

ion is greater than between neutral molecules

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

| Column I | Column II |
|---------------|---|
| (a) Molarity | (i) $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 10^6$ |
| (b) Molality | (ii) Number of gram moles of a solute per litre of solution |
| (c) Normality | (iii) Number of gram moles of a solute per kg of solvent |
| (d) ppm | (iv) Number of gram equivalent of a solute per litre of solution |

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

7. Chlorine reacts with cold and dilute NaOH to give [1]

- a) NaClO and NaClO₃ b) NaCl and NaClO₃
c) NaCl and NaClO d) NaCl and NaClO₄

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

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

9. The half life of a substance in a first order reaction is 15 min. The rate constant is [1]

- a) $4.62 \times 10^{-2} \text{ min}^{-1}$ b) $6.74 \times 10^{-2} \text{ min}^{-1}$
c) $2.46 \times 10^2 \text{ min}^{-1}$ d) $7.18 \times 10^2 \text{ min}^{-1}$

10. Which of the following does not give Cannizzaro reaction? [1]

- a) (CH₃)₃C - CHO b) (CH₃)₂CH - CHO
c) HCHO d) 

11. The conversion of an alkyl halide into alcohol by aqueous NaOH is classified as [1]

- a) a dehydrohalogenation reaction b) a substitution reaction
c) an addition reaction d) a dehydration reaction

12. Which of the following methods of preparation of amines will give same number of carbon atoms in the chain of amines as in the reactant? [1]

- a) Treatment of amide with bromine in an aqueous solution of sodium hydroxide b) Heating alkylhalide with potassium salt of phthalimide followed by hydrolysis
c) Reaction of nitrite with LiAlH₄ d) Reaction of amide with LiAlH₄ followed by treatment with water

13. **Assertion (A):** Primary structure of proteins gives an idea about the conformation of the molecule. [1]

Reason (R): The differences in chemical and biological properties of various proteins arise due to the difference in primary structure.

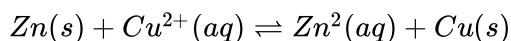
- a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
- c) A is true but R is false. d) A is false but R is true.
14. **Assertion (A):** RCHO, RCOCH₃ and cyclic ketones react with sodium bisulphite. [1]
Reason (R): Crystalline solid derivatives are formed when aldehydes or ketones are shaken with saturated aqueous solution of sodium bisulphite.
- 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):** Aryl halide gives a mixture of o- and p-products. [1]
Reason (R): Aryl halides undergo electrophilic substitutions more readily than benzene.
- 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):** Last traces of moisture in ethanol can be removed by keeping it over sodium wire [1]
Reason (R): Sodium reacts with water but not with ethanol to produce H₂ gas.
- 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) Both A and R are false.

Section B

17. i. What type of isomerism is shown by the complex [Cr(H₂O)₆]Cl₃? [2]
 ii. On the basis of crystal field theory, write the electronic configuration for d⁴ ion if $\Delta_o > P$.
 iii. Write the hybridization and shape of [CoF₆]³⁻. (Atomic number of Co = 27)
18. What is lanthanoid contraction? What is its effect on the chemistry of the elements which follow the lanthanoids? [2]
19. **Answer the following:** [2]
 (a) For a certain reaction large fraction of molecules has energy more than the threshold energy, yet the rate of reaction is very slow. Why? [1]
 (b) State a condition under which a bimolecular reaction is kinetically first-order reaction. [1]
20. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile, non-electrolyte solid weighing 0.5 g when added to 39.0 g of benzene (molar mass 78 g mol⁻¹). Vapour pressure of the solution, then, is 0.845 bar. What is the molar mass of the solid substance? [2]
 OR
 Calculate the osmotic pressure in pascals exerted by a solution prepared by dissolving 1.0 g of polymer of molar mass 185,000 in 450 mL of water at 37°C.
21. Describe how the following conversions can be brought about (any two)? [2]
 i. Cyclohexanol to cyclohexan-1-one.
 ii. Ethyl benzene to benzoic acid.
 iii. Bromobenzene to benzoic acid.

Section C

22. Calculate the equilibrium constant for the reaction. [3]

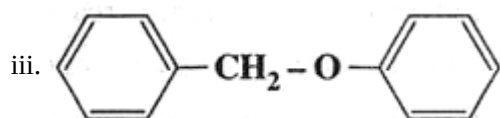
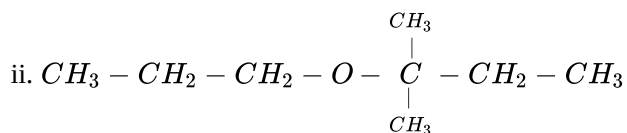
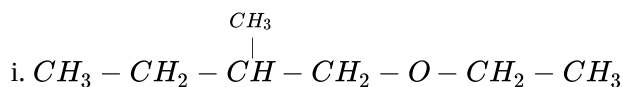


Given: $E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.763\text{V}$

and $E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} = +0.34\text{V}$

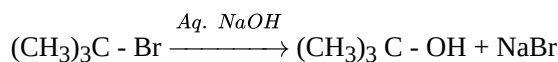
23. Consider a certain reaction $A \rightarrow \text{Products}$ with $k = 2.0 \times 10^{-2} \text{ s}^{-1}$. Calculate the concentration of A remaining after 100 s if the initial concentration of A is 1.0 mol L^{-1} . [3]

24. Give the major products that are formed by heating each of the following ethers with HI. [3]



OR

- i. Write the mechanism of the following $\text{S}_{\text{N}}1$ reaction:



- ii. Write the equation for the preparation of 2-methyl-2-methoxypropane by Williamson synthesis.

25. Arrange the following compounds in the increasing order of their property indicated: [3]

i. Acetaldehyde, Benzaldehyde, Acetophenone, Acetone (Reactivity towards HCN)

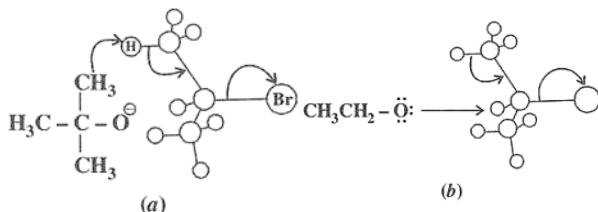
ii. $(\text{CH}_3)_2\text{CHCOOH}$, $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{COOH}$, $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{COOH}$ (Acidic strength)

iii. $\text{CH}_3\text{CH}_2\text{OH}$, CH_3CHO , CH_3COOH (Boiling point)

26. One half-cell in a voltaic cell is constructed from a silver wire dipped in silver nitrate solution of unknown concentration. The other half-cell consists of a zinc electrode in 1.0 M solution of $\text{Zn}(\text{NO}_3)_2$. A voltage of 1.48 V is measured for this cell. Use this information to calculate the concentration of silver nitrate solution. [3]

[Given, $E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.763\text{V}$ and $E_{\text{Ag}^+/\text{Ag}}^{\circ} = +0.80\text{V}$].

27. One of the two figures given below represents substitution and the other represents elimination. Indicate which is substitution and which is elimination. [3]



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

Section D

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

The transition metals when exposed to oxygen at low and intermediate temperatures form thin, protective oxide films of up to some thousands of Angstroms in thickness. Transition metal oxides lie between the extremes of ionic and covalent binary compounds formed by elements from the left or right side of the periodic table. They

range from metallic to semiconducting and deviate by both large and small degrees from stoichiometry. Since d-electron bonding levels are involved, the cations-exist in various valence states and hence give rise to a large number of oxides. The crystal structures are often classified by considering a cubic or hexagonal close-packed lattice of one set of ions with the other set of ions filling the octahedral or tetrahedral interstices. The actual oxide structures, however, generally show departures from such regular arrays due in part to distortions caused by packing of ions of different size and to ligand field effects. These distortions depend not only on the number of d-electrons but also on the valence and the position of the transition metal in a period or group.

- i. Why does copper, which is in first series of transition metal exhibits +1 oxidation state most frequently? (1)
- ii. The lowest oxide of transition metal is basic. Why? (1)
- iii. The variability in oxidation states of d-block different from that of the p-block elements. Explain. (2)

OR

Crystal structure of oxides of transition metals often show defects. Given reason. (2)

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

Aariv Sharma is very fond of a special drink made by his grandmother using different fruits available in their hometown. It has an outstanding taste and also provide great health benefits of natural fruits. He thought of utilizing his grandmother recipe to create a new product in the beverage market that provide health benefits and also contain fizziness of various soft drinks available in the market.

- i. How he can add fizz to the special drink made by his grandmother? (1)
- ii. What is the law stated in the chapter that can help Aariv to make his drink fizzy? (1)
- iii. What precautions he should take while bottling so that his product does not lose fizz during storage and handling across long distances? (2)

OR

The mole fraction of helium in a saturated solution at 20°C is 1.2×10^{-6} . Find the pressure of helium above the solution. Given Henry's constant at 20°C is 144.97 kbar. (2)

Section E

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

- (a) What is the structural feature characterising reducing sugars? [1]
- (b) What type of linkage is present in polysaccharides? [1]
- (c) Give examples of fat soluble vitamins. [1]
- (d) The two strands in DNA are not identical but are complementary. Explain. [1]
- (e) Write uses of B-Complex. [1]
- (f) Name the disaccharide which on hydrolysis gives two molecules of glucose. [1]
- (g) Name purines present in DNA? [1]

32. Write the IUPAC names of the following coordination compounds: [5]

- a. $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NO}_2)]$
- b. $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3]$
- c. $[\text{CoCl}_2(\text{en})_2]\text{Cl}$
- d. $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]\text{Cl}$
- e. $\text{Hg}[\text{Co}(\text{SCN})_4]$

OR

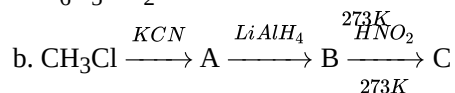
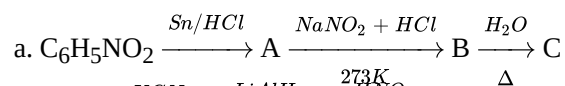
Using Valence bond theory, explain the following in relation to the paramagnetic complex $[\text{Mn}(\text{CN})_6]^{3-}$

- type of hybridisation
- magnetic moment value
- type of complex - inner, outer orbital complex

33. i. Write the structures of main products when benzene diazonium chloride ($\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-$) reacts with the following reagents : [5]

- HBF_4/Δ
- Cu/HBr

ii. Write the structures of A, B and C in the following reactions :



OR

i. Illustrate the following reactions giving suitable example in each case:

- Ammonolysis
- Coupling reaction
- Acetylation of amines

ii. Describe Hinsberg method for the identification of primary, secondary and tertiary amines. Also, write the chemical equations of the reactions involved.

Solution

Section A

1. (a) $C_6H_5CH(C_6H_5)Br$

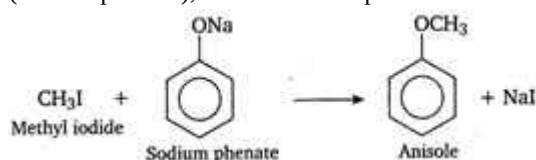
Explanation: $C_6H_5CH(C_6H_5)^+$ carbocation formed is more stable.

2. (d) secondary structure

Explanation: Alpha helices and beta sheets are the two most known secondary structures of protein, As the protein folds into a three-dimensional structure, the secondary structure forms an intermediate.

3. (c) Williamsons reaction

Explanation: The reaction of an alkyl halide with sodium alkoxide to give ether (alkoxy alkane), is known as Williamson's synthesis. In this reaction, an ether (anisole) is prepared by the action of alkyl halide (methyl iodide) on sodium alkoxide (sodium phenate), so it is an example of Williamson's synthesis.



4. (a) Pentan-3-one

Explanation: Pentan-3-one

5. (a) It does not involve bond breaking

Explanation: Ionic reactions do not involve bond breaking, energy is directly used in completing the reaction, therefore they are fast.

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

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

7. (c) $NaCl$ and $NaClO$

Explanation: Chlorine reacts with cold and dilute $NaOH$ to produce a mixture of sodium chloride ($NaCl$) and sodium hypochloride ($NaOCl$).



8. (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.

9. (a) $4.62 \times 10^{-2} \text{ min}^{-1}$

Explanation: for first order reaction

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

10. (b) $(CH_3)_2CH - CHO$

Explanation: $(CH_3)_2CH - CHO$ doesn't give cannizzaro reaction.

11. (b) a substitution reaction

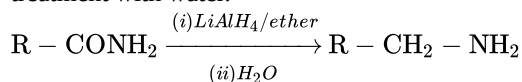
Explanation: Alkyl halides on alkaline hydrolysis (aqueous $NaOH$) get converted into alcohol. This takes place by a nucleophilic substitution reaction where the $-X$ atom is substituted by a nucleophile i.e $-OH$ group. The primary alkyl halides undergo nucleophilic substitution reaction by S_N2 substitution mechanism, while tertiary alkyl halides follow S_N1 substitution mechanism.

12. (a) Treatment of amide with bromine in an aqueous solution of sodium hydroxide

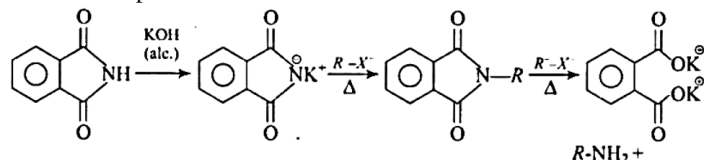
Explanation: Aliphatic and aryl/alkyl primary amines can be prepared by the reduction of the corresponding nitriles with lithium aluminium hydride LiAlH_4 .



Heating alkyl halide with primary, secondary, and tertiary amine can be prepared by reduction of LiAlH_4 ether followed by treatment with water.



Heating alkyl halide with potassium salt of phthalimide followed by hydrolysis produces primary amine. This process is known as Gabriel's phthalimide reaction. The number of carbon atoms in the chain of amines of the product is the same as a reactant.



13. (d) A is false but R is true.

Explanation: The primary structure of a protein gives only the nature of linkages of α -amino acids in a protein chain.

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

Explanation: SO_3^{--} is a large ion. Its addition is possible only under the condition that >C=O grouping is not sterically hindered as is the case for RCHO , RCOCH_3 and cyclic ketones.

15. (c) A is true but R is false.

Explanation: Halogens are somewhat deactivating but o, p-directing. As a result, aryl halides undergo the usual electrophilic substitution reactions less readily than benzene.

16. (d) Both A and R are false.

Explanation:

Last traces of moisture in ethanol cannot be removed by keeping it over sodium wire. Sodium reacts both with H_2O and ethanol.

Section B

17. i. Hydration isomerism
 ii. Electronic configuration is t_{2g}^4
 iii. Hybridization is sp^3d^2 and shape is octahedral.
18. The decrease in atomic and ionic size with increase in atomic number among lanthanoids is called lanthanoid contraction. The elements after lanthanoids closely resemble with the elements exactly above them due to similar ionic size for example Zr and Hf have similar sizes.
19. Answer the following:
- (i) Though the reacting large fraction of molecules may be having energy more than threshold energy, yet they may not be effective due to lack of proper orientation.
- (ii) Let us consider a biomolecular reaction:
 $\text{A} + \text{B} \rightarrow \text{Product}$
 $\text{Rate} = k[\text{A}][\text{B}] \dots(i)$
 When the concentration of [B] is taken in large excess that its concentration hardly change, rate law will become $\text{Rate} = k'[\text{A}]$
 where, $k' = k[\text{B}]$
 The order of reaction will be equal to one.
20. The various quantities known to us are as follows:
 $p_1^0 = 0.850 \text{ bar}$; $p = 0.845 \text{ bar}$; $M_1 = 78 \text{ g mol}^{-1}$; $w_2 = 0.5 \text{ g}$; $w_1 = 39 \text{ g}$

Substituting these values in equation of relative lowering of vapour pressure, we get

$$\frac{0.850 \text{ bar} - 0.845 \text{ bar}}{0.850 \text{ bar}} = \frac{0.5 \text{ g} \times 78 \text{ g mol}^{-1}}{M_2 \times 39 \text{ g}}$$

Therefore, $M_2 = 170 \text{ g mol}^{-1}$

OR

It is given that:

Volume of water, $V = 450 \text{ mL} = 0.45 \text{ L}$

Temperature, $T = (37 + 273) \text{ K} = 310 \text{ K}$

Number of moles of the polymer, $n = \frac{1}{185000} \text{ mol}$

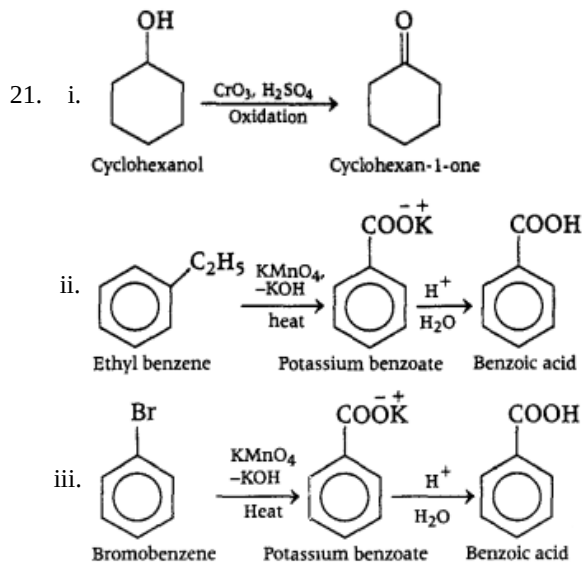
We know that:

$$\text{Osmotic pressure, } \pi = \frac{n}{V} RT$$

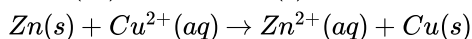
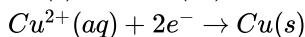
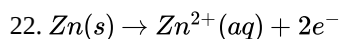
$$= \frac{1}{185000} \text{ mol} \times \frac{1}{0.45} \times 8.314 \times 10^3 \text{ Pa L K}^{-1} \text{ mol}^{-1} \times 310 \text{ K}$$

$$= 30.98 \text{ Pa}$$

$$= 31 \text{ Pa (approximately)}$$



Section C



$$E_{\text{cell}} = E^{\circ}_{\text{Cu}^{2+}/\text{Cu}} - E^{\circ}_{\text{Zn}^{2+}/\text{Zn}}$$

$$= +0.34 \text{ V} - (-0.763 \text{ V})$$

$$= 1.103 \text{ V}$$

$$\log K = \frac{nE^{\circ}}{0.0591}$$

$$= \frac{2 \times 1.103}{0.0591}$$

$$\log K = \frac{2.206}{0.0591} = 37.326$$

$$k = \text{Antilog } 37.326$$

$$= 2.118 \times 10^{37}$$

$$23. k = 2.0 \times 10^{-2} \text{ s}^{-1}$$

$$T = 100 \text{ s}$$

$$[A]_0 = 1.0 \text{ mol L}^{-1}$$

Since the unit of k is s^{-1} , the given reaction is a first order reaction.

$$\text{Therefore, } k = \frac{2.303}{t} \log \frac{[A]_0}{[A]}$$

$$2.0 \times 10^{-2} \text{ s}^{-1} = \frac{2.303}{100} \log \frac{1.0}{[A]}$$

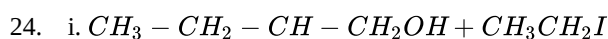
$$2.0 \times 10^{-2} \text{ s}^{-1} = \frac{2.303}{100} (-\log [A])$$

$$-\log [A] = \frac{2.0 \times 10^{-2} \times 100}{2.303}$$

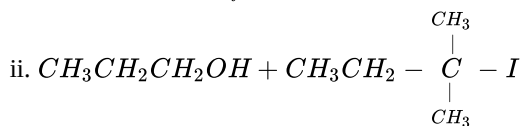
$$[A] = \text{antilog} \left(-\frac{2.0 \times 10^{-2} \times 100}{2.303} \right)$$

$$= 0.135 \text{ mol L}^{-1} \text{ (approximately)}$$

Hence, the remaining concentration of A is 0.135 mol L^{-1} .

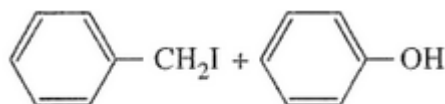


2-Methylbutane-1-ol



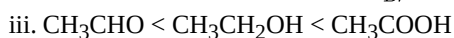
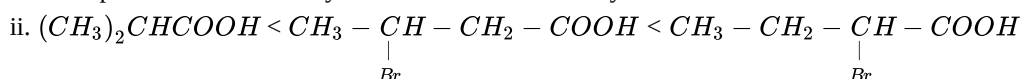
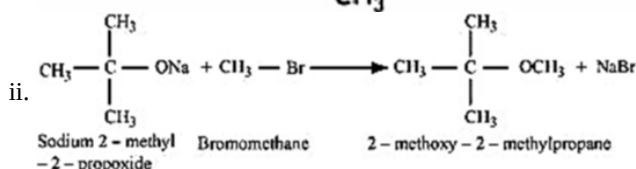
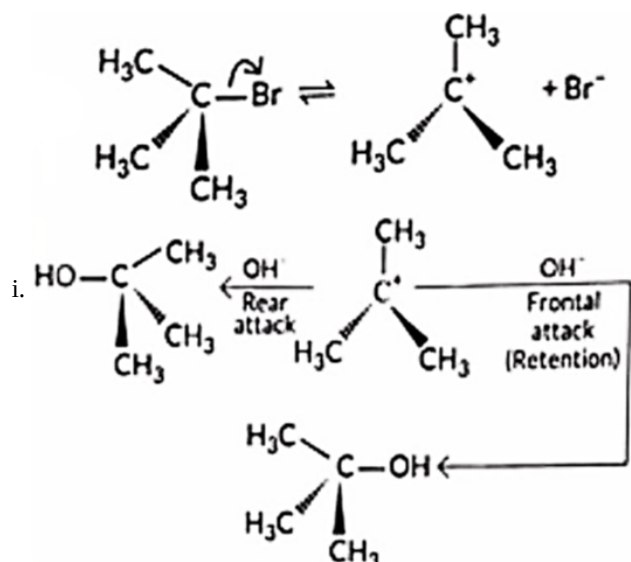
2-Iodo-2-methylbutane

iii.



Benzyl iodide

OR



26. It is clear that, $E_{\text{Zn}^{2+}/\text{Zn}}^\circ = -0.763\text{V} < E_{\text{Ag}^+/\text{Ag}}^\circ = +0.80\text{V}$

Therefore, cell can be represented as $\text{Zn(s)} \mid \text{Zn}^{2+}(\text{aq}) (1\text{M}) \parallel \text{Ag}^+(\text{aq}) \mid \text{Ag(s)}$

$$\therefore E_{\text{Cell}}^\circ = E_{\text{Cathode}}^\circ - E_{\text{Anode}}^\circ = 0.80 - (-0.76) = 1.56; E_{\text{cell}} = 1.48\text{V (given)}$$

By applying Nernst equation, we get

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{0.0591}{2} \log \frac{[\text{Zn}^{2+}]}{[\text{Ag}^+]^2}$$

$$1.48 = 1.56 - \frac{0.0591}{2} \log \frac{1}{[\text{Ag}^+]^2}$$

$$0.08 = 0.0295 \log \frac{1}{[\text{Ag}^+]^2}$$

$$\frac{0.08}{0.0295} = -2 \log [\text{Ag}^+]$$

$$-\frac{0.08}{0.0295 \times 2} = \log [\text{Ag}^+]$$

$$\log [\text{Ag}^+] = -1.356$$

$$[\text{Ag}^+] = \text{Antilog} [-1.356]$$

$$\text{Therefore, } [\text{Ag}^+] = 0.0441 = 4.4 \times 10^{-2} \text{ M}$$

27. a. represents elimination because in this the anion attacks the H and simultaneously Br leaves leading to formation of a double bond.

b. represents substitution as the nucleophile attacks the compound and simultaneously the leaving group leaves.

28. 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]

$$emf = E_{cathode}^0 - E_{anode}^0$$

Section D

29. i. Copper readily loses one electron from its 4s orbital, to form stable 3d electronic configuration.

ii. The lower oxide of transition metal has low oxidation states. This means some of the valence electrons of the metal atoms do not participate in bonding. Thus, they can donate electrons and can behave as bases.

iii. In p-block, lower oxidation state is more stable due to inert pair effect, whereas in d-block elements higher oxidation states are more stable. In d-block, oxidation states differ by one, whereas in p-block, it differs by two.

OR

The actual oxide structures, generally show departures from a regular arrays due in part to distortions caused by packing of ions of different size and to ligand field effects.

30. i. Carbondioxide is a gas which provide fizz and tangy flavour. He can dissolve Carbondioxide gas in the drink.

ii. Henry's law which states that solubility of a gas in liquid is directly proportional to partial pressure of the gas.

iii. Bottles should be sealed under high pressure of CO₂ and capping should be done perfectly to avoid leakage of CO₂ as any loss of partial pressure will result into decrease in solubility.

OR

$$p_{\text{He}} = K_{\text{Hx}} \times X_{\text{He}}$$

$$= (144.97 \times 10^3 \text{ bar}) (1.2 \times 10^{-6})$$

$$= 0.174 \text{ bar}$$

Section E

31. Attempt any five of the following:

(i) The reducing sugars have free aldehydic or ketonic groups.

(ii) Glycosidic linkage

(iii) Fat soluble vitamins are absorbed along with fats in the diet and are stored in body's fatty tissue and in the liver. Vitamin A, D, E and K are fat soluble vitamins.

(iv) In the helical structure of DNA, the two strands are held together by hydrogen bonds between specific pairs of bases. Cytosine forms hydrogen bond with guanine, while adenine forms hydrogen bond with thymine. As a result, the two strands are complementary to each other.

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

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

(vii) Adenine and guanine

32. a. The IUPAC name of [Pt (NH₃)₂ Cl(NO₂)] is Diamminechloridonitrito-N-platinum(II).

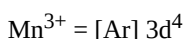
b. The IUPAC name of K₃ [Cr (C₂O₄)₃] is Potassium trioxalatochromate(III).

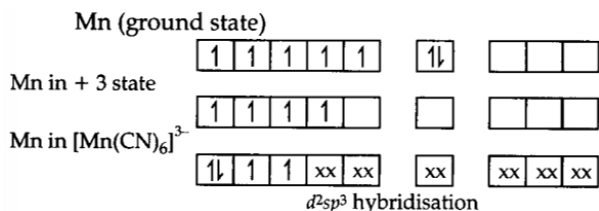
c. The IUPAC name of [CoCl₂ (en)₂]Cl is Dichloridobis (ethane-1,2-diamine)cobalt(III) chloride.

d. The IUPAC name of [Co(NH₃)₅ (CO₃)]Cl is Pentaamminecarbonatocobalt(III) chloride.

e. The IUPAC name of Hg [Co (SCN)₄] is Mercury (I) tetrathiocyanatocobaltate(III).

OR





xx are electrons donated by ligand CN^-

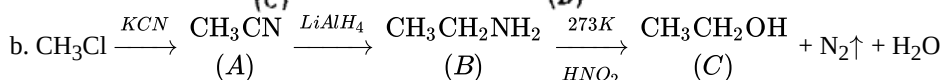
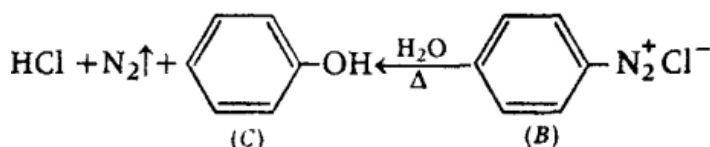
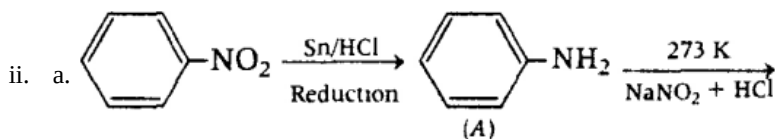
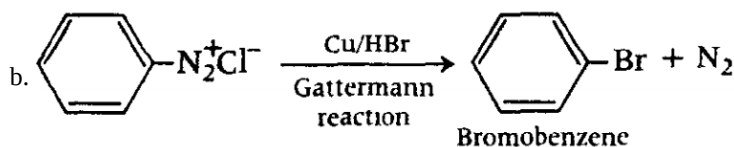
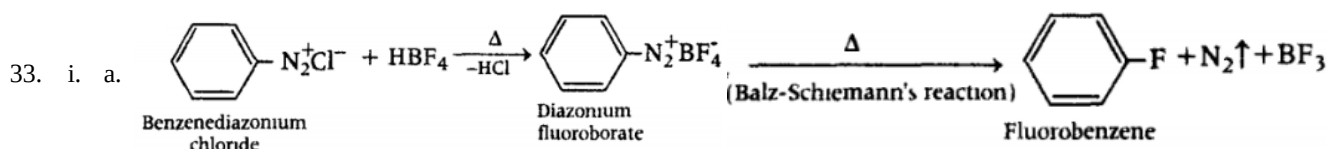
a. Type of hybridisation - d^2sp^3

b. Magnetic moment value

$$= \sqrt{n(n+2)} = \sqrt{2(2+2)} = 2.87 \text{ BM}$$

(n = no. of unpaired electrons)

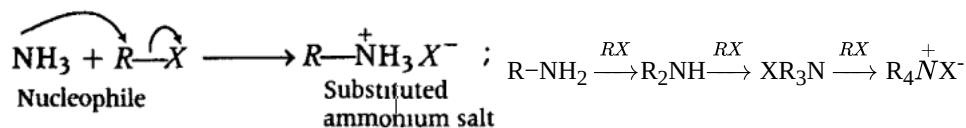
c. Type of complex - inner orbital



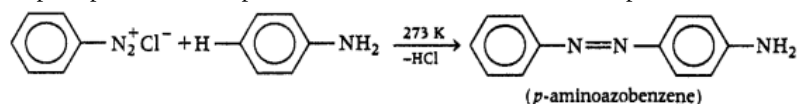
OR

i.

a. **Ammonolysis** The process of cleavage of the C-X bond by ammonia molecule is known as ammonolysis. In this process, an alkyl or benzyl halide on reaction with an ethanolic solution of ammonia undergoes nucleophilic substitution reaction in which halogen atom is replaced by an amino ($-\text{NH}_2$) group. The reaction is carried out in a sealed tube at 373 K. The primary amine thus obtained behaves as a nucleophile and can further react with alkyl halide to form secondary and tertiary amines and further quaternary salts.

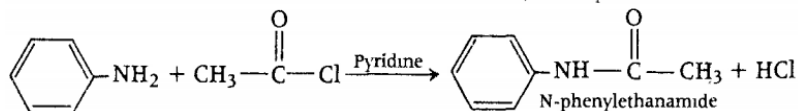
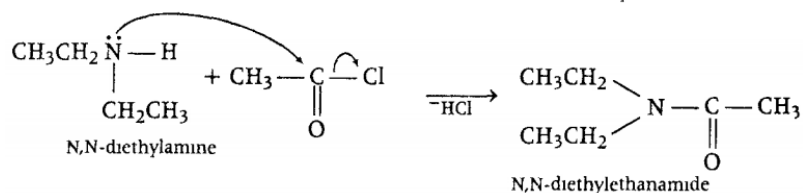
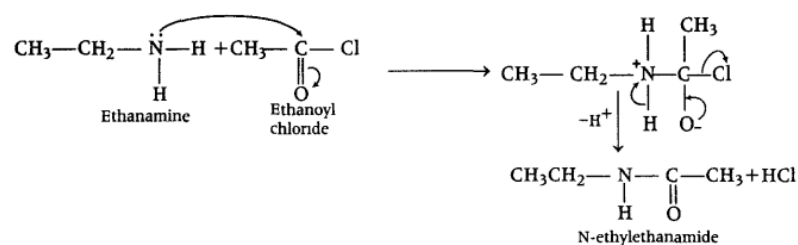


b. **Coupling reaction** Arenediazonium salts react with highly reactive (i.e. electron-rich) aromatic compounds such as aniline, phenols to form brightly coloured azo compounds, $\text{Ar-N}=\text{N-Ar}$. This reaction is called coupling reaction. e.g. Benzene diazonium chloride reacts with aniline in faintly acidic medium (pH 4-5) at 273-278K, in which the molecule at its para-position is coupled with the diazonium salt to form p-aminoazobenzene. This is an example of coupling reaction.



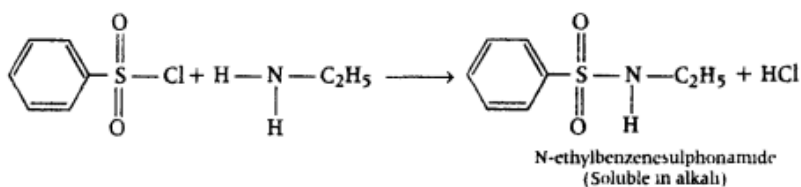
c. **Acetylation of amines** The process of introducing an acetyl group $\left(\text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} - \right)$ into the molecule is called

acetylation of amines.



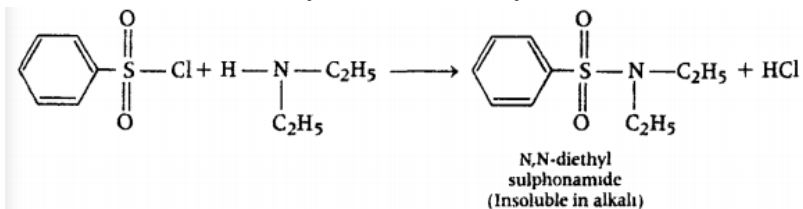
ii. The reaction of primary and secondary amines with benzenesulphonyl chloride ($\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$, known as Hinsberg's reagent to form sulphonamides is known as Hinsberg's method (or reaction). This method (or reaction) is used for separating 1° , 2° and 3° amines.

a. The reaction of benzenesulphonyl chloride with primary amine yields N-ethylbenzenesulphonamide.



The hydrogen attached to N-atom in sulphonamide is strongly acidic due to the presence of strong electron withdrawing sulphonyl group. Hence, it is soluble in alkali.

b. In the reaction with secondary amine, N, N-diethylbenzenesulphonamide is formed.



Since, N, N-diethylbenzenesulphonamide does not contain any hydrogen atom attached to nitrogen atom, it is not acidic and hence, insoluble in alkali.

c. Tertiary amines do not react with benzenesulphonyl chloride, as it doesn't contain replaceable hydrogens.