SAMPLE QUESTION PAPER

BLUE PRINT

Time Allowed : 2 hours   Maximum Marks : 35

S. No.	Chapter	Section-A (2 Marks)	Section-B (3 Marks)	Section-C (5 Marks)	Total
1.	Electrochemistry	–	–	1(5)	
2.	Chemical Kinetics	1(2)	1(3)	–	5(13)
3.	Surface Chemistry	–	1(3)	–	
4.	d- and f-Block Elements	–	1(3)	–	
5.	Coordination Compounds	–	2(6)*	–	3(9)
6.	Aldehydes, Ketones and Carboxylic Acids	2(4)	1(3)	–	
7.	Amines	–	2(6)*	–	4(13)
	Total Questions	3(6)	8(24)	1(5)	12(35)

*It is a choice based question.

CHEMISTRY

Time allowed : 2 hours   *Maximum marks : 35*

General Instructions :

Read the following instructions carefully.

1. There are 12 questions in this question paper with internal choice.
2. SECTION A - Q. No. 1 to 3 are very short answer questions carrying 2 marks each.
3. SECTION B - Q. No. 4 to 11 are short answer questions carrying 3 marks each.
4. SECTION C - Q. No. 12 is case based question carrying 5 marks.
5. All questions are compulsory.
6. Use of log tables and calculators is not allowed.

SECTION - A

1. The complexation of Fe^{2+} and chelating agent dipyridyl has been studied kinetically in both forward and reverse directions.

   $$Fe^{2+} + 3(dipy) \longrightarrow [Fe(dipy)_3]^{2+}$$

   Rate of forward reaction $= (1.45 \times 10^{13})$ $[Fe^{2+}][dipy]^3$ and rate of reverse reaction $= (1.22 \times 10^{-4})$ $[Fe(dipy)_3]^{2+}$ Find the rate constant for the complex.

2. Account for the following :
   (a) Aromatic carboxylic acids do not undergo Friedel–Crafts reaction.
   (b) pK_a value of 4-nitrobenzoic acid is lower than that of benzoic acid.

3. What do the following reactions produce? (*any two*).
   (a) Reaction of benzaldehyde with methyl amine.
   (b) Reaction of propanal with dilute NaOH.
   (c) Reaction of cyclohexanone in presence of H_2/Ni.

SECTION - B

4. Classify the following as primary, secondary or tertiary amine :
   (a) Allylamine
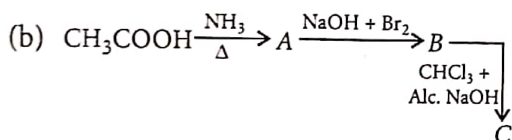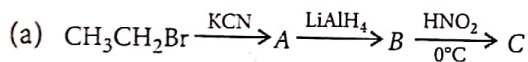   (b) Aniline
   (c) Trimethylamine

OR

$$CH_3Cl \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow{CHCl_3 + KOH \text{ (alc.)}} C$$
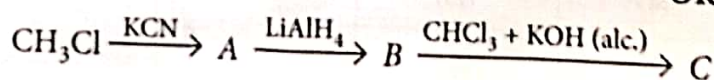
   (a) Identify product A.
   (b) Identify product B.
   (c) Identify product C.

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5. (a) Is $[Zn(NH_3)_6]^{2+}$ outer orbital complex or inner orbital complex?

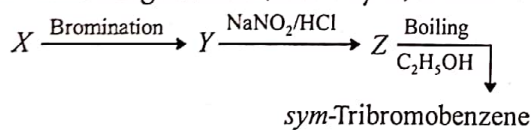   (b) Is $[Ni(H_2O)_6]^{2+}$ paramagnetic or diamagnetic?

   OR

   Arrange the following in increasing order according to the properties indicated :

   (a) $[Fe(H_2O)_6]^{2+}$, $[Fe(CN)_2(H_2O)_4]$, $[Fe(CN)_4(H_2O)_2]^{2-}$
   (Order of Δ_o)

   (b) $[Cu(H_2O)_4]^+$, $[Cu(NH_3)_4]^{2+}$, $[CoF_6]^{3-}$
   (Number of unpaired electrons)

6. How does amount of gas absorbed by solid depend upon nature of gas? Why is adsorption of CO_2 on tungsten higher in comparison to O_2?

7. The half life for the reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + O_{2(g)}$ is 2.4 hr at 30°C.

   (a) Starting with 10 g, what is the mass of N_2O_5 left after 9.6 hr?

   (b) How much time is required to reduce 5.0×10^{10} molecules of N_2O_5 to 1.0×10^8 molecules?

8. How are the following conversions carried out?

   (a) Ethyl cyanide to ethanoic acid.

   (b) Butan-1-ol to butanoic acid.

   (c) Benzoic acid to *m*-bromobenzoic acid.

9. Give the structures of products A, B and C in the following reactions :

   (a) $CH_3CH_2Br \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[0°C]{HNO_2} C$

   (b) $CH_3COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow{NaOH + Br_2} B \xrightarrow[\substack{CHCl_3 + \\ Alc. NaOH}]{} C$

   OR

   In the following reaction, identify X, Y and Z.

   $X \xrightarrow{Bromination} Y \xrightarrow{NaNO_2/HCl} Z \xrightarrow[C_2H_5OH]{Boiling}$ *sym*-Tribromobenzene

10. Following ions are given : Cr^{2+}, Cu^{2+}, Cu^+, Fe^{2+}, Fe^{3+}, Mn^{3+}

    Identify the ion which is

    (a) a strong reducing agent.

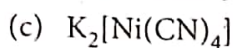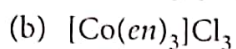   (b) unstable in aqueous solution.

    (c) a strong oxidising agent.

    Give suitable reason in each.

11. Explain the hybridisation in following complexes :

    (a) $[Mn(CN)_6]^{4-}$

    (b) $[Cr(NH_3)_6]^{3+}$

    (c) $[Co(NH_3)_6]^{3+}$

Write the state of hybridization, the shape and the magnetic behaviour of the following complex entities :

(a) $[Cr(NH_3)_4Cl_2]Cl$

(b) $[Co(en)_3]Cl_3$

(c) $K_2[Ni(CN)_4]$

SECTION - C

12. Read the passage given below and answer the following questions.

The concentration of potassium ions inside a biological cell is at least twenty times higher than the outside. The resulting potential difference across the cell is important in several processes such as transmission of nerve impulses and maintaining the ion balance. A simple model for such a concentration cell involving a metal M is

$M_{(s)} \mid M^+(aq.; 0.05 \text{ molar}) \parallel M^+(aq.; 1 \text{ molar}) \mid M_{(s)}$
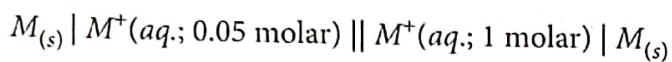
(a) What is value of ΔE for the cell?

(b) What will be the magnitude of cell potential if 0.05 M solution of M^+ is replaced by 0.0025 M solution?

(c) What are the conditions for a reaction to be feasible in term of electrochemistry?

(d) What is the emf of the cell when the cell reaction attains equilibrium?

Does the potential of cell change with concentration of ions in solution or voltage of cell?