upon the relative position of [1]

the amino group with respect to the carboxyl group. Which type of amino acids forms a polypeptide chain in proteins?

- (e) What are any two good sources of vitamin A? [1]  
(f) What is anomeric carbon? [1]  
(g) What is the difference between a glycosidic linkage and a peptide linkage? [1]

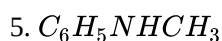
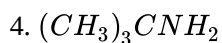
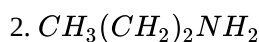
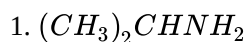
32. Specify the oxidation numbers of the metals in the following coordination entities: [5]



OR

What is crystal field splitting energy? How does the magnitude of  $\Delta_0$  decide the actual configuration of d-orbitals in a coordination entity?

33. Write IUPAC names of the following compounds and classify them into primary, secondary and tertiary amines. [5]



OR

A colorless substance 'A' ( $\text{C}_6\text{H}_7\text{N}$ ) is sparingly soluble in water and gives a water-soluble compound 'B' on treating with a mineral acid. On reacting with  $\text{CHCl}_3$  and alcoholic potash 'A' produces an obnoxious smell due to the formation of compound 'C'. The reaction of 'A' with benzene sulphonyl chloride gives compound 'D' which is soluble in alkali. With  $\text{NaNO}_2$  and  $\text{HCl}$ , 'A' forms compound 'E' which reacts with phenol in alkaline medium to give an orange dye 'F'. Identify compounds 'A' to 'F'.

# Solution

## Section A

- (d)  $R-X + NaI \xrightarrow{\text{Dry acetone}} R-I + NaX$   
**Explanation:**  $R-X + NaI \xrightarrow{\text{Dry acetone}} R-I + NaX$
- (a) amylopectin  
**Explanation:** Starch is a polymer of  $\alpha$ -glucose and consists of two components - Amylose and Amylopectin. Amylose is water-soluble component which constitutes about 15-20% of starch. Amylopectin is insoluble in water and constitutes about 80-85% of starch. Thus, Amylopectin is the major component of starch.
- (a)  $(CH_3)_2CHOH$   
**Explanation:** Secondary alcohol on oxidation forms ketone which reacts with hydrazine but doesn't give a silver mirror test.
- (d) 2,2-Dimethylbutanoic acid  
**Explanation:** 2,2-Dimethylbutanoic acid
- (c)  $\frac{+k}{2.303}$   
**Explanation:** First order of reaction is  $\frac{+k}{2.303}$ .
- (a) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii).  
**Explanation:** (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii).
- (a)  $CH_3 - \overset{\overset{CH_3}{|}}{C} = CH_2$   
**Explanation:**  $(CH_3)_3C-Br + Na-O-Me \longrightarrow CH_3 - \overset{\overset{CH_3}{|}}{C} = CH_2 + NaBr + CH_3OH$   
iso-butene  
Tert-halide with strong base favours elimination reaction not the substitution reaction.
- (a)  $I_2$   
**Explanation:** Iodine is liberated from potassium iodide.  
 $10I^- + 2MnO_4^- + 16H^+ \longrightarrow 2Mn^{2+} + 8H_2O + 5I_2$
- (a) 4 years  
**Explanation:** Radioactivity follows 1st order kinetics.  
 $k = \frac{2.303}{t} \log \frac{a}{a-x}$   
 $k = \frac{2.303}{12} \log \frac{10}{1.25}$   
 $k = 0.1919 \log 8$   
 $k = 0.1919 \times \log 2^3$   
 $k = 0.1919 \times 3 \times \log 2 = 0.575 \times 0.3010 = 0.173 \text{ yr}^{-1}$   
now,  
 $t_{1/2} = \frac{0.693}{0.173} = 4.005 \text{ yrs} \simeq 4 \text{ yrs}$
- (a) Butan-2-ol  
**Explanation:**  $CH_3CH_2\overset{\overset{OH}{|}}{C}HCH_3 \xrightarrow[\text{KMnO}_4]{\text{alk}} CH_3CH_2COCH_3$  Butan-2-ol converted to butanone  
Bu tan -2-ol  
Bu tan one
- (b) 2-Methylbutan-2-ol  
**Explanation:** 2-Methylbutan-2-ol will not undergo oxidation.

12. (a) Coupling reaction

**Explanation:** The reaction is known as Coupling reaction.

13.

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

**Explanation:** Enamel is the hardest substance in the human body and contains the highest percentage of minerals, with water and organic material composing the rest. The primary mineral is hydroxyapatite, which is crystalline calcium phosphate. Magnesium is not present in human enamel. However, magnesium is an essential mineral for human health. Magnesium is a cofactor for more than 300 enzyme systems and is involved in both aerobic and anaerobic energy generation and in glycolysis, either directly as an enzyme activator or as part of the magnesium-ATP complex. Magnesium is required for mitochondria to carry out oxidative phosphorylation. It plays a role in regulating potassium fluxes and in the metabolism of calcium.

14.

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

**Explanation:** HCHO cannot be prepared by Rosenmund's reduction because formyl chloride is unstable at room temperature.

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

**Explanation:** The greater the molecular mass, the stronger the van der Waals' forces of attraction and hence higher is the melting point/boiling point.

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

**Explanation:** Both assertion and reason are true and reason is the correct explanation of assertion.

### Section B

17. a. If  $\Delta_0 > P$ , then on the basis of crystal field theory the electronic configuration of the  $d^4$  ion will be  $t_{2g}^4 e_g^0$  as it is associated with strong field and low spin situation.
- b.  $H_2O$  is a weak field ligand in  $[Ni(H_2O)_6]^{2+}$ . As a result,  $Ni^{2+}$  has unpaired electrons. In this compound, d-electrons from the lower energy level can be stimulated to the higher energy level, implying that a d-d transition is possible. As a result,  $[Ni(H_2O)_6]^{2+}$  appears green, whereas  $[Ni(CO)_4]$  is colourless due to the absence of an unpaired electron in the complex. CO is a strong field ligand that produces electron pairing.
18. As we move from left to right in a series from Sc to Mn atomic radii decreases. This decrease occurs because of increase in nuclear charge that occurs. After Mn, electron pairing occurs so shielding effect of d orbitals increases which try to increase the size. From Fe to Ni size almost remains constant because of two factors playing role simultaneously i.e nuclear charge effect as well as shielding effect. After Ni, size increases from Cu to Zn, because Cu and Zn have completely filled d orbital so shielding effect plays dominant role.
19. Answer the following:
- (i) The reaction in redox titration between  $KMnO_4$  and oxalic acid is very slow. By raising the temperature we can increase the rate of reaction.
- (ii) The units of rate of a reaction are  $\text{mol L}^{-1} \text{s}^{-1}$ . In gaseous reaction the unit of rate of reaction is  $\text{atm s}^{-1}$ .
20. i. Molarity (M)  $\times$  Molecular mass of solute  
= Normality (N)  $\times$  Equivalent mass of solute
- ii. Solubility of gas ( $C_1$ ) = 0.08 g /litre
- $P_1 = 760 \text{ mm}$
- $P_2 = 1520 \text{ mm}$
- Solubility of gas ( $C_2$ ) at pressure  $P_2 = ?$
- By Henry's law,
- $$\frac{C_1}{C_2} = \frac{P_1}{P_2}$$
- $$C_2 = \frac{C_1 \times P_2}{P_1} = \frac{0.08 \times 1520}{760} = 0.16 \text{ g/litre}$$
- $\therefore$  Solubility of nitrogen in 4 litres of water  
=  $0.16 \times 4 = 0.64 \text{ g}$

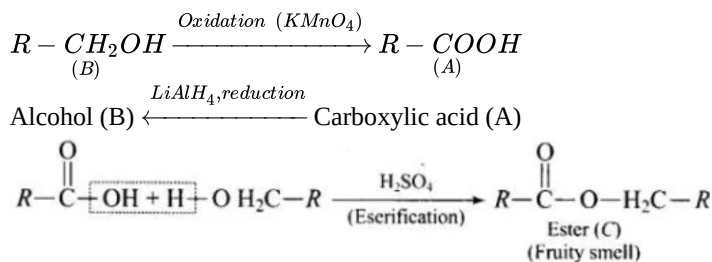
OR

- a. 0.5 ( in case of dimer)



$$\begin{aligned} \text{b. } M &= \frac{wRT}{PV} \\ &= \frac{3.5 \times 0.0821 \times 310}{0.035 \times 0.05} \\ &= 50902 \text{ g mol}^{-1} \end{aligned}$$

21. Compound (A) is carboxylic acid (R-COOH), (B) is an alcohol (R-CH<sub>2</sub>OH) and (C) is an ester (RCH<sub>2</sub>-COOR)



### Section C

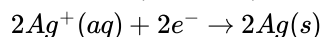
22. a. We have

$$E^\ominus_{(Cu^{2+}/Cu)} = 0.34V \text{ and } E^\ominus_{(Ag^+/Ag)} = 0.80V$$

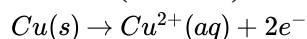
Standard emf of Cu is less than Ag, therefore it is strong reducing agent and is oxidised. Therefore Cu acts as Anode and Ag acts as Cathode.

Half cell reactions are:

At Cathode (Reduction):

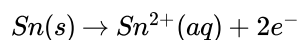


At Anode (Oxidation):

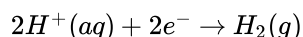


b. The reactions are :

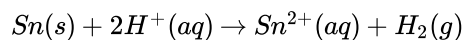
At Anode:



At Cathode:



Full cell reaction:



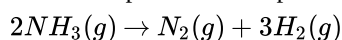
Standard emf of the cell is:

$$\begin{aligned} E_{cell}^0 &= E_{H^+/H_2}^0 - E_{Sn^{2+}/Sn}^0 \\ &= 0 - (-0.14)V \\ &= +0.14V \end{aligned}$$

For this reaction n=2 moles of electrons. Using Nernst equation,

$$\begin{aligned} E_{cell} &= 0.14 - \frac{0.0591}{2} \log \frac{[Sn^{2+}]}{[H^+]^2} \\ &= 0.14 - \frac{0.0591}{2} \log \frac{0.04}{(0.02)^2} \\ &= 0.14 - \frac{0.0591}{2} \log \frac{4}{100} \times \frac{100}{2} \times \frac{100}{2} \\ &= 0.14V - 0.0591V \\ &= 0.0809V \end{aligned}$$

23. The decomposition of on platinum surface is represented by the following equation.



$$\text{Therefore, Rate} = -\frac{1}{2} \frac{d[NH_3]}{dt} = \frac{d[N_2]}{dt} = \frac{1}{3} \frac{d[H_2]}{dt}$$

However, it is given that the reaction is of zero order.

$$-\frac{1}{2} \frac{d[NH_3]}{dt} = \frac{d[N_2]}{dt} = \frac{1}{3} \frac{d[H_2]}{dt} = k$$

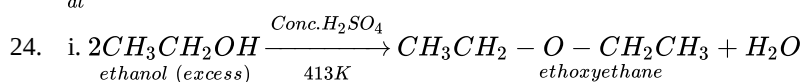
$$\text{Therefore, } k = 2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

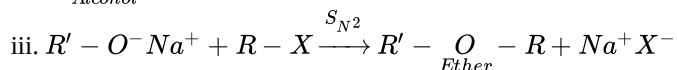
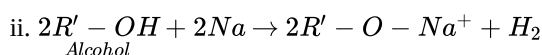
Hence, the rate of production of N<sub>2</sub> is

$$\frac{d[N_2]}{dt} = 2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

And, the rate of production of H<sub>2</sub> is

$$\frac{d[H_2]}{dt} = 3 \times 2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1} = 7.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$



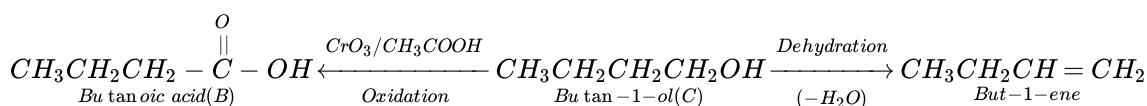
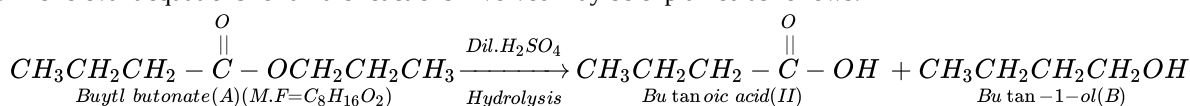


**Boiling points:** Ethers are isomeric with monohydric alcohols but their boiling points are much lower than those of the isomeric alcohols. This is due to the reason that unlike alcohols, ethers do not form hydrogen bonds. As a result ethers do not show molecular association and hence have lower boiling point than corresponding alcohols.

OR

- Acidified potassium permanganate
- Pyridinium chlorochromate (PCC)
- Bromine water
- Acidified potassium permanganate
- 85% phosphoric acid
- $NaBH_4$  or  $LiAlH_4$

25. The relevant equations for all the reactions involved may be explained as follows:



26. You have mols in

500 ml of 0.15 M  $CuSO_4$  solution contains

$$\frac{500 \times 0.15}{1000} = 0.075 \text{ mole of Cu}$$

$$\text{Mass of Cu} = 0.075 \times 63.5 = 4.7625 \text{ g}$$

$$\text{Eq. Wt. of Cu} = \frac{63.5}{2} = 31.75$$

$$m = Z \times I \times t$$

$$4.7625 = \frac{31.75}{96500} \times 0.15 \times t$$

$$t = \frac{4.7625 \times 96500}{31.75 \times 0.15} = 96500 \text{ sec}$$

$$= \frac{96500}{60 \times 60} = 26.80 \text{ hours.}$$

27. i. 2-Bromopropane to 1-bromopropane

a. alc KOH heat

b. HBr peroxide.

ii. Chloroethane to butane

Na wurtz reaction

iii. Benzene to diphenyl

a. Bromine, ferric bromide

b. Na Dry ether fitting reaction

28. Adding the two half reactions, e.m.f. comes out to positive.

$$\text{emf} = E_{\text{cathode}} - E_{\text{anode}}$$

$$\text{emf} = 1.82 - 1.23 = +0.59$$

This means that Co (III) in aqueous solution has the tendency to change to Co (II). Hence, Co (III) is not stable in aqueous solution.

#### Section D

29. i. Due to the removal of an electron from the stable  $d^{10}$  configuration of  $Zn^{2+}$ .

ii. Transition metals despite having high  $E^\circ$  oxidation, are poor reducing agents because of their high heat of vaporization, high ionisation energies and low heats of hydration.

iii.  $Cr^{2+}$  is reducing as its configuration changes from  $d_4$  to  $d_3$ , the having a half-filled  $t_{2g}$  level. On the other hand, the change from  $Mn^{3+}$  to  $Mn^{2+}$  results in the half-filled ( $d_5$ ) configuration which has extra stability.

OR

The Stability of  $\text{Cu}^{2+}$  is more than  $\text{Cu}^+$  as stability depends on the hydration energy of the ions when they bond to the water molecules. The  $\text{Cu}^{2+}$  ion has a greater charge density than  $\text{Cu}^+$  ion and thus forms much stronger bonds releasing more energy.

30. i. The product is based on the phenomenon of Reverse Osmosis between solutions of two different concentration.  
 ii. When solutions of two different concentration are separated by a semipermeable membrane and excess pressure is applied on the solution of higher concentration, solvent flow from higher concentration to lower concentration. This is called Reverse Osmosis and same can be used to treat seawater and convert into drinking water.  
 iii. Following arrangement must have been made:
- Use of a semipermeable membrane.
  - Separate Compartment having seawater and Drinking Water separated by semipermeable membrane.
  - Excess pressure applied in compartment having sea water.

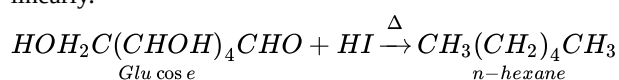
**OR**

$\text{NaCl}$  is an electrolyte and gets dissociated to two ions ( $\text{Na}^+$  and  $\text{Cl}^-$ ) and exerts almost double osmotic pressure than glucose which is a non-electrolyte and does not dissociate.

### Section E

31. Attempt any five of the following:

- Nitrogenous base linked with pentose sugar called as nucleoside while Nucleoside linked with phosphate group is called as nucleotide.
  - Amylose is water soluble while amylopectin is water insoluble.
- On prolonged heating with  $\text{HI}$ , glucose gives n-hexane which suggest that all the six carbon atoms in glucose are linked linearly.



(iii)	<b>DNA</b>	<b>RNA</b>
	Double stranded	Single stranded
	Thymine base is present	Uracil base is present

(iv)  $\alpha$ -Amino acid,  $\text{R} - \underset{\text{NH}_2}{\text{CH}} - \text{COOH}$  forms a polypeptide chain in the proteins.

(v) Milk, carrot

(vi) An anomeric carbon can be identified as the carbonyl carbon (of the aldehyde or ketone functional group) in the open-chain form of the sugar. It can also be identified as the carbon bonded to the ring oxygen and a hydroxyl group in the cyclic form.

(vii) **Glycosidic linkage:** It is the linkage which joins two monosaccharides through oxygen atom. It is present in carbohydrates.

**Peptide Linkage:** It is the linkage which joins two amino acids through - CO-NH- bond. It is present in proteins.

32. i.  $[\text{Co}(\text{H}_2\text{O})(\text{CN})(\text{en})_2]^{2+}$  Let the oxidation number of Co be x. The charge on the complex is +2.

$$\begin{array}{ccccccc} [\text{Co} & (\text{H}_2\text{O}) & (\text{CN}) & (\text{en})_2 ]^{2+} \\ \downarrow & \downarrow & \downarrow & \downarrow \\ x & + & 0 & + & (-1) & + & 2(0) = +2 \end{array}$$

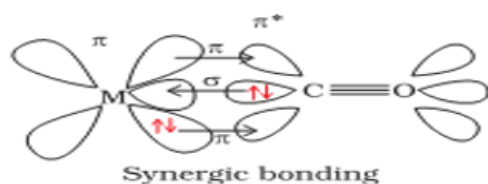
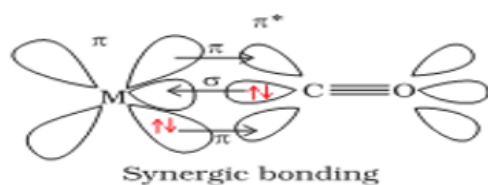
$$x - 1 = +2$$

$$x = +3$$

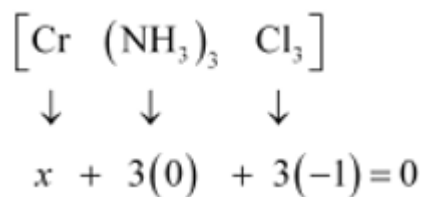
ii.  $[\text{Pt}(\text{Cl})_4]^{2-}$  Let the oxidation number of Pt be x. The charge on the complex is -2.

$$\begin{array}{ccc} [\text{Pt} & (\text{Cl})_4 ]^{2-} \\ \downarrow & \downarrow \\ x & + & 4(-1) = -2 \end{array}$$

$$x = +2$$



iv.



$$x - 3 = 0$$

$$x = +3$$

OR

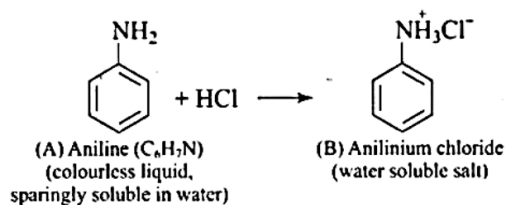
The degenerate d-orbitals (in a spherical field environment) split into two levels i.e.,  $e_g$  and  $t_{2g}$  in the presence of ligands. The splitting of the degenerate levels due to the presence of ligands is called the crystal-field splitting while the energy difference between the two levels ( $e_g$  and  $t_{2g}$ ) is called the crystal-field splitting energy. It is denoted by  $\Delta_0$ . After the orbitals have split, the filling of the electrons takes place. After 1 electron (each) has been filled in the three  $t_{2g}$  orbitals, the filling of the fourth electron takes place in two ways. It can enter the  $e_g$  orbital (giving rise to  $t_{2g}^3 e_g^1$  like electronic configuration) or the pairing of the electrons can take place in the  $t_{2g}$  orbitals (giving rise to  $t_{2g}^4 e_g^0$  like electronic configuration). If the  $\Delta_0$  value of a ligand is less than the pairing energy (P), then the electrons enter the  $e_g$  orbital. On the other hand, if the  $\Delta_0$  value of a ligand is more than the pairing energy (P), then the electrons enter the  $t_{2g}$  orbital.

33. i. Propan-2-amine ( $1^\circ$  amine)  
 ii. Propan-1-amine ( $1^\circ$  amine)  
 iii. N-Methyl-1-methylethanamine ( $2^\circ$  amine)  
 iv. 2-Methylpropan-2-amine ( $1^\circ$  amine)  
 v. N-Methylbenzamine or N-methylaniline ( $2^\circ$  amine)

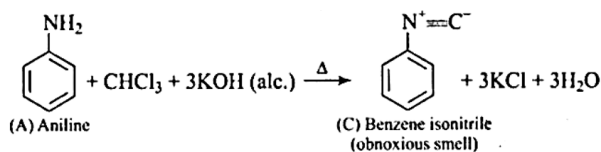
OR

Substance 'A'-Aniline, 'B'-Anilinium chloride, 'C'-Benzene isonitrile, 'D'-N-phenylbenzene sulphonamide, 'E'-benzene diazonium chloride, 'F'-p- hydroxyazobenzene.

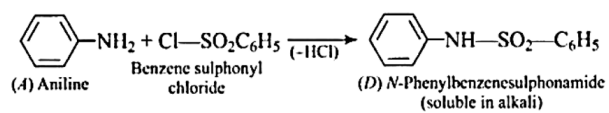
i.



ii.



iii.



iv.

