Answer any 4 questions from 1 to 5. Each carries 1 score. $(4 \times 1 = 4)$

1. An electrochemical cell can behave like an electrolytic cell when _____.

    (a)   Ecell = 0   (b)   Ecell > Eext

    (c)   Eext > Ecell   (d)   Ecell = Eext

2. Which of the following is the unit of rate constant for a first order reaction ?

    (a) $L\ mol^{-1}\ s^{-1}$ (b) s^{-1}

    (c) $L^{-1}\ mol\ s^{-1}$ (d) $L^2\ mol^{-2}\ s^{-1}$

3. Coordination number of copper in $[Cu(CN)_4]^{3-}$ is _____.

4. Write the name of the poisonous gas formed when chloroform is oxidised by air in the presence of light.

5. Name the linkage between two monosaccharide units in a disaccharide.

Answer any 8 questions from 6 to 15. Each carries 2 scores. $(8 \times 2 = 16)$

6. Write any two applications of Henry's law.

7. Calculate the standard emf of the cell in which the following reaction takes place :

    $Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$

    $(E° Cu^{2+}/Cu = 0.34\ V\ \&\ E° Zn^{2+}/Zn = -0.76\ V)$

8. Write any two differences between order and molecularity.

9. What is the effect of temperature on the rate constant of a reaction ? Write the equation used to determine the effect of temperature on rate constant.

10. Identify the products X and Y formed in the following reactions :

   (i) $CH_3CH_2OH + PCl_5 \longrightarrow X + POCl_3 + HCl$ (1)

   (ii) $CH_3-Br + AgF \longrightarrow Y + AgBr$ (1)

11. The reaction between *tert*-butylbromide and hydroxide ion yields *tert*-butyl alcohol follows S_N1 mechanism. Write the mechanism.

12. Write the name and statement of the law that helps to identify the major product in the β-elimination reactions of haloalkanes.

13. Give reason for the solubility of alcohols in water.

14. (i)   What is Tollens' reagent ?   (1)

    (ii) Which among CH_3CHO and CH_3COCH_3 form a silver mirror on reaction with Tollens' reagent ?   (1)

15. Among CH_3NH_2 and $C_6H_5NH_2$, which is more basic ? Give reason.

Answer any 8 questions from 16 to 26. Each carries 3 scores.   **(8 × 3 = 24)**

16. Define ideal solutions by citing a suitable example. What are the values of $\Delta_{mix}H$ and $\Delta_{mix}V$ for such a solution ?

17. (i) Define molar conductivity of a solution. How does it vary with concentration ? **(2)**

(ii) State the law that helps to determine limiting molar conductivity of electrolytes. **(1)**

18. (i) What is meant by half-life of a reaction ? **(1)**

(ii) 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. **(2)**

19. (i) Some transition metal ions are given in the box below. Choose the ions which are coloured :

(Z for Sc, Ti and Cr are 21, 22 and 24 respectively) **(2)**

$$Sc^{3+}, \; Ti^{4+}, \; Ti^{3+}, \; Cr^{3+}$$

(ii) Give reason for the formation of coloured ions by transition metals. **(1)**

20. What is lanthanoid contraction ? What are the consequences of lanthanoid contraction ?

21. Draw the hybridisation scheme of $[Co(NH_3)_6]^{3+}$ based on Valence Bond Theory. Predict the geometry and magnetic behaviour of the complex.

22. (i) Write the formulae of the following coordination compounds :

(a) Pentaamminechloridocobalt(III)chloride **(1)**

(b) Potassiumhexacyanidoferrate(III) **(1)**

(ii) Which of the above is a heteroleptic complex ? **(1)**

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23. (i) Identify the products P & Q in the following reaction : **(2)**

OH
|
[benzene ring] $\xrightarrow{\text{Dilute HNO}_3}$ P + Q
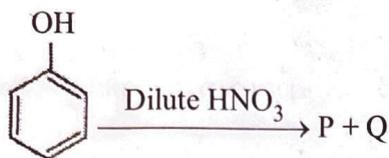
(ii) What is the product obtained when phenol is treated with concentrated nitric acid ? **(1)**

24. (i) An organic compound A on reaction with CrO_2Cl_2 in CS_2 followed by acidification gives benzaldehyde as a product. Identify the compound A and also name the reaction. **(2)**

(ii) What is the product obtained when the above organic compound A undergoes side chain oxidation with acidic potassium permanganate ? **(1)**

25. Describe Hinsberg test to distinguish primary, secondary and tertiary amines.

26. Write the classification of proteins on the basis of their molecular shape by giving suitable examples.

Answer any 4 questions from 27 to 31. Each carries 4 scores. **(4 × 4 = 16)**

27. (i) What are colligative properties ? **(1)**

(ii) The boiling point of benzene is 353.23 K. When 1.80 g of a non-volatile solute is dissolved in 90 g of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of the solute. K_b for benzene is 2.53 K kg mol^{-1}. **(3)**

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28. (i) Sketch the diagram of a H_2–O_2 fuel cell. **(1)**

(ii) Write the chemical equations for electrode reactions in it. **(2)**

(iii) Write any two advantages of a fuel cell. **(1)**

29. Explain the different types of structural isomerism in coordination compounds with the help of suitable examples.

30. (i) Describe the manufacture of ethanol from molasses. **(2)**

(ii) What is meant by denaturation of alcohol ? **(1)**

(iii) Identify the product obtained when ethanol is treated with Conc. H_2SO_4 at 443 K. **(1)**

31. Describe the following reactions :

(i) Cannizaro reaction **(2)**

(ii) Stephen reaction **(2)**