NATIONAL ACADEMY FOR LEARNING
BENGALURU
2022 – 2023
FIRST TERM EXAMINATION
CHEMISTRY PAPER 1
(THEORY)

Grade: 12 ISC **Maximum Marks: 70**
Time: 3 hours **No. of Pages: 7**

Candidates are allowed **additional 15 minutes** for **only** reading the Paper.
They must **not** start writing during this time.
This paper is divided into **four** sections – A, B, C and D.
Answer **all** questions.
Section A consists of **one** question **having sub-parts** of **one** mark each.
Section B consists of **ten** questions of **two** marks each.
Section C consists of **seven** questions of **three** marks each, and
Section D consists of **three** questions of **five** marks each.
Internal choices have been provided in one question each in Section B, Section C and Section D.
All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.
The intended marks for questions or parts of questions are given in brackets [ ].
Balanced equations must be given wherever possible and diagrams where they are helpful.
When solving numerical problems, all essential working must be shown.
In working out problems, use the following data:
Gas constant R = 1⊕987 cal deg^{-1} mol^{-1} = 8⊕314 JK^{-1} mol^{-1} = 0⊕0821 dm^3 atm K^{-1}mol^{-1}
1 l atm = 1 dm^3 atm = 101⊕3 J. 1 Faraday = 96500 coulombs.
Avogadro's number = 6⊕023 · 10^{23}

SECTION A – 14 MARKS

Question 1

A. Fill in the blanks by choosing the appropriate word(s) from those given in the brackets: **[4x1]**
[ohm^{-1}cm^{2}eq $^{-1}$, two, four, zero, ohm^{-1}cm^{2}mol $^{-1}$, inner, anode, paramagnetic, cathode, outer, one, diamagnetic, ohm^{-1}cm^2, ohm^{-1}]

i. The units of molar conductivity and equivalent conductivity are _____and _____ respectively.

ii. When the concentration of a reactant of first order reaction is doubled, the rate becomes .....times, but for..... order reaction, the rate remains the same.

iii. In a Galvanic cell, the movement of electrons in the external circuit is from..... to…….

iv. [Cr $(NH_3)_6]^{3+}$ is an ..... orbital complex and ..... in nature.

B. Select and write the correct alternative from the choices given below: **[4x1]**

i. Which alkyl halide reacts most readily by nucleophilic substitution?
a. Ethyl chloride
b. Ethyl bromide
c. Ethyl iodide
d. Ethyl fluoride

ii. The limiting molar conductivities λ^0 for NaCl, KBr and KCl are 126, 152 and 150 $Scm^2 mol^{-1}$ respectively. The λ^0 for NaBr is:
a. 128 S cm^2 mol^{-1}
b. 176 S cm^2 mol^{-1}
c. 278 S cm^2 mol^{-1}
d. 302 S cm^2 mol^{-1}

iii. Which of the following reagents cannot be used to prepare an alkyl chloride from an alcohol?
a. HCl +$ZnCl_2$
b. $SOCl_2$
c. NaCl
d. PCl_5

iv. Halogenation of an alkane gives:
a. only the required alkyl halide
b. alkyl halide and unreacted halogen
c. a mixture of mono-, di-, tri- and tetra-halogen derivatives
d. alkyl halide and unreacted alkane

C. Match the following: **[4x1]**

Column I	**Column II**
i. a positive catalyst	a. osmotic pressure
ii. Lucas test	b. sum of powers to which concentration of reactants are raised
iii. order of a reaction	c. provides an alternative path with low energy barrier
iv. colligative property	d. tertiary alcohol

D. **[2x1]**

i**. Assertion:** $CHCl_3$ is stored in dark bottles.
Reason: $CHCl_3$ is oxidised in the dark.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, but reason is not the correct explanation for the assertion.
c. Assertion is true but reason is false.
d. Assertion is false but reason is true.

ii. **Assertion:** Specific conductance of all electrolytes decreases on dilution.
Reason: On dilution, number of ions per unit volume increases.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, but reason is not the correct explanation for the assertion.
c. Assertion is true but reason is false.
d. Assertion is false but reason is true.

SECTION B – 20 MARKS

Question 2 **[2]**
Write the cell representation and calculate standard EMF of Cu/Cu^{2+} // Zn/Zn^{2+}.
E^0 Cu^{2+}/Cu=0.34Volts, E^0 Zn^{+2}/Zn= 0.76 volts

Question 3 **[2]**
Write the mechanism of acid dehydration of ethanol to ethene.

Question 4 **[2]**
How will you distinguish between the following?
i. 1-propanol and 2-propanol

ii. Ethanol and Phenol

Question 5 **[2]**
What type of isomerism is exhibited by the following pairs of compounds?
i. $[PtCl_2(NH_3)_4]$ Br_2 and $[PtBr_2(NH_3)_4]Cl_2$
ii. $[Cr(SCN)(H_2O)_5]^{2+}$ and $[Cr(NCS)(H_2O)_5]^{2+}$

[2]

Question 6
Explain the following:

i. Specific conductance decreases with dilution whereas equivalent conductance increases with dilution.
ii. P-dichlorobenzene has a higher melting point than its o-and m-isomers.

Question 7 **[2]**
Explain how the OH group attached to a carbon of benzene ring activates it towards electrophilic substitution?

Question 8 **[2]**

i. Alcohols having lower molecular weights are soluble in water but those with higher molecular weights are insoluble in water. Explain.

OR

ii. Ethyl alcohol dissolves in water in all proportions but dimethyl ether is sparingly soluble in water. Explain.

Question 9 **[2]**

$[CoF_6]^{3-}$ is a coordination complex ion.(atomic number of Co=27)

i. What is the oxidation number of cobalt in the complex?

ii. How many unpaired electrons are there in the complex?

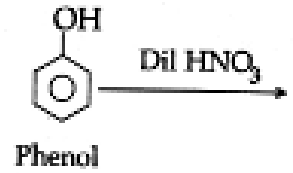
iii. State the magnetic behaviour of the complex.

iv. Give the I.U.P.A.C. name of the complex.

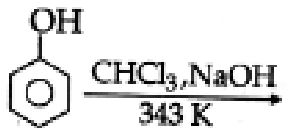
Question 10 **[2]**

Complete and balance the following equations:

i.



ii.



Question 11 **[2]**

i. Why does electrolysis of aqueous solutions of NaBr and NaI give Br_2 and I_2 respectively, while that of NaF gives O_2 instead of F_2?

ii. Explain how specific conductance and equivalent conductance changes with dilution.

SECTION C- 21 MARKS

Question 12 **[3]**

i. State Kohlrausch law for the electrical conductance of an electrolyte at infinite dilution.

ii. Three electrolytic cells A, B and C containing $ZnSO_4$, $AgNO_3$ and $CuSO_4$ solutions respectively are connected in series. A steady current of 1.5 amperes was passed through them until 1.45g of silver was deposited at the cathode of cell B. How long did the current flow? What mass of copper and zinc were deposited?
[Zn= 65, Cu=63.5, Ag= 108]

Question 13 **[3]**

Calculate the $\Delta_r G^0$ and comment on feasibility for the following cell reaction.
$2\ Cr\ (s) + 3\ Cd^{2+}\ (aq) \rightarrow 2\ Cr^{3+}\ (aq) + 3\ Cd\ (s)$
(Given $E^0\ Cr^{+3}/Cr = -0.70V$, $E^0\ Cd^{+2}/Cd = -0.40V$, $F = 96500C\ mol^{-1}$)

Question 14 **[3]**

i. Ethylene glycol is used as an antifreeze agent. Calculate the amount of ethylene glycol to be added to 4 kg of water to prevent it from freezing at – 5°C.
(K_f for H_2O = 1·85 K mol^{-1} Kg)

ii. A solution of lactose containing 8·45 g of lactose in 100 g of water has a vapour pressure of 4·559 mm of Hg at 0°C. If the vapour pressure of pure water is 4·579 mm of Hg, calculate the molecular weight of lactose.

Question 15 **[3]**

i.
In the button cell used in watches, the following reaction occurs:
$Zn\ (s) + Ag_2\ O\ (s) + H_2O\ (l) \rightarrow Zn^{2+}\ (aq) + 2\ Ag\ (s) + 2\ OH^{--}\ (aq)$
Determine E^0 for the cell and $\Delta_r G^0$ for the reaction.
(Given: $Zn^{2+}\ (aq) + 2e^- \rightarrow Zn\ (s)$; E° = — 0.76 V,
$Ag_2O\ (s) + 2\ H_2O\ (l) + 2e^- \rightarrow Ag\ (s) + 2\ OH^-(aq)$,
$E^0 = + 0.34$ V, $F = 96500\ C\ mol^{-1}$)

ii.
Differentiate between primary and secondary cells with the help of an example for each.

Question 16 **[3]**

i. What is crystal field splitting? Draw a diagram to show the splitting of degenerated d–orbitals in an octahedral crystal field.

ii. A metal coordination number six complex having composition Cr $(NH_3)_4Cl_2Br$ has been isolated in two forms (A) and (B). The form (A) reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aq. ammonia, whereas (B) gives a pale-yellow precipitate soluble in concentrated ammonia. Write the formula of (A) and (B) and state the hybridization of chromium in each.

Question 17 **[3]**

i. If 1.71 g of sugar (molar mass = 342) is dissolved in 500 ml of an aqueous solution at 300 K, what will be its osmotic pressure?

ii. 0.70 g of an organic compound when dissolved in 32 g of acetone produces an elevation of 0.25°C in the boiling point. Calculate the molecular mass of organic compound (K_b for acetone=1.72$Kkgmol^{-1}$).

OR

i. What will be the vapour pressure of a solution containing 5 moles of sucrose ($C_{12}H_{22}O_{11}$) in 1 kg of water, if the vapour pressure of pure water is 4.57 mm of Hg?

[C = 12, H = 1, O = 16].

ii. A 2 molal solution of sodium chloride in water causes an elevation in the boiling point of water by 1.88 K. What is the value of van't Hoff factor? What does it signify? [Kb = 0.52 $K\ kg\ mol^{-1}$].

[Na= 23, Cl=35.5]

Question 18 **[3]**

How are the following conversions done? (Give chemical equations only.)

i. Toluene to o-cresol

ii. Benzene to benzene diazonium chloride.

iii. Chlorobenzene into phenol.

SECTION D - 15 MARKS

Question 19 **[5]**

i. Name the following compounds according to IUPAC rules.

a. $[Co(NH_3)_6]Cl_3$

b. $K[PtCl_3(NH_3)]$

ii. Explain why an aqueous solution of potassium hexacyanoferrate (II) does not give a test for ferrous ion.

iii. Draw the geometrical isomers of the compound $[Co(NH_3)_2Cl_2]$.

iv. Write the formula of potassium trioxalatoferrate (III).

Question 20

i. At 300 K, a first order reaction is 50% complete in 20 minutes. At 350 K, the same reaction is 50% complete in 5 minutes. Calculate the activation energy of the reaction. **[5]**

ii. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate:

a. the half-life of the reaction

b. the time required for completing 17% of the reaction

iii. A reaction between A and B is of second order. Write three different rate law expressions which might possibly apply to the reaction.

OR

i.

a. Give one example (equation) of a homogeneously catalysed reaction and name the catalyst.

b. A study of chemical kinetics of the reaction A+B→ Products, gave the following data at 25°C:

Experiment	**[A]**	**[B]**	d[Products] /dt
1	1.0	0.15	4.20×10^{-6}
2	2.0	0.15	8.40×10^{-6}
3	1.0	0.20	5.60×10^{-6}

Find:

(a) the order of reaction with respect to A

(b) the order of reaction with respect to B

(c) the rate law

ii. A first order reaction is completed 50% in 30 minutes at 27°C.Calculate the rate constant of the reaction at 27° C.

iii. Name the three factors that usually modify the rate of a reaction.

Question 21 **[5]**

Explain the following name reactions:

i. Fittig reaction
ii. Finkelstein reaction
iii. Kolbe's reaction
iv. Sandmeyer's reaction
v. Friedel-Crafts reaction on aryl ether

****