

Class-XII Session 2022-23  
Subject - Chemistry  
Sample Question Paper - 22  
With Solution

BLUE PRINT

S. No.	Chapter Name	Section-A		Section-B		Section-C		Section-D		Section-E		Total Marks
		(MCQs & A/R) 1 Mark		(VSA) 2 Marks		(SA) 3 Marks		(Case Study) 4 Marks		(LA) 5 Marks		
		Q. No.	Marks	Q. No.	Marks	Q. No.	Marks	Q. No.	Marks	Q. No.	Marks	
1	Solutions	4, 14	2	25	2	26	3					7
2	Electrochemistry	9, 18	2	23	2			32	4			8
3	Chemical Kinetics	5, 16	2	21	2	30. a, b, c	3					7
4	d -and f -Block Elements	10, 17	2	20	2			31	4			8
5	Coordination Compounds	2	1							33	5	6
6	Haloalkanes and Haloarenes	1, 11	2							34	5	7
7	Alcohols, Phenols and Ethers	6	1	22	2	29. a, b, c	3					6
8	Aldehydes, Ketones and Carboxylic Acids	7, 12	2	19, 24	4	27. a, b	2					8
9	Amines	3, 13	2			27. c, 28	4					6
10	Biomolecules	8, 15	2							35	5	7
	Total Marks (Total Questions)	18	18	7	14	5	15	2	8	3	15	70

### General Instructions

Read the following instructions carefully

- (a) There are 35 questions in this question paper with internal choice.
- (b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- (c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
- (d) SECTION C consists of 5 short answer questions carrying 3 marks each.
- (e) SECTION D consists of 2 case-based questions carrying 4 marks each.
- (f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- (g) All questions are compulsory.
- (h) Use of log tables and calculator are not allowed

### SECTION-A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. The process of converting alkyl halides into alcohols involves .....  
 (a) addition reaction (b) substitution reaction (c) dehydrohalogenation (d) rearrangement reaction
2. The type of isomerism present in pentamminenitrochromium (III) chloride is  
 (a) optical (b) linkage (c) ionisation (d) polymerisation
3. Which of the following amines will not give  $N_2$  gas on treatment with nitrous acid ( $NaNO_2 + HCl$ )?  
 (a)  $C_2H_5NH_2$  (b)  $CH_3NH_2$  (c)  $(CH_3)_2CHNH_2$  (d) All will give  $N_2$
4. Which solution has the highest vapour pressure?  
 (a) 0.02 M NaCl at 50 °C (b) 0.03 M sucrose at 15 °C  
 (c) 0.005 M  $CaCl_2$  at 50 °C (d) 0.005 M  $CaCl_2$  at 25 °C
5. The rate constant for a first order reaction whose half life is 480 sec, is :  
 (a)  $1.44 \times 10^{-3} \text{ sec}^{-1}$  (b)  $1.44 \text{ sec}^{-1}$  (c)  $0.72 \times 10^{-3} \text{ sec}^{-1}$  (d)  $2.88 \times 10^{-3} \text{ sec}^{-1}$
6. Which of the following cannot be made by using Williamson's synthesis?  
 (a) Methoxybenzene (b) Benzyl *p*-nitrophenyl ether  
 (c) Methyl tertiary butyl ether (d) Di-*tert*-butyl ether
7. Among the following the strongest acid is  
 (a)  $CH_3COOH$  (b)  $C_6H_5COOH$  (c) *m*- $CH_3OC_6H_4COOH$  (d) *p*- $CH_3OC_6H_4COOH$
8. Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories?  
 (a) A carbohydrate (b) A hormone (c) A co-enzyme (d) An antibiotic
9. What will be the reduction potential for the following half-cell reaction at 298 K?  
 (Given :  $[Ag^+] = 0.1 \text{ M}$  and  $E^\circ_{\text{cell}} = +0.80 \text{ V}$ )  
 (a) 0.741 V (b) 0.80 V (c) -0.80 V (d) -0.741 V
10. For *d*-block elements the first ionization potential is of the order  
 (a)  $Zn > Fe > Cu > Cr$  (b)  $Sc = Ti < V = Cr$  (c)  $Zn < Cu < Ni < Co$  (d)  $V > Cr > Mn > Fe$
11. Which of the following is a primary halide?  
 (a) Isopropyl iodide (b) Secondary butyl iodide (c) Tertiary butyl bromide (d) Neohexyl chloride
12. The cyanohydrin of a compound on hydrolysis gives an optically active  $\alpha$ -hydroxy acid. The compound is?  
 (a) Diethyl ketone (b) Formaldehyde (c) Acetaldehyde (d) Acetone
13. Which one of the following on reduction with lithium aluminium hydride yields a secondary amine?  
 (a) Methyl isocyanide (b) Acetamide (c) Methyl cyanide (d) Nitroethane.
14. Value of Henry's constant  $K_H$  .....  
 (a) increases with increase in temperature. (b) decreases with increase in temperature.  
 (c) remains constant. (d) first increases then decreases.



In the following questions (15-18) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (a) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.  
 (b) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.  
 (c) Assertion is correct, but reason is wrong statement.  
 (d) Assertion is wrong, but reason is correct statement.
15. **Assertion :** Alpha ( $\alpha$ )-amino acids exist as internal salt in solution as they have amino and carboxylic acid groups in near vicinity.  
**Reason :**  $H^+$  ion given by carboxylic group ( $-COOH$ ) is captured by amino group ( $-NH_2$ ) having lone pair of electrons.
16. **Assertion :** Inversion of cane sugar is a pseudo first order reaction.  
**Reason :** Water is present in excess during hydrolysis.
17. **Assertion:** Transition metals are good catalysts.  
**Reason:**  $V_2O_5$  or Pt is used in the preparation of  $H_2SO_4$  by contact process.
18. **Assertion:** On increasing dilution, the specific conductance keep on increasing.  
**Reason:** On increasing dilution, degree of ionisation of weak electrolyte increases and molality of ions also increases.

### SECTION-B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. How will you convert the following?  
 (a) Ethanol to propanone (acetone). (b) Benzene to acetophenone.  
 OR  
 (a) Toluene to benzaldehyde. (b) Isopropyl iodide to 2,3-dimethylbutane
20. Name an important alloy which contains some of the lanthanoid metals. Mention its two uses.
21. What is meant by the rate constant, ' $k$ ' of a reaction? If the concentration is expressed in  $\text{mol L}^{-1}$  and time in seconds, what will be the units of rate constant  $k$  for (i) zero order reaction (ii) first order reaction?

OR

Calculate the rate of reaction from the rate law:  $-\frac{d[A]}{dt} = k[A][B]^2$ , when the concentration of A and B are  $0.01 \text{ M}$  and  $0.02 \text{ M}$  respectively and  $k = 5 \cdot 1 \times 10^{-3} \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$ .

22. Out of cyclohexanol or phenol, which one is more acidic and why?
23. The resistance of a  $0.01 \text{ N}$  solution of an electrolyte was found to be  $210 \text{ ohm}$  at  $298 \text{ K}$  using a conductivity cell with a cell constant of  $0.88 \text{ cm}^{-1}$ . Calculate specific conductance and equivalent conductance of solution.
24. (a) Why the oxidation of toluene to benzaldehyde with  $\text{CrO}_3$  is carried out in presence of acetic anhydride?  
 (b) Tertiary-butyl benzene does not give benzoic acid when oxidized with  $\text{KMnO}_4$ . Why?
25. Define the following:  
 (a) Molality of solution (b) Osmotic pressure

### SECTION-C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

26. In a cold climate, water gets frozen causing damage to the radiator of a car. Ethylene glycol is used as an antifreezing agent. Calculate the amount of ethylene glycol to be added to  $4 \text{ kg}$  of water to prevent it from freezing at  $-6^\circ\text{C}$ .  
 ( $K_f$  for water =  $1.85 \text{ K mol}^{-1} \text{ kg}$ )
27. How will you convert  
 (a) a primary alcohol to an aldehyde.  
 (b) 3-Hydroxy pentan-2-one shows positive Tollen's test.  
 (c) Phenol to N-phenylethanamide.



28. Give the structures of A and B in the following sequence of reactions:

- (a)  $\text{CH}_3\text{COOH} \xrightarrow[\Delta]{\text{NH}_3} \text{A} \xrightarrow{\text{NaOBr}} \text{B}$   
 (b)  $\text{C}_6\text{H}_5\text{NO}_2 \xrightarrow{\text{Fe/HCl}} \text{A} \xrightarrow[0^\circ-5^\circ\text{C}]{\text{NaNO}_2+\text{HCl}} \text{B}$   
 (c)  $\text{C}_6\text{H}_5\text{N}_2+\text{Cl}^- \xrightarrow[\Delta]{\text{CuCN}} \text{A} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{B}$

OR

- (a) How will you distinguish between the following pairs of compounds:  
 (i) Aniline and Ethanamine  
 (ii) Aniline and N-Methylaniline  
 (b) Arrange the following compounds in decreasing order of their boiling points:  
 Butanol, Butanamine, Butane

29. (a) Anhydrous  $\text{CaCl}_2$  is not recommended as a drying agent for alcohols and amines.  
 (b) Why are Grignard reagents soluble in ether but not in benzene?  
 (c) Explain why the cleavage of aryl ethers with hydrogen halides always yield phenol and a molecule of halide and not aryl halide and alcohol.

OR

Draw the structure and name the product formed if the following alcohols are oxidised. Assume that an excess of oxidising agent is used.

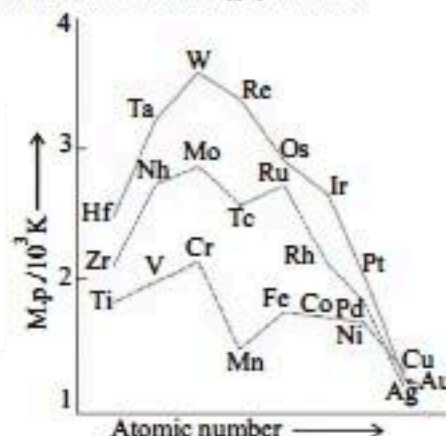
- (a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$  (b) 2-butanol (c) 2-methyl-1-propanol

30. The decomposition of  $\text{H}_2\text{O}_2$  in presence of iodide ion is found to be first order with rate constant  $1.01 \times 10^{-2} \text{ min}^{-1}$  by following graphical method. Calculate the rate of reaction when,  
 (a) Conc. of  $\text{H}_2\text{O}_2$  is  $0.4 \text{ mol L}^{-1}$   
 (b) Conc. of  $\text{H}_2\text{O}_2$  is  $0.15 \text{ mol L}^{-1}$   
 (c) What conc. of  $\text{H}_2\text{O}_2$  would give rate of  $1.12 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}$ ?

#### SECTION-D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow:

31. On the basis of the figure given below, answer the following questions:



Answer the following questions :

- (a) Why Manganese has lower melting point than Chromium?  
 (b) In the third transition series, identify and name the metal with the highest melting point.  
 (c) Why do transition metals of 3d series have lower melting points as compared to 4d series?

OR

Zn, Cd, Hg have low m.p. and are comparatively softer than other transition metals—Justify.



32. Both conductivity and molar conductivity change with the concentration of the electrolyte. Conductivity always decreases with decrease in concentration both, for weak and strong electrolytes. This can be explained by the fact that the number of ions per unit volume that carry the current in a solution decreases on dilution. The conductivity of a solution at any given concentration is the conductance of one unit volume of solution kept between two platinum electrodes with unit area of cross section and at a distance of unit length. Molar conductivity of a solution at a given concentration is the conductance of the volume  $V$  of solution containing one mole of electrolyte kept between two electrodes with area of cross section  $A$  and distance of unit length.

Answer the following questions :

- Conductivity decreases with dilution whereas Molar conductivity increases. Why?
- Conductivity of solutions of different electrolytes in the same solvent and at a given temperature is different. Why?
- Conductivity of metals decreases with increase of temperature whereas that of electrolytic solution increases. Why?

OR

For strong electrolytes, molar conductivity increases slowly with dilution. Why?

### SECTION-E

The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

33. (a) Designate the coordination entities and counter ions in the coordination compounds:  
 $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ ;  $\text{K}_4[\text{Fe}(\text{CN})_6]$ ;  $\text{K}_2[\text{PtCl}_4]$ ;  $[\text{Ni}(\text{CO})_4]$ ;  $\text{K}_2[\text{Ni}(\text{CN})_4]$ .

- (b) By considering the complex  $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$  indicate the following:

- |                                      |                          |
|--------------------------------------|--------------------------|
| (i) Central atom                     | (ii) Coordination sphere |
| (iii) Ionisation sphere              | (iv) Coordination number |
| (v) Oxidation number of central atom |                          |

OR

- (a) What is meant by crystal field splitting energy? On the basis of crystal field theory, write the electronic configuration of  $d^4$  in terms of  $t_{2g}$  and  $e_g$  in an octahedral field when

- |                    |                     |
|--------------------|---------------------|
| (i) $\Delta_0 > P$ | (ii) $\Delta_0 < P$ |
|--------------------|---------------------|

- (b) In which case will be splitting larger – 3d-orbitals or 4d-orbitals?

- (c) Why does  $\text{NH}_2\text{--NH}_2$  act as monodentate ligand, not bidentate ligand?

34. (a) (i) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.  
 (ii) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1 methylcyclohexane with alcoholic KOH.

- (b) Following compounds are given to you :

2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane

- Write the compound which is most reactive towards  $\text{S}_\text{N}2$  reaction.
- Write the compound which is optically active.
- Write the compound which is most reactive towards  $\beta$ -elimination reaction.

35. (a) Define the following terms with a suitable example in each:

- Polysaccharides
- Denatured protein

- (b) (i) What is the difference between native protein and denatured protein?

- (ii) Which one of the following is a disaccharide :  
 Glucose, Lactose, Amylose, Fructose

- (iii) Write the name of the vitamin responsible for the coagulation of blood.

OR

- (a) Write the product when D-glucose react with conc.  $\text{HNO}_3$ .

- (b) Amino acids show amphoteric behaviour. Why?

- (c) Write one difference between  $\alpha$ -helix and  $\beta$ -pleated structures of proteins.

- (d) Define the following with an example of each:

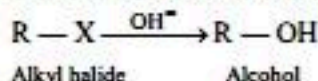
- Fibrous protein
- Essential amino acids



# Solutions

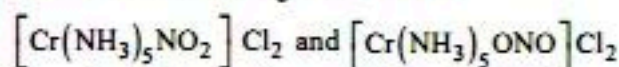
## SAMPLE PAPER-3

1. (b) The process of conversion of alkyl halides into alcohols involves substitution reaction.



2. (b) The chemical formula of pentamminenitrochromium (III) chloride is  $[\text{Cr}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$

It can exist in following two structures



Therefore the type of isomerism found in this compound is linkage isomerism as nitro group is linked through N as  $-\text{NO}_2$  or through O as  $-\text{ONO}$ .

3. (d) All aliphatic primary amines give  $\text{N}_2$  with nitrous acid ( $\text{NaNO}_2 + \text{HCl}$ ).
4. (c) For high v.p. concentration of solute should be low and temperature should be high.

5. (a)  $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{480} = 1.44 \times 10^{-3} \text{ s}^{-1}$

6. (d) The two components should be  $(\text{CH}_3)_3\text{CONa} + (\text{CH}_3)_3\text{CBr}$ . However, tert-alkyl halides tend to undergo elimination reaction rather than substitution leading to the formation of an alkene,  $\text{Me}_2\text{C}=\text{CH}_2$

7. (b) Benzoic acid is the strongest acid as the benzoate ion is stabilised by resonance effect. +I effect of  $-\text{CH}_3$  or  $-\text{OCH}_3$  group reduces the possibility of ionisation of  $\text{H}^+$  from  $\text{COOH}$ .

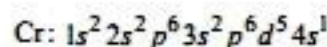
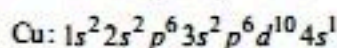
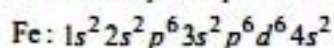
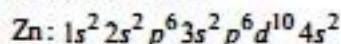
8. (b) Insulin is a biochemically active peptide hormone secreted by pancreas.

9. (a)  $\text{Ag}^+ + e^- \rightarrow \text{Ag}$

$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.0591}{1} \log \frac{1}{[\text{Ag}^+]}$$

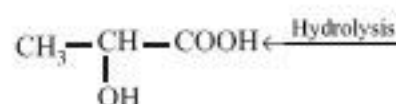
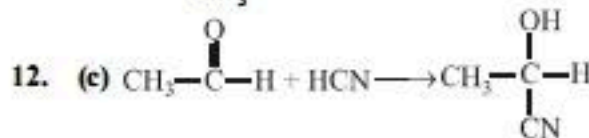
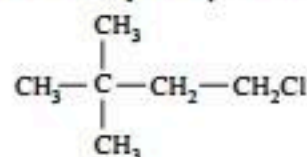
$$E_{\text{cell}} = 0.80 - \frac{0.0591}{1} \log \frac{1}{0.1} = 0.80 - 0.0591 = 0.741 \text{ V}$$

10. (a) With increase in atomic numbers ionisation energy also increases. But the trend is irregular among some d-block elements.



On the basis of electronic configuration, the  $\text{IE}_1$  follows the order:  $\text{Zn} > \text{Fe} > \text{Cu} > \text{Cr}$ .

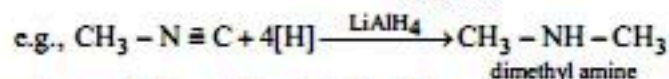
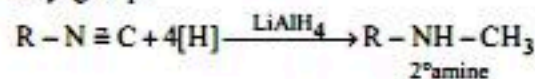
11. (d) Neohexyl chloride is a primary halide as in it Cl-atom is attached to a primary carbon.



2-Hydroxy propanoic acid

(As it has a chiral C-atom thus it is optically active)

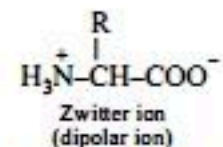
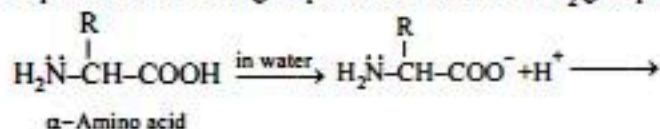
13. (a) Reduction of alkyl isocyanides in presence of  $\text{LiAlH}_4$  yields secondary amines containing methyl as one of the alkyl group.



whereas, alkyl cyanides give 1° amine on reduction.

14. (a) Solubility decreases and  $K_H$  increases with increase in temperature.

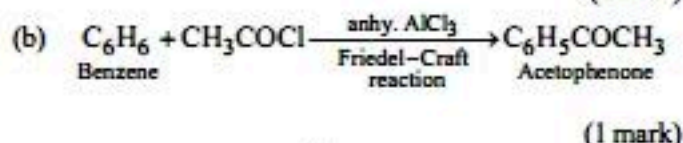
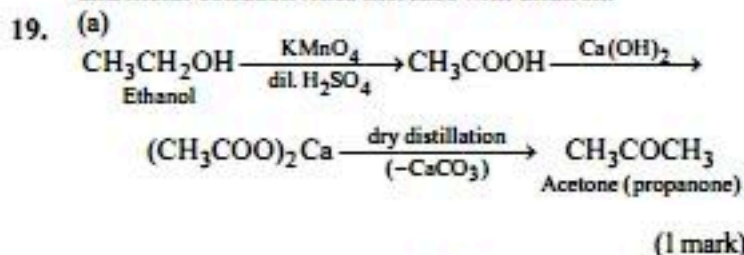
15. (a) All  $\alpha$ -amino acids have  $-\text{NH}_2$  and  $-\text{COOH}$  groups. Since  $-\text{NH}_2$  group is basic and  $-\text{COOH}$  group is acidic, in neutral solution it exists as internal salt which is also called as zwitter ion. This zwitter ion is formed due to the reason that proton of  $-\text{COOH}$  group is transferred to  $-\text{NH}_2$  group.



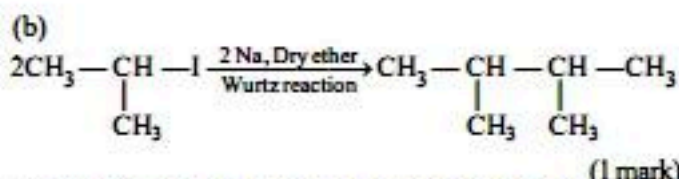
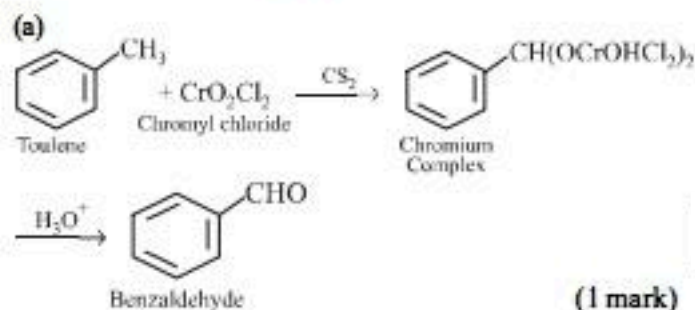
Hence assertion and reason both are true and reason is the correct explanation of assertion.



16. (a) If a reactant is present in excess, order with respect to that reactant is zero.  
 17. (b) Due to larger surface area and variable valencies shown by transition metals, they are used as catalysts.  
 18. (d) The specific conductivity decreases while equivalent and molar conductivities increase with dilution.



OR



20. An important alloy of lanthanoids is Mischmetal. It contains Lanthanoids (94–95%), iron (5%) and traces of S, C, Si, Ca and Al.

Uses:

- (i) Mischmetal is used in cigarettes and gas lighters.  
 (ii) It is used in tracer bullets and shells.
- (1 mark)

21. Rate constant,  $k = \frac{\text{Rate}}{(\text{Conc.})^n}$  (1 mark)

Thus, rate constant ( $k$ ) is defined as the rate of reaction when the concentration of reactants is taken to be unity.

$$\text{As } k = \frac{\text{Rate}}{(\text{Conc.})^n} = \frac{\text{mol L}^{-1} \text{s}^{-1}}{(\text{mol L}^{-1})^n} = (\text{mol L}^{-1})^{1-n} \text{s}^{-1}$$

∴ Units of  $k$  for (i) zero order reaction:  $\text{mol L}^{-1} \text{s}^{-1}$

(½ mark)

(ii) first order reaction :  $\text{s}^{-1}$  (½ mark)

OR

$$\text{Rate of reaction, } -\frac{d[A]}{dt} = k[A][B]^2$$

$$= 5.1 \times 10^{-3} \times [0.01][0.02]^2 \text{ mol L}^{-1} \text{s}^{-1}$$

$$= 20.4 \times 10^{-9} = 2.04 \times 10^{-8} \text{ mol L}^{-1} \text{s}^{-1}$$

(1 mark)

22. Phenol is more acidic than cyclohexanol. In phenol, the carbon atom that bears the hydroxyl group is  $\text{sp}^2$  hybridized whereas in cyclohexanol it is  $\text{sp}^3$  hybridized. Because of greater s-character,  $\text{sp}^2$  hybridized carbon atoms are more electronegative than  $\text{sp}^3$  hybridized carbon atoms and hence more acidic. Also, phenoxide ion is a resonance stabilized whereas there is no resonance in cyclohexanol or its anion.
- (2 marks)

23. Given for 0.01 N solution

$$R = 210 \text{ ohm, } \frac{\ell}{A} = 0.88 \text{ cm}^{-1}$$

Specific conductance

$$\therefore \kappa = \frac{1}{R} \times \frac{\ell}{A}$$

(½ mark)

$$\kappa = \frac{1}{210} \times 0.88 = 4.19 \times 10^{-3} \text{ mho cm}^{-1}$$

(½ mark)

$$\Lambda_{\text{eq}} = \frac{\kappa \times 1000}{N} = \frac{4.19 \times 10^{-3} \times 1000}{0.01}$$

$$= 419 \text{ mho cm}^2 \text{eq}^{-1}$$

(1 mark)

24. (a) This is because if acetic anhydride is not used, benzoic acid is formed instead of benzaldehyde. So acetic anhydride stops further oxidation of  $\text{C}_6\text{H}_5\text{CHO}$ . (1 mark)  
 (b) For any alkyl group attached to benzene ring to be oxidized to  $-\text{COOH}$  group, at least one  $\alpha$ -hydrogen atom must be present in the group that is attached to the ring. Since, no  $\alpha$ -hydrogen atom is present in *tert*-butyl group that is attached to the benzene ring in *tert*-butyl benzene so it does not give benzoic acid when oxidised with  $\text{KMnO}_4$ .
- (1 mark)

25. (a) Molality is defined as the number of moles of solute dissolved per kg of the solvent. It is denoted by  $m$ .

$$m = \frac{\text{No. of moles of solute}}{\text{Mass of solvent in kg}}$$

The unit of molality is  $\text{mol kg}^{-1}$ . (1 mark)

(b) Osmotic Pressure: The pressure which need to be applied to a solution to prevent the flow of solvent into the solution through the semi-permeable membrane is called osmotic pressure.

(1 mark)

26.  $K_f = 1.85 \text{ K mol}^{-1} \text{kg}$ ,  $\Delta T_f = 6\text{K}$ ,  $m = 62$ ,  
 $W = 4 \text{ kg} = 4 \times 10^3 \text{ g}$ ,  $w = \text{wt. of solute}$

$$\text{Now we know that } \Delta T_f = \frac{1000 \times K_f \times w}{W \times m}$$

$$6 = \frac{1000 \times 1.85 \times w}{4 \times 10^3 \times 62}$$

On usual calculations,  $w = 804.32 \text{ g}$  (3 marks)

27. (a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{PCC}} \text{CH}_3\text{CH}_2\text{CHO}$
- Propanal (1° alcohol)  Propanal (an aldehyde)
- (1 mark)

PCC is pyridinium chlorochromate (a complex of  $\text{Cr}_2\text{O}_3$  with pyridine and  $\text{HCl}$ ). It does not oxidise  $\text{C}=\text{C}$ , if present.

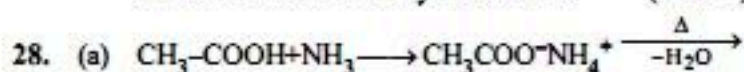
- (b) Tollen's reagent is a weak oxidizing agent not capable of breaking the  $\text{C}-\text{C}$  bond in ketones. Thus ketones



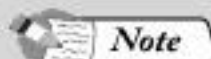
cannot be oxidized using Tollen's reagent itself gets reduced to Ag. (1 mark)

- (c) In case of chlorobenzene, the C—Cl bond is quite difficult to break as it acquires a partial double bond character due to conjugation.

So Under the normal conditions, ammonolysis of chlorobenzene does not yield aniline. (1 mark)



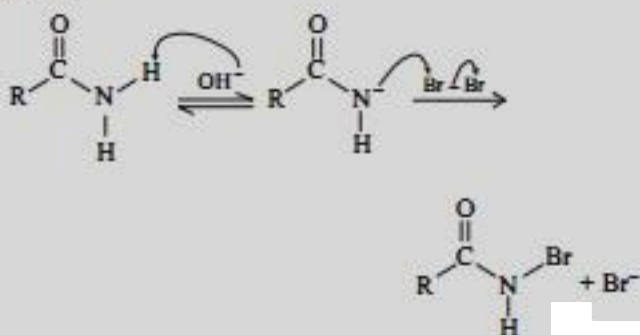
( $\frac{1}{2} + \frac{1}{2} = 1$  mark)



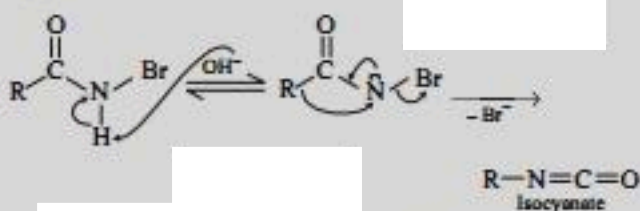
### Note

Conversion of A to B is Hofmann Degradation reaction.

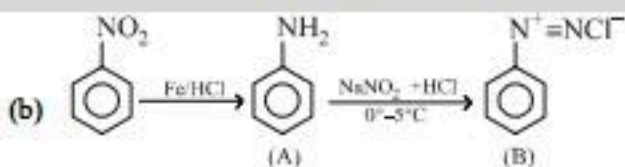
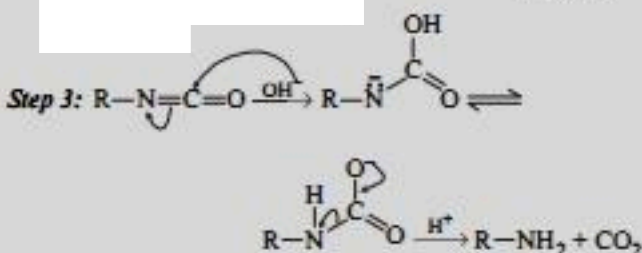
Step 1:



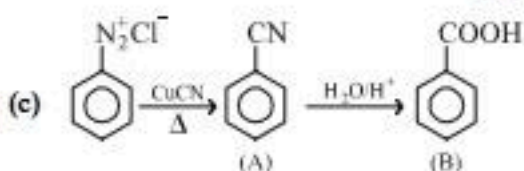
Step 2:



Step 3:



( $\frac{1}{2} + \frac{1}{2} = 1$  mark)

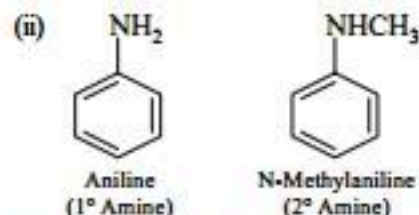


( $\frac{1}{2} + \frac{1}{2} = 1$  mark)

OR

- (a) (i) Aniline and ethanamine can be distinguished by the azo-dye test.

An orange dye is obtained when aniline reacts with  $(\text{NaNO}_2 + \text{dil. HCl})$  at  $0^\circ-5^\circ\text{C}$  followed by a reaction with alkaline solution of 2-naphthol. Ethanamine gives a brisk effervescence with the same solution due to evolution of  $\text{N}_2$  gas.



Only primary amines react with  $(\text{CHCl}_3 + \text{KOH})$  to give a foul odour of isocyanide (carbylamine reaction). Hence, aniline will give this test but N-methylaniline will not. Also, aniline will form azo dye as in (i), but N-methylaniline will not form dye.

(1 + 1 = 2 marks)

- (b)  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-OH}$  (butanol)  
 $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-NH}_2$  (butanamine)  
 $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$  (butane)

Due to hydrogen bonding, the decreasing order of boiling point is:

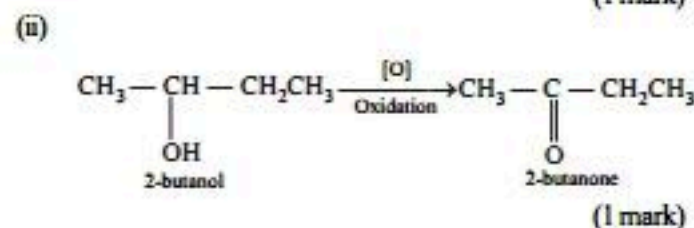
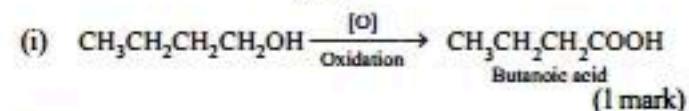
Butanol > Butanamine > Butane (1 mark)

29. (a) Alcohols and amines combine with anhydrous  $\text{CaCl}_2$  to form complexes. For example, with  $\text{C}_2\text{H}_5\text{OH}$  it gives a complex of molecular formula,  $\text{CaCl}_2 \cdot 3\text{C}_2\text{H}_5\text{OH}$ . Therefore, it cannot be used as a drying agent. (1 mark)

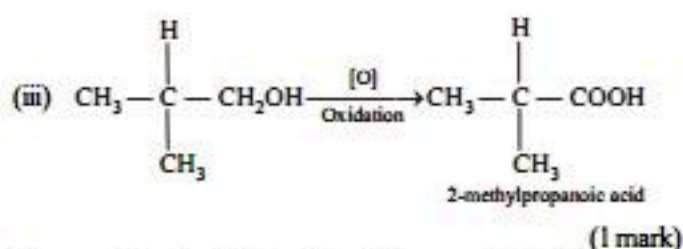
- (b) Grignard reagents form coordination complexes with ethers but not with benzene since the former has lone pairs of electrons but the latter does not. Grignard reagent and ether form a complex where Mg acts as a Lewis acid and ether act as a Lewis base. This makes Grignard reagent soluble in ether. (1 mark)

- (c) This is because the nucleophile attack by the halide ion on the carbon of the benzene ring does not occur. Oxygen of ether is in resonance with ring. Also the C of ring is sterically more hindered. (1 mark)

OR







30. The reaction is of first order with respect to  $\text{H}_2\text{O}_2$

$$\therefore \text{Rate} = k [\text{H}_2\text{O}_2]$$

$$k = 1.01 \times 10^{-2} \text{ min}^{-1}$$

$$[\text{H}_2\text{O}_2] = 0.4 \text{ mol L}^{-1}$$

$$\text{(i)} \quad \text{Rate} = (1.01 \times 10^{-2} \text{ min}^{-1}) \times (0.4 \text{ mol L}^{-1}) = 4.04 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1} \quad (1 \text{ mark})$$

$$\text{(ii)} \quad \text{When } [\text{H}_2\text{O}_2] = 0.15 \text{ mol L}^{-1}, \quad \text{Rate} = (1.01 \times 10^{-2} \text{ min}^{-1}) \times (0.15 \text{ mol L}^{-1}) = 1.5 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1} \quad (1 \text{ mark})$$

(iii) To obtain concentration of  $\text{H}_2\text{O}_2$  when rate =  $1.12 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}$ ,

$$[\text{H}_2\text{O}_2] = \frac{\text{Rate}}{k} = \frac{1.12 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}}{1.01 \times 10^{-2} \text{ min}^{-1}} = 1.11 \text{ mol L}^{-1} \quad (1 \text{ mark})$$

31. (a) Manganese is having lower melting point as compared to chromium, as it has highest number of unpaired electrons, strong interatomic metal bonding, hence no delocalisation of electrons. (1 mark)

(b) Tungsten (1 mark)

(c) There is much more frequent metal – metal bonding in compounds of the heavy transition metals i.e 4d and 5d series, which accounts for lower melting point of 3d series. (2 marks)

OR

(c) Due to the presence of completely filled d-orbitals  $[(n-1)d^{10}ns^2]$  in Zn, Cd, Hg, the interaction with adjacent atoms is weaker in comparison to that other transition elements which are having unpaired d-electrons. (2 marks)

32. (a) On dilution, number of ions per millilitre decreases but per mole increases. (1 mark)

(b) Conductivity of solutions of different electrolytes in the same solvent and at a given temperature is different. It also depend on charge and size in which they dissociate. (1 mark)

(c) Electrons are not tightly held but are free to flow. Instead, kernels start vibrating which create hinderance to the flow of electrons. In case of electrolytes, dissociation and ionic mobilities increase with temperature. (2 marks)

OR


The percent dissociation of a strong electrolyte is already very high. Thus, on dilution, molar conductivity increases slowly. (2 mark)

(a)	Coordination compound	Coordination entity	Counter ions
(i)	$[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$	$[\text{Cr}(\text{NH}_3)_6]^{3+}$	$\text{Cl}^-$
(ii)	$\text{K}_4[\text{Fe}(\text{CN})_6]$	$[\text{Fe}(\text{CN})_6]^{4-}$	$\text{K}^+$
(iii)	$\text{K}_2[\text{PtCl}_4]$	$[\text{PtCl}_4]^{2-}$	$\text{K}^+$
(iv)	$[\text{Ni}(\text{CO})_4]$	$[\text{Ni}(\text{CO})_4]$	Nil
(v)	$\text{K}_2[\text{Ni}(\text{CN})_4]$	$[\text{Ni}(\text{CN})_4]^{2-}$	$\text{K}^+$

- (b) (i) Fe.  
 (ii)  $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ .  
 (iii)  $(\text{K}_3)^{3+}$  or  $3 \text{ K}^+$ .  
 (iv) Six (each oxalate ion is bidentate).  
 (v) +3.


OR

(a) The d-orbitals present in metal have the same energy in the free state. This is called degenerate state of d-orbital. But, when a complex is formed the ligands destroy the degeneracy of these orbitals. The d-orbitals gets split into two sets one with lower and one with higher energy. The difference of energy between two sets is called crystal field splitting energy.

(i) When  $\Delta_0 > P$ , the  $d^4$  has configuration 

$e_g$

i.e.,  $t_{2g}^4 e_g^0$  

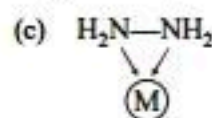
(ii) When  $\Delta_0 < P$ , the  $d^4$  has configuration 

$e_g$

i.e.,  $t_{2g}^3 e_g^1$  

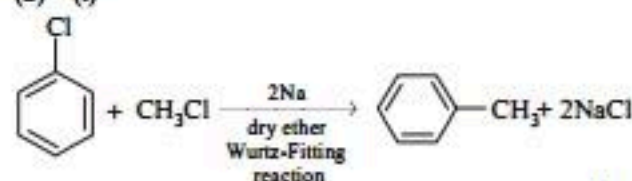
(b) Splitting will be larger in 4d-orbitals.

[Note: The splitting of 4d-orbitals is about 1.45 times as large as the splitting of 3d-orbitals.]



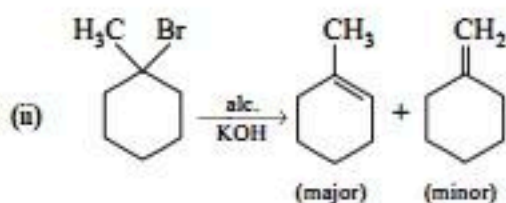
Although hydrozine has two lone pairs of electrons of each 'N' atom, it cannot donate both the lone pairs of electrons to the metal as it forms highly strained 3-membered ring as shown in the figure, it is unstable.

34. (a) (i)



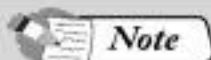
(1 mark)





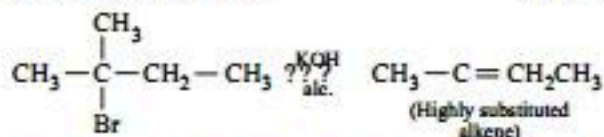
(This is in accordance with the Saytzeff's rule) (1 mark)

- (b) (i) 1-Bromopentane is most reactive towards  $S_N2$  reaction. It is a primary halide. (1 mark)



*Primary halides are more reactive towards  $S_N2$  reaction and tertiary halides are more reactive towards  $S_N1$  reaction.*

- (ii) 2-Bromopentane  $\text{CH}_3 - \underset{\text{Br}}{\text{CH}} - \text{CH}_2\text{CH}_2\text{CH}_3$  (1 mark)
- (iii) 2-Bromo-2-methylbutane is most reactive towards  $\beta$ -elimination reaction. (1 mark)

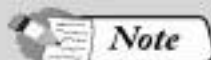


35. (a) (i) **Polysaccharides:** Carbohydrates which yield a large number of monosaccharide units on hydrolysis are called polysaccharides. *Example:* Starch (1 mark)
- (ii) **Denatured protein:** When a protein is subjected to physical change like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity. This form is called 'denatured protein'. *Example:* Coagulation of egg white on boiling (1 mark)

**Note:** Denaturation destroys secondary and tertiary structures of protein, but primary structure remains intact.

- (b) (i) Proteins which are found in a biological system with unique 3D-structure and biological activity are called native proteins. When a native protein is subjected to physical and chemical change, it loses its biological activity and are called as denatured protein. (1 mark)

- (ii) Lactose is a disaccharide. (1 mark)
- (iii) Vitamin K is responsible for the coagulation of blood. (1 mark)

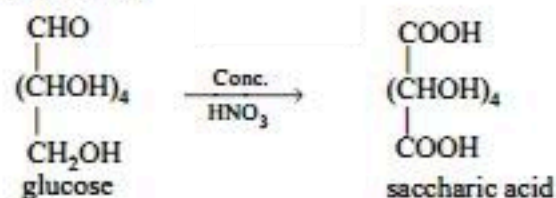


*Deficiency of vitamin K is rare, but, in severe cases, it can increase clotting time, leading to the hemorrhage and excessive bleeding.*

*The nine essential amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine.*

OR

- (a) When glucose reacts with conc  $\text{HNO}_3$ , saccharic acid is formed.



(1 mark)

- (b) Amino acids show amphoteric behaviour in zwitter ionic form as they react both with acids and bases. Due to presence of both acidic (carboxyl group) and basic (amino group) in same molecule, amino acids exist as zwitter ion form and can react with acids as well bases. (1 mark)
- (c)  **$\alpha$ -Helix:** The polypeptide chains twist into a right handed screw with  $-\text{NH}$  group of amino acid hydrogen bonded with  $>\text{C}=\text{O}$  group of an adjacent turn of the helix.
- $\beta$ -pleated:** The polypeptide chains stretch to maximum extension and lay side by side in a zig-zag manner to form a flat sheet. Each chain is held to two neighbouring chains by hydrogen bond. (1 mark)
- (d) (i) **Fibrous protein:** When the polypeptide chains run parallel and are held together by hydrogen and disulphide bonds, then fibre like structure is formed. Such type of proteins are called 'fibrous proteins' *Example:* Keratin (1 mark)
- (ii) **Essential amino acids :** These amino acids cannot be synthesised in the body and must be obtained through diet. (1 mark)
- For ex : Valine, leucine, lysine