

TIME: 3 hrs.

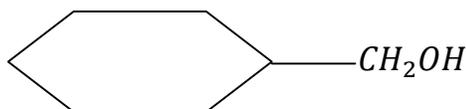
Max. Marks: 70

**GENERAL INSTRUCTIONS:**

- . All questions are compulsory.
- Question numbers 1 to 5 are very short answer questions of one mark each. Answer these in one word or about one sentence each.
  - Question numbers 6 to 10 are short answer question of two marks each. Answer these in about 30 words each.
  - Question numbers 11 to 22 are short answer question of three marks each. Answer these in about 40 words each. Question no. 23 is of 4 marks .
  - Question numbers 24 to 26 are long answer question of five marks each. Answer these in about 70 words each.
  - Use log tables, if necessary.

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 1

- What are interstitials?
- What happens when an electrolyte, NaCl is added to hydrate ferric oxide sol?
- How will you prepare the following alcohol by the reaction of a suitable Grignard reagent on methanol? 1



- What is peptide linkage? 1
- Give one chemical test to distinguish 2-pentanone from 3-pentanone. 1
- Predict the products of electrolysis in each of the following: 2
  - A dil. Solution of  $\text{H}_2\text{SO}_4$  with platinum electrodes.
  - An aqueous solution of  $\text{AgNO}_3$  with Ag electrodes.

OR

Write the cell reactions taking place at electrodes in a fuel cell.

- Give reasons: 2
  - $\text{H}_3\text{PO}_3$  is diprotic.
  - $\text{H}_2\text{S}$  is less acidic than  $\text{H}_2\text{Te}$ .
- Which compound in each of the following pairs will react faster in  $\text{SN}_2$  reaction with  $\text{OH}^-$  and why? 2
  - $\text{CH}_3\text{Br}$  or  $\text{CH}_3\text{I}$ .
  - $(\text{CH}_3)_3\text{CCl}$  or  $\text{CH}_3\text{Cl}$ .
- In which classes, the polymers are classified on the basis of molecular forces? 2
- Convert: 2
  - Bromoethane to propanoic acid.
  - Toluene to benzyl alcohol.
- Answer the following: 3
  - How will you distinguish acetone from acetaldehyde?
  - What type of alcohols undergo Cannizzaro's reaction?

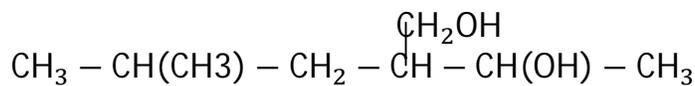
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- (iii) Aniline dissolves in HCl.
- 12.(a) How will you prepare? 3
- (i) Ethanamine from phthalimide.
- (ii) Methanamine from acetamide.
- (b) Which is more basic amide or amine and why?
13. (a) Why cyclohexylamine is a stronger base than aniline? 3
- (b) Primary amines have higher boiling points than tertiary amines.

OR

- (a) Explain the following order of basic nature of methyl substituted amines in aqueous solutions:  $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N} > \text{NH}_3$ .
- (b) Tertiary amines do not react with Hinsberg's reagent.
14. (a) Complete the following reactions: 3
- (i)  $\text{P}_4 + 3\text{NaOH} + 3\text{H}_2\text{O} \xrightarrow{\Delta}$
- (ii)  $2\text{KMnO}_4 + 5\text{SO}_2 + 2\text{H}_2\text{O} \longrightarrow$
- (b) Potassium permanganate titrations are not carried out with HCl. Why?
15. An element crystallizes in BCC structure. The edge length of its unit cell is 288 pm. If the density of crystal is  $7.2 \text{ g/cm}^3$ , what is the atomic mass of the element? 3
16. Calculate the equilibrium constant for the reaction: 3
- $\text{Cu(s)} + 2\text{Ag}^+(\text{aq}) \longrightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag(s)}$
- Given:  $E_{\text{cell}}^0 = 0.46\text{V}$ ;  $T = 25^\circ\text{C}$ ;  $F = 96500\text{C/mol}$ ;  $R = 8.314\text{J/K/mol}$ .
17. (a) Give differences between lyophilic and lyophobic sols. 3
- (b) What is demulsification?
18. Outline the principles of refining of metals by the following methods: 3
- (a) Zone refining
- (b) Vapour phase refining
19. Arrange the following in order of property indicated against each set: 3
- (i)  $\text{F}_2, \text{Cl}_2, \text{Br}_2, \text{I}_2$  - Increasing bond dissociation enthalpy.
- (ii)  $\text{HF}, \text{HCl}, \text{HBr}, \text{HI}$  - Increasing acidic strength.
- (iii)  $\text{NH}_3, \text{PH}_3, \text{AsH}_3, \text{SbH}_3, \text{BiH}_3$  - Increasing basic strength.
20. (a) Give the IUPAC name of the linkage isomer of the complex 2+1=3
- $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$ .
- (b) Draw the geometrical isomers of the complex ion  $[\text{CrCl}_2(\text{ox})_2]^{3+}$ .
21. (a) Give an example of each: 2+1=3
- (i) Reimer-Tiemann Reaction.
- (ii) Williamson's ether synthesis.
- (b) Give the IUPAC name of the compound:

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22. (a) Account for the following: - 2+1=3
- (i) Chloroacetic acid has lower  $\text{pK}_a$  value than acetic acid.
  - (ii) Cyclohexanone forms cyanohydrin in good yield but 2,2,6-trimethyl cyclohexanone does not.
- (b) Outline the mechanism of  $\text{Nu}^-$  addition reaction of carbonyl compounds.

OR

- What happens when? 1+1+1=3
- (i) 2-methyl but-2-ene is ozonised & the product is reduced.
  - (ii) Methylmagnesium bromide is added to propanone & the product is hydrolysed.
  - (iii) 2-methyl propan-2-ol is heated with copper at 573 K.

23. After watching at T V programme about the ill effects of fast food and soft drinks SIMRAN and PRANJAL students of class XII discussed the issue with the school principal. Principal immediately instructed the canteen instructor to replace the fast food with fibre and vitamin rich food. This decision was welcomed by the parents and the students.

1. What values are expressed by Simran and Pranjal and principal of the school?
2. Give two examples of water soluble vitamins?
3. Why vitamin c be supplied regularly in diet?

24. (a) If  $\text{N}_2$  gas is bubbled through water at 293K, how many millimoles of  $\text{N}_2$  gas would dissolve in one litre of water. Assume that  $\text{N}_2$  exerts a partial pressure of 0.987 bar. Given that Henry's law constant for  $\text{N}_2$  at 293K is 76.48 k-bar.
- (b) Illustrate elevation in boiling point with the help of vapour pressure temperature curve of a solution. Show the elevation in boiling point is a colligative property. 3+2=5

OR

- (a) 1.0 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. The freezing point depression constant of benzene is 5.12 K kg/mol. Find the molar mass of the solute.
  - (b) Name the process used for large scale desalination of sea water.
  - (c) What type of azeotrope is formed when  $\text{HNO}_3$  is mixed with water? 3+1+1=5
25. (a) Calculate the overall order of a reaction which has the rate expression,  $\text{Rate} = k[\text{A}]^{3/2}[\text{B}]^{-1}$ .
- (b) The first order rate constant for the decomposition of ethyl iodide by the reaction:  $\text{C}_2\text{H}_5\text{I}(\text{g}) \longrightarrow \text{C}_2\text{H}_4(\text{g}) + \text{HI}(\text{g})$ , at 600K is  $1.60 \times 10^{-5} \text{ s}^{-1}$ .

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Its energy of activation is 209 kJ/mol. Calculate the rate constant of the reaction at 700K.

- (c) Give an example of pseudounimolecular reaction. 1+3+1=5

OR

- (a) A first order reaction is found to have a rate constant  $K=1.60 \times 10^{-5} \text{s}^{-1}$ . Find the half life of the reaction.

- (b) What will be the effect of temperature on rate constant?

- (c) Define energy of activation. 2+2+1=5

26. Give reasons:

- (a) The enthalpies of atomization of the T.M. are high.

- (b) T.M. acts as good catalysts.

- (c) Zn, Cd & Hg are highly volatile.

- (d) Cu has paired up 3d electrons, yet it is considered as T.M.

- (e) Zr & Hf exhibit similar properties. 1+1+1+1+1=5

OR

- (a) Out of  $\text{La}(\text{OH})_3$  &  $\text{Lu}(\text{OH})_3$ , which one is more basic and why?

- (b) Actinide contraction is more than lanthanide contraction, why?

- (c) How will you prepare potassium dichromate from chromite ore? 1+1+3=5

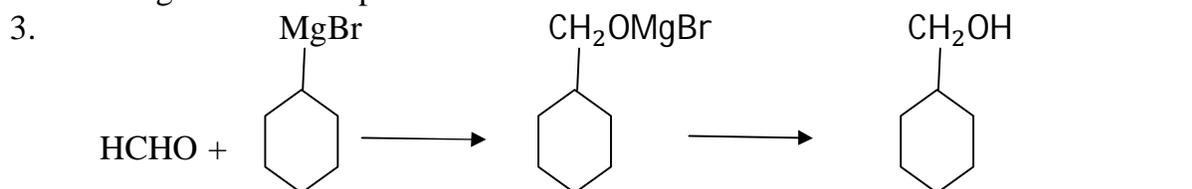
### Marking scheme

**TIME: 3 hrs.**

**Max. Marks: 70**

1. Atoms, ions or molecules occupying interstitial sites. 1

2. Coagulation takes place. 1



4. CO-NH linkage between two amino acids 1

5. By iodoform test. 1

6. (i) Cathode :  $\text{H}_2$  2

Anode :  $\text{O}_2$

- (ii) Ag at Cathode,  $\text{Ag}^+$  at anode.

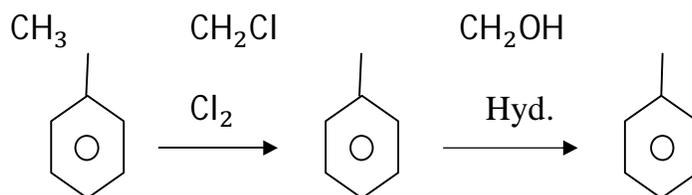
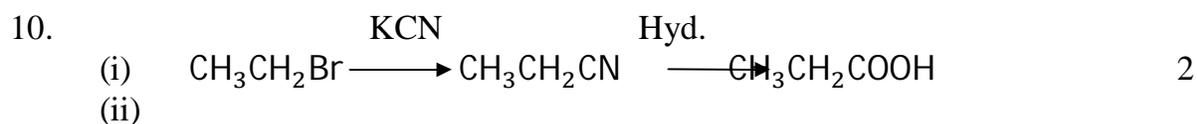
OR

Correct reaction at cathode and anode.

7. (i) Since H is non-ionisable (P-H). 2

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- (ii) Te-H bond strength is less as size of Te > S.
8. (i) CH<sub>3</sub>I as I<sup>-</sup> is a better leaving group. 2  
 (ii) CH<sub>3</sub>Cl as it is 1<sup>o</sup> Alkyl halide.
9. Elastomers, Fibres, Thermoplastics, Thermosettings. (Type of forces & e.g.) 2



11. (i) Tollen's or Fehling's test. 3  
 (ii) Aldehydes lacking alpha-H.  
 (iii) Due to lone pair basic, and accepts H<sup>+</sup> ions to form salt.
12. (a) (i) Chemical reaction of Gabriel phthalimide synthesis. 3  
 (ii) Reaction of acetamide with Br/alkali.  
 (b) Amines. As the lone pair is involved in resonance in amides.
13. (a) Electron pair of nitrogen is involved in resonance, thus not available for 3  
 donation.  
 (b) Because of maximum H-bonding

OR

- (a) Steric factors, solvation, +I effect (explanation).  
 (b) Because they lack replaceable H.
14. (a) (i) PH<sub>3</sub> + 3NaHPO<sub>2</sub> 3  
 (ii) K<sub>2</sub>SO<sub>4</sub> + 2MnSO<sub>4</sub> + 2H<sub>2</sub>SO<sub>4</sub>  
 (b) Because it liberates Chlorine.
15. a = 288 × 10<sup>-10</sup> cm ; Z = 2 3

$$M = \frac{d \times a^3 \times N_A}{Z} = \frac{7.2 \times (288 \times 10^{-10})^3 \times 6.023 \times 10^{23}}{2} = 51.77 \text{ g/mol}$$

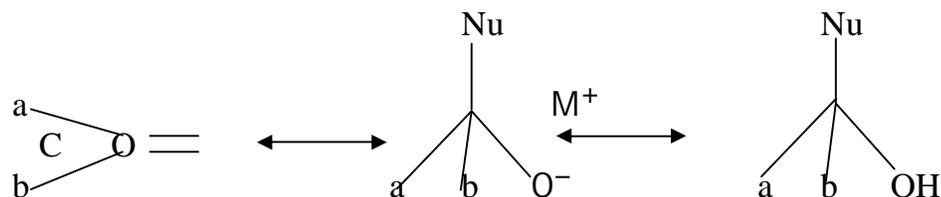
16.  $\log K = \frac{nFE_{\text{cell}}^0}{2.303 \times RT}$  3

$$= \frac{2 \times 96500 \times 0.46}{2.303 \times 8.314 \times 298} = 15.5 \implies K = 3.69 \times 10^{15}$$

17. (a) Any (2-4) differences. 3  
 (b) Separation of emulsions to its constituents.
18. Principle involved and explanation. 3

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19. (i)  $I_2 < F_2 < Br_2 < Cl_2$   
 (ii)  $HF < HCl < HBr < HI$   
 (iii)  $BiH_3 < SbH_3 < AsH_3 < PH_3 < NH_3$
20. (a) Penta amminenitrito-O-Cobalt (III) chloride 2+1=3  
 (b) Cis and trans isomers  
 Cis-OA
21. (a) Example of each. 2+1=3  
 (b) 2,5-dimethyl hexane-1,3 diol
22. (a) Electron withdrawing effect in  $Cl^-$  group increases the acidic character.  
 (b) More steric hindrance in trimethyl cyclohexanone & thus attack of  $CN^-$  is difficult. 2+1=3



OR

- (i)  $CH_3 - HC - C(CH_3)_2 \xrightarrow{O_3/Red.} CH_3CHO + CH_3COCH_3$   
 (ii) 2-methyl propan-2-ol is formed.  
 (iii) 2-methyl propene. 1+1+1=3

23. (i) Students: Concern for friends, awareness and knowledge  
 Principal: Concern for students.  
 (ii) Vitamins B and C (any example)  
 (iii) It's excreted through urine as its water soluble.

24. (a)  $X(N_2) - p/K_H = 1.29 \times 10^{-5}$  3+2=5

$$X(N_2) \rightleftharpoons \left[ \frac{n}{N+55.5} \right] \text{mol} = 1.29 \times 10^{-5}$$

$$N = 7.16 \times 10^{-4} \text{ mol} = 0.716 \text{ m mol}$$

- (b) TVs V.P. diagram  
 $\Delta T_b = K_b \times m$   
 i.e. depends upon molality and not on nature of solute.

OR

- (a) Correct formula 3+1+1=5

$$M_2 = \frac{5.12 \text{ K kg/mol} \times 1.0 \text{ g} \times 1000 \text{ g}}{0.40 \times 50} = 256 \text{ g/mol}$$

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- (b) Reverse osmosis.  
 (c) Maximum boiling azeotrope.  
 25. (a) Half order. 1+3+1=5

$$(b) \log K_2 = \log K_1 + \frac{E_a}{2.303 R} \left[ \frac{1}{T_1} - \frac{1}{T_2} \right]$$

$$= \log (1.60 \times 10^{-5}) + \frac{209000 \text{ J mol/L}}{2.303 \times 8.314 \text{ J mol/L/K}} \left[ \frac{1}{600 \text{ K}} - \frac{1}{700 \text{ K}} \right]$$

$$= -2.197 \implies K = 6.36 \times 10^{-3} \text{ s}^{-1}.$$

- (c) Any e.g. hydrolysis of ester.

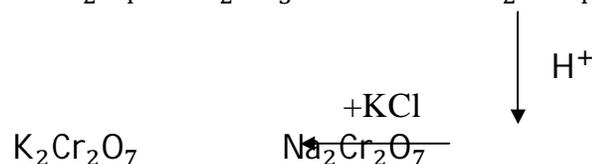
OR

- (a)  $t_{1/2} = \frac{0.693}{5.5 \times 10^{-14} \text{ s}^{-1}} = 1.26 \times 10^{14}$  2+2+1=5  
 (b) Note constant gets doubled as given by Arrhenius  
 (c) Definition.

26. (a) Because of strong bonding. 1+1+1+1+1=5  
 (b) Because of variable oxidation state.  
 (c) Paired up electrons hence weak bonding.  
 (d)  $\text{Cu}^{2+}$  has unpaired electrons in 3d .  
 (e) Due to lanthanoid contraction.

OR

- (a)  $\text{La}(\text{OH})_3$  because of lanthanoid contraction. 1+1+3=5  
 (b) Poor shielding of 4f.  
 (c)  $\text{FeCr}_2\text{O}_4 + \text{Na}_2\text{CO}_3 \longrightarrow \text{Na}_2\text{CrO}_4$



6. What products would be formed when DNA is hydrolysed? 1  
 7. Give the monomers of Buna-S. 1  
 8. Give an example of broad spectrum antibiotic. 1

Explain cationic and anionic detergents with a suitable example. 2

- (a) Give the important structural & functional differences between DNA and RNA. 2+1=3  
 (b) What is the basic structural difference between starch and cellulose?



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