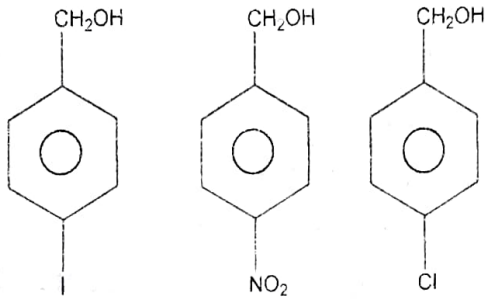
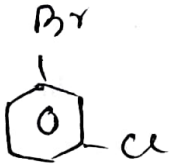
HS SECOND YEAR PRE FINAL 2 EXAM 2024

SUB: CHEMISTRY

Time: 3 hours **Full Marks: 70**

1. Why must vitamin C be supplied regularly in diet? 1
2. Write any two roles of coordination compounds in biological systems. 1
3. For which type of reactions, order and molecularity have the same value? 1
4. Why does the rate of a reaction increase with rise in temperature? 1
5. State Kohlrausch law of independent migration of ions. 1
6. On what ground can you say that scandium is a transition element but zinc is not? 1
7. How can you prepare 1-Bromo-3-chlorobenzene from benzene? 1
8. Arrange the following in increasing order of reactivity with HBr: 1





9. Explain why the C–O bond length in phenol is shorter than that in ethanol. 2
10. Write the chemical equations to illustrate the following name reactions: 1+1=2
    (a) Wolff-Kishner reduction
    (b) Cannizzaro reaction
11. Identify the products A,B, C and D in the following reactions: ½ x4=2

a) $CH_3-\underset{Cl}{\overset{H}{C}}-CH_3 \xrightarrow{KCN} A \xrightarrow{SnCl_2 + HCl} B$

b) $CH_3CH_2CN \xrightarrow[H_3O^+]{SnCl_2/HCl} C \xrightarrow[HCl]{Zn\text{-}Hg} D$

12. What is lanthanide contraction? Why actinoid contraction is greater from element than lanthanide contraction? 1+1=2
13. The rate of the chemical reaction doubles for an increase of 10 K in absolute temperature from 298 K. Calculate the activation energy. 2
14. Write the mechanism of hydration of ethene to yield ethanol. 2

15. Explain why the C—N bond length is shorter in ethanamide than in aniline. 2

16. State the Henry's law. Mention its one important application. 2

17. A 5(w/v) % solution of cane sugar is isotonic with 1% (w/v) of a solution of an unknown non-electrolyte solute at 300K. What is the molar mass of unknown solute? 2

18. At equimolar concentration of Fe^{2+} and Fe^{3+}, what must be the $[Ag^+]$ so that the voltage of the galvanic cell made from $Ag^+|Ag$ and $Fe^{3+}|Fe^{2+}$ electrodes equals zero ? The cell reaction is $Fe^{2+} + Ag^+ \rightarrow Fe^{3+} + Ag$ (Given that $E^0_{Fe^{3+}/Fe^{2+}}$=0.77 V, $E^0_{Ag^+/Ag}$= 0.80 V) 2

19. a) Amino acids behave like salts rather than simple amines or carboxylic acids. Explain why? 1

b) What is the difference between α-helix and β-pleated sheet structure of proteins? 1

c) What products would be formed when a nucleotide from DNA containing thymine is hydrolysed? 1

20. a) How is glucose commercially prepared? 1

b) Why do we call polysaccharides as non-sugars? 1

c) What are the purine bases present in DNA? 1

21. a) What are ambidentate ligands? Give an example. 1

b) Explain why $[Fe(H_2O)_6]^{3+}$ has magnetic moment value of 5.92 B.M. whereas $[Fe(CN)_6]^{3-}$ has a value of only 1.74 B.M. 2

22. a) A coordination compound $CrCl_3.4H_2O$ precipitates silver chloride when treated with silver nitrate. The molar conductance of its solution corresponds to a total of two ions. Write the structural formula of the compound and its name. 2

b) Name the type of isomerism when ambidentate ligands are attached to central metal ion. 1

23. (a) A first order reaction is found to have a rate constant, $k = 5.5 \times 10^{-14}\ s^{-1}$. Find the half-life of the reaction. 1

(b) Show that in a first order reaction, time required for completion of 99.9% is 10 times of half-life ($t_{1/2}$) of the reaction 2

24. a) Cr^{2+} and Mn^{3+} have d^4 configuration. But Cr^{2+} is reducing and Mn^{3+} is oxidising. Explain why? 1

b) Explain why Cu^+ ion is unstable in aqueous solutions. 1

c) Explain why Ce^{4+} is a good oxidising agent whereas Sm^{2+} is a good reducing agent. 1

25. a) An aqueous solution is 34% H_3PO_4 by mass and has density 1.21 g ml^{-1}. Find the molarity of the solution. **1**

b) Calculate the boiling point of a solution containing 13.4 g of $CuCl_2$ in 1 kg of water. (K_b for H_2O = 0.52 K kg mol^{-1} and Cu = 63.5 u, Cl = 35.5 u) **2**

26. a) Why does the conductivity of a solution decrease with dilution? **1**

b) Λ^0_m for NaCl, HCl and NaAc are 126.4, 425.9 and 91.0 S cm^2 mol^{-1} respectively. Calculate Λ^0_m for HAc. **2**

27. The conductivity of 0.001028 mol L^{-1} acetic acid is 4.95×10^{-5} S cm^{-1}. Calculate its dissociation constant if Λ^0_m for acetic acid is 390.5 S cm^2 mol^{-1}. **3**

28. a) An organic compound containing C, H and O having pleasant smell with boiling point 78°C. On boiling with conc. H_2SO_4 at 443K, a colourless gas is produced which decolourises bromine water and alkaline $KMnO_4$. Identify the compound and write all the reactions involved. **3**

b) Compound C_2H_6O has two isomers X and Y. On reaction with HI, X gives alkyl iodide and water while Y gives alkyl iodide and alcohol. Identify X and Y. **2**

29. a) Convert the following: **1x3=3**

i) Acetylchloride to 2-methylpropan-2-ol

ii) Ethylchloride to butan-2-one

iii) Ethanenitrile to propan-2-ol

b) Give a chemical test to distinguish between methanal and ethanal. **2**

30. a) An optically active amine (X) with molecular formula $C_5H_{13}N$ on treatment with aq.$NaNO_2$/HCl gives a tertiary alcohol (Y) with evolution of N_2 gas. Identify the compounds X and Y & write all the reactions involved. **2**

b) An organic compound X with molecular formula C_3H_6O is not readily oxidized. On reduction, it gives C_3H_8O (Y) which reacts with HBr to give a bromide (Z) which is converted to Grignard reagent which reacts with X to give 2,3-dimethylbutan-2-ol. Identify X, Y and Z. **3**

Or

Alkene X (C_5H_{10}) on ozonolysis gives a mixture of two compounds Y and Z. Compound Y gives positive Fehling solution test and Iodoform test but compound Z does not give Fehling's solution test but gives Iodoform test. Identify X, Y and Z. **3**