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

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

General Instructions:

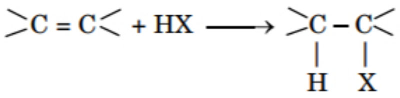
Read the following instructions carefully.

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.**

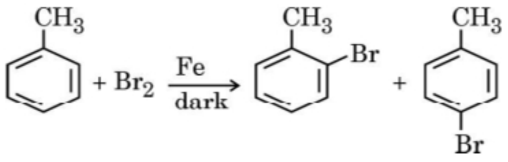
Section A

1. Which of the following reactions is a halogenated exchange reaction: **[1]**

a) $R - OH + HCl \xrightarrow{ZnCl_2} R - Cl + H_2O$

b) 

$>C=C< + HX \longrightarrow >\underset{H}{C}-\underset{X}{C}<$

c) 

d) $R - X + NaI \xrightarrow{Dry\ acetone} R - I + NaX$

2. The major component of starch is: **[1]**

a) amylopectin

b) water

c) amylose

d) glucose

3. An organic compound X is oxidized by using acidified $K_2Cr_2O_7$. The product obtained reacts with Phenyl hydrazine but does not answer the silver mirror test. The possible structure of X is: **[1]**

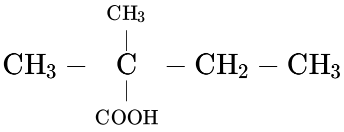
a) $(CH_3)_2CHOH$

b) $(CH_4)_2CH_3OH$

c) CH_3CHO

d) CH_3CH_2OH

4. What is the correct IUPAC name of the given compound? **[1]**



$CH_3 - \overset{CH_3}{\underset{COOH}{C}} - CH_2 - CH_3$

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]**

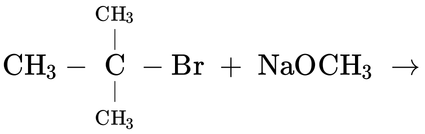
a) -k
b) $\frac{-k}{2.303}$
c) $\frac{+k}{2.303}$
d) +k

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.

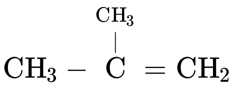
a) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii).
b) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i).
c) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv).
d) (a) - (i), (b) - (iv), (c) - (ii), (d) - (iii).

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



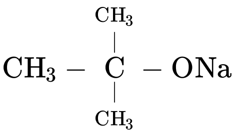
$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-Br + NaOCH_3 \rightarrow$$

a)



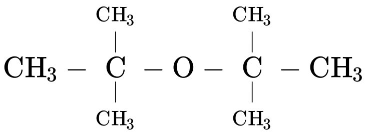
$$CH_3-\overset{CH_3}{C}=CH_2$$

b)



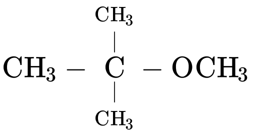
$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-ONa$$

c)



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

d)



$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-OCH_3$$

8. The product of oxidation of I^- with MnO_4^- in acidic medium is: **[1]**

a) I_2
b) IO_3^-
c) IO^-
d) 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 $KMnO_4$ 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^oC 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:
$2CH_3COOH \rightleftharpoons (CH_3COOH)_2$, assuming its complete association.

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 L atm K^{-1} mol^{-1})

21. Compound A was prepared by oxidation of compound B with alkaline $KMnO_4$. 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 H_2SO_4 it produces fruity smell of compound C to which family the compounds A, B and C belong to? **[2]**

Section C

22. **[3]**
a. Write the formulation for the galvanic cell in which the reaction
$Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$ takes place.
Identify the cathode and the anode reactions in it.

b. Write Nernst equation and calculate the emf of the following cell: Sn(s) | Sn^{2+}(0.04M) || H^+(0.02M) | H_2(g)|Pt(s)
$\left(Given\ \ E^{\ominus}{}_{Sn^{2+}/Sn} = -0.14V\right)$

23. The decomposition of NH_3 on platinum surface is zero order reaction. What are the rates of production of N_2 and H_2 if $k = 2.5 \times 10^{-4}\ mol^{-1}\ L\ s^{-1}$? **[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 $C_8H_{16}O_2$) 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

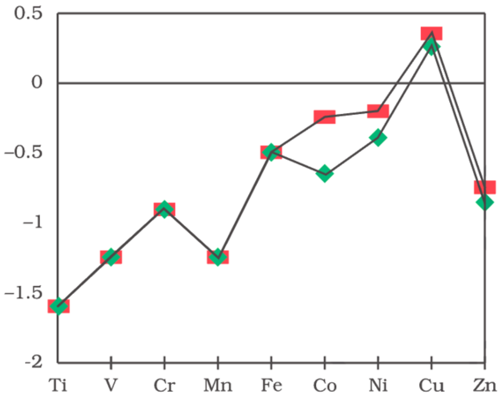
28. On the basis of the following data, explain why Co -(III) is not stable in aqueous solution? **[3]**
$Co^{3+} + e^- \rightarrow Co^2$ +, $E^0 = +1.82V$

$2H_2O \rightarrow O_2 + 4H^+ + 4e^-, E^0 = 1.23V$

Section D

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

The unique behaviour of Cu, having a positive E° accounts for its inability to liberate 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 Mn^{2+} and the completely filled d^{10} configuration in Zn^{2+} are related to their E° values, whereas E° for Ni is related to the highest negative $\Delta_{hyd}H°$. An examination of the $E^o_{(M^{3+}/M^{2+})}$ values the low value for Sc reflects the stability of Sc^{3+} which has a noble gas configuration. The comparatively high value for Mn shows that $Mn^{2+}(d^5)$ is particularly stable, whereas a comparatively low value for Fe shows the extra stability of Fe^{3+} (d^5). The comparatively low value for V is related to the stability of V^{2+} (half-filled t_{2g} level).



i. Why Zn has high value for M^{3+}/M^{2+} Standard Electrode Potentials? (1)

ii. Transition metals, despite high E° oxidation, are poor reducing agents. Justify. (1)

iii. Why is Cr^{2+} reducing and Mn^{3+} oxidising when both Cr and Mn have d^4 configuration? (2)

OR

Why Cu^{2+} is more stable than 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.

i. Name the phenomenon/process based on which this product is made? (1)

ii. How difference in concentration of solutions help in converting sea water into drinking water? (1)

iii. 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]**

(a) Differentiate between **[1]**

a. Nucleotide and Nucleoside

b. Amylose and Amylopectin

(b) Write a reaction which shows that all the carbon atoms in glucose are linked in a straight chain. **[1]**

(c) Write two differences between DNA and RNA. **[1]**

(d) 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]**

i. $[Co(H_2O)(CN)(en)_2]^{2+}$

ii. $[Pt(Cl)_4]^{2-}$

iii. $K_3[Fe(CN)_6]$

iv. $[Cr(NH_3)_3Cl_3]$

OR

What is crystal field splitting energy? How does the magnitude of Δ_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]**

1. $(CH_3)_2CHNH_2$
2. $CH_3(CH_2)_2NH_2$
3. $CH_3NHCH(CH_3)_2$
4. $(CH_3)_3CNH_2$
5. $C_6H_5NHCH_3$

OR

A colorless substance ‘A’ (C_6H_7N) is sparingly soluble in water and gives a water-soluble compound ‘B’ on treating with a mineral acid. On reacting with 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 $NaNO_2$ and 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

1\.

(d) $R - X + NaI \xrightarrow{Dry\ acetone} R - I + NaX$

Explanation: $R - X + NaI \xrightarrow{Dry\ acetone} R - I + NaX$

2\. **(a)** amylopectin

Explanation: Starch is a polymer of α-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.

3\. **(a)** $(CH_3)_2CHOH$

Explanation: Secondary alcohol on oxidation forms ketone which reacts with hydrazine bus doesn't gives a silver mirror test.

4\.

(d) 2,2-Dimethylbutanoic acid

Explanation: 2,2-Dimethylbutanoic acid

5\.

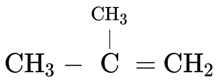
(c) $\frac{+\mathrm{k}}{2.303}$

Explanation: First order of reaction is $\frac{+\mathrm{k}}{2.303}$.

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

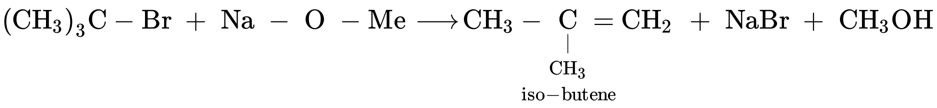
Explanation: (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii).

7\. **(a)**



$\mathrm{CH_3} - \overset{\overset{\displaystyle \mathrm{CH_3}}{|}}{\mathrm{C}} = \mathrm{CH_2}$

Explanation:



$(\mathrm{CH_3})_3\mathrm{C} - \mathrm{Br} + \mathrm{Na} - \mathrm{O} - \mathrm{Me} \longrightarrow \underset{\text{iso}-\text{butene}}{\mathrm{CH_3} - \underset{\underset{\displaystyle \mathrm{CH_3}}{|}}{\mathrm{C}} = \mathrm{CH_2}} + \mathrm{NaBr} + \mathrm{CH_3OH}$

Tert-halide with strong base favours elimination reaction not the substitution reaction.

8\. **(a)** I_2

Explanation: Iodine is liberated from potassium iodide.

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

9\. **(a)** 4 years

Explanation: Radioactivity follow 1st order kinetics.

$k = \frac{2.303}{t}\log\frac{a}{a-x}$

$k = \frac{2.303}{12}\log\frac{10}{1.25}$

$k = 0.1919 \log 8$

$k = 0.1919 \times \log 2^3$

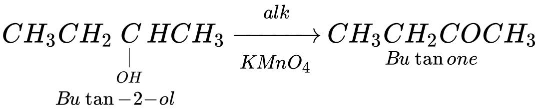
$k = 0.1919 \times 3 \times \log 2 = 0.575 \times 0.3010 = 0.173 \text{yr}^{-1}$

now,

$t_{1/2} = \frac{0.693}{0.173} = 4.005 yrs \simeq 4 yrs$

10\. **(a)** Butan-2-ol

Explanation:



$\underset{Bu\tan-2-ol}{CH_3CH_2\underset{\underset{OH}{|}}{C}HCH_3} \xrightarrow[KMnO_4]{alk} \underset{Bu\tan one}{CH_3CH_2COCH_3}$ Butan-2-ol converted to butanone

11\.

(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 $\Delta_0 > \mathrm{P}$, 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 mol L^{-1} s^{-1}. In gaseous reaction the unit of rate of reaction is atm s^{-1}.

20. i. Molarity (M) × Molecular mass of solute

= Normality (N) × Equivalent mass of solute

ii. Solubility of gas (C_1) = 0.08 g /litre

P_1 = 760 mm

P_2 = 1520 mm

Solubility of gas (C_2) at pressure P_2 = ?

By Henry's law,

$$\frac{C_1}{C_2} = \frac{P_1}{P_2}$$

$$C_2 = \frac{C_1 \times P_2}{P_1} = \frac{0.08 \times 1520}{760} = 0.16 \text{ g/ litre}$$

∴ Solubility of nitrogen in 4 litres of water

= 0.16 × 4 = 0.64 g

OR

a. 0.5 (in case of dimer)

b. $M = \frac{wRT}{\Pi V}$

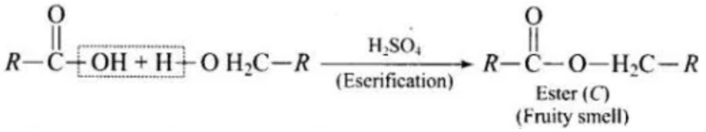
$= \frac{3.5 \times 0.0821 \times 310}{0.035 \times 0.05}$

$= 50902 \text{ g mol}^{-1}$

21. Compound (A) is carboxylic acid (R-COOH), (B) is an alcohol (R - CH_2OH) and (C) is an ester (RCH_2 - COOR)

$$\underset{(B)}{R - CH_2OH} \xrightarrow{Oxidation\ \ (KMnO_4)} \underset{(A)}{R - COOH}$$

$$\text{Alcohol (B)} \xleftarrow{LiAlH_4, reduction} \text{Carboxylic acid (A)}$$



$$R-\overset{O}{\overset{\|}{C}}-\boxed{OH + H}-O\,H_2C-R \xrightarrow[\text{(Escrification)}]{H_2SO_4} \underset{\substack{\text{Ester }(C)\\ \text{(Fruity smell)}}}{R-\overset{O}{\overset{\|}{C}}-O-H_2C-R}$$

Section C

22. a. We have

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

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):

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

At Anode (Oxidation):

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

b. The reactions are :

At Anode:

$$Sn(s) \rightarrow Sn^{2+}(aq) + 2e^{-}$$

At Cathode:

$$2H^{+}(aq) + 2e^{-} \rightarrow H_2(g)$$

Full cell reaction:

$$Sn(s) + 2H^{+}(aq) \rightarrow Sn^{2+}(aq) + H_2(g)$$

Standard emf of the cell is:

$$E^{0}_{cell} = E^{0}_{H^{+}/H_2} - E^{0}_{Sn^{2+}/Sn}$$

= 0 - (-0.14)V

= + 0.14V

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

$$E_{cell} = 0.14 - \frac{0.0591}{2} \log \frac{[Sn^{2}+]}{[H^{+}]^{2}}$$

$$= 0.14 - \frac{0.0591}{2} \log \frac{0.04}{(0.02)^{2}}$$

$$= 0.14 - \frac{0.0591}{2} \log \frac{4}{100} \times \frac{100}{2} \times \frac{100}{2}$$

= 0.14 V - 0.0591 V

= 0.0809 V

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

$$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$$

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.

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

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

Hence, the rate of production of N_2 is

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

And, the rate of production of H_2 is

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

24. i. $\underset{ethanol\ (excess)}{2CH_3CH_2OH} \xrightarrow[413K]{Conc.H_2SO_4} \underset{ethoxyethane}{CH_3CH_2 - O - CH_2CH_3} + H_2O$

ii. $2\underset{Alcohol}{R'-OH}+2Na\rightarrow 2R'-O-Na^{+}+H_2$

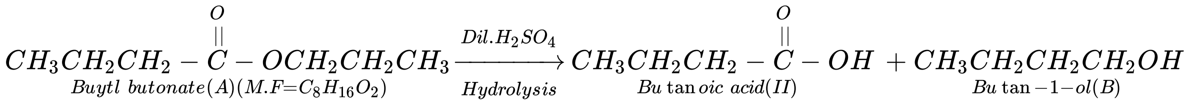
iii. $R'-O^{-}Na^{+}+R-X\xrightarrow{S_{N}2}R'-\underset{Ether}{O}-R+Na^{+}X^{-}$

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.

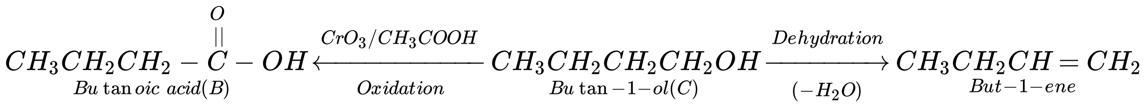
OR

i. Acidified potassium permanganate
ii. Pyridinium chlorochromate (PCC)
iii. Bromine water
iv. Acidified potassium permanganate
v. 85% phosphoric acid
vi. $NaBH_4$ or $LiAlH_4$

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



$$\underset{Buytl\ butonate(A)(M.F=C_8H_{16}O_2)}{CH_3CH_2CH_2-\overset{\overset{O}{||}}{C}-OCH_2CH_2CH_3}\xrightarrow[Hydrolysis]{Dil.H_2SO_4}\underset{Bu\tan oic\ acid(II)}{CH_3CH_2CH_2-\overset{\overset{O}{||}}{C}-OH}+\underset{Bu\tan-1-ol(B)}{CH_3CH_2CH_2CH_2OH}$$



$$\underset{Bu\tan oic\ acid(B)}{CH_3CH_2CH_2-\overset{\overset{O}{||}}{C}-OH}\xleftarrow[Oxidation]{CrO_3/CH_3COOH}\underset{Bu\tan-1-ol(C)}{CH_3CH_2CH_2CH_2OH}\xrightarrow[(-H_2O)]{Dehydration}\underset{But-1-ene}{CH_3CH_2CH=CH_2}$$

26. You have mols in

500 ml of 0.15 M $CuSO_4$ solution contains

$\frac{500\times0.15}{1000}$ = 0.075 mole of Cu

Mass of Cu = 0.075×63.5 = 4.7625 g

Eq. Wt. of $Cu=\frac{635}{2}$ = 31.75

$m=Z\times I\times t$

$4.7625=\frac{31.75}{96500}\times0.15\times t$

$t=\frac{4.7625\times96500}{31.75\times0.15}$ = 96500 sec

$=\frac{96500}{60\times60}$ = 26.80 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.

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

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° 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 Cu^{2+} is more than Cu^+ as stability depends on the hydration energy of the ions when they bond to the water molecules. The Cu^{2+} ion has a greater charge density than 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:

  i. Use of a semipermeable membrane.
  ii. Separate Compartment having seawater and Drinking Water separated by semipermeable membrane.
  iii. Excess pressure applied in compartment having sea water.

OR

NaCl is an electrolyte and gets dissociated to two ions (Na^+ and 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:

(i) a. Nitrogeneous base linked with pentose sugar called as nucleoside while Nucleoside linked with phosphate group is called as nucleotide.

b. Amylose is water soluble while amylopectin is water insoluble.

(ii) On prolonged heating with HI, glucose gives n-hexane which suggest that all the six carbon atoms in glucose are linked linearly.

$$\underset{Glu\cos e}{HOH_2C(CHOH)_4CHO} + HI \xrightarrow{\Delta} \underset{n-hexane}{CH_3(CH_2)_4CH_3}$$

(iii)

DNA	RNA
Double stranded	Single stranded
Thymine base is present	Uracil base is present

(iv) α-Amino acid, $R - \underset{NH_2}{\underset{|}{\dot{C}H}} - COOH$ 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. $[Co(H_2O)(CN)(en)_2]^{2+}$ Let the oxidation number of Co be x. The charge on the complex is +2.

$$\begin{array}{llll} [Co & (H_2O) & (CN) & (en)_2]^{2+} \\ \downarrow & \downarrow & \downarrow & \downarrow \\ x \;+ & 0 \;+ & (-1) \;+ & 2(0) \;=+2 \end{array}$$

x -1 = +2

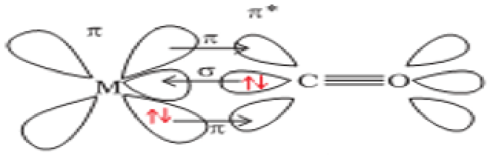
x = +3

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

$$\begin{array}{ll} [Pt & (Cl)_4]^{2-} \\ \downarrow & \downarrow \end{array}$$

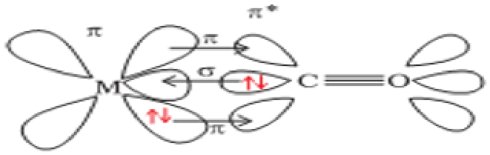
$$x + 4(-1) = -2$$

x = +2



Synergic bonding

iii. $K_3[Fe(CN)_6]$



Synergic bonding

iv.

$$\begin{array}{ccc}[Cr & (NH_3)_3 & Cl_3] \\ \downarrow & \downarrow & \downarrow \\ x & +\ 3(0) & +\ 3(-1)=0\end{array}$$

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 Δ_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 Δ_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 Δ_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^o amine)

ii. Propan-1-amine (1^o amine)

iii. N-Methyl-1-methylethanamine (2^o amine)

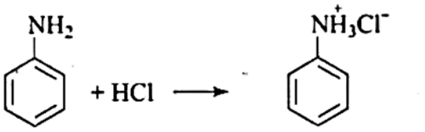
iv. 2-Methylpropan-2-amine (1^o amine)

v. N-Methylbenzamine or N-methylaniline (2^oamine)

OR

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

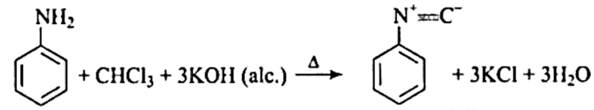
i.



(A) Aniline (C_6H_7N)
(colourless liquid,
sparingly soluble in water)

(B) Anilinium chloride
(water soluble salt)

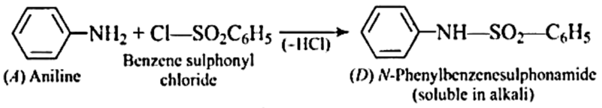
ii.



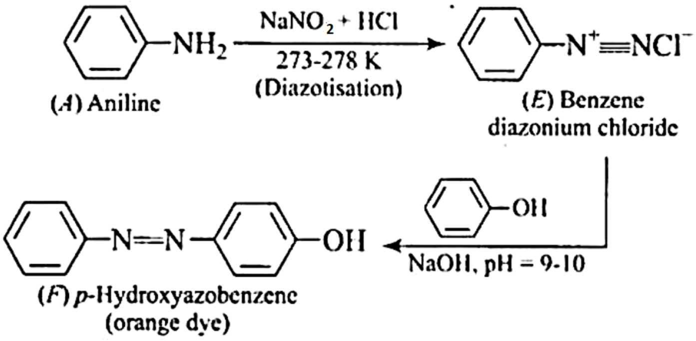
(A) Aniline

(C) Benzene isonitrile
(obnoxious smell)

iii.


NH2 + Cl—SO2C6H5
(-HCl)
NH—SO2—C6H5
(A) Aniline
Benzene sulphonyl chloride
(D) N-Phenylbenzenesulphonamide (soluble in alkali)

iv.


NH2
NaNO2 + HCl
273-278 K
(Diazotisation)
N+≡NCl−
(A) Aniline
(E) Benzene diazonium chloride
OH
NaOH, pH = 9-10
N=N
OH
(F) p-Hydroxyazobenzene (orange dye)