ST. JOSEPH'S ACADEMY, DEHRADUN

2ND PRELIMINARY EXAMINATION 2024-25

SUBJECT: CHEMISTRY **CLASS: XII** **M.M.: 70 TIME: 3 HOURS**

NAME OF THE STUDENT.....CLASS/SECTION.....ROLL NO.....

Instructions to Candidates

- You are allowed additional 15 minutes for only reading the question paper.
- You must NOT start writing during the reading time.
- This question paper has 08 printed pages.
- It is divided into four sections and has 21 questions in all.
- All questions are compulsory. Answer all questions.
- Section A has fourteen subparts. Each question carries 1 mark.
- While attempting Multiple Choice Questions in Section A, you are required to write only ONE option as the answer.
- Section B has ten questions. Each question carries 2 marks.
- Section C has seven questions. Each question carries 3 marks.
- Section D has three questions. Each question carries 5 marks.
- Internal choices have been provided in one question each in Sections B, C and D.
- The intended marks for questions are given in brackets [ ].
- All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.
- Balanced equations must be given wherever possible and diagrams where they are helpful.
- When solving numerical problems, all essential workings must be shown.
- In working out problems, use the following data:

Gas constant $R=1{\cdot}987 cal\ deg^{-1}mol^{-1}=8{\cdot}314 JK^{-1}\ mol^{-1}=0{\cdot}0821 dm^3\ atmK^{-1}mol^{-1}$,

$1\ l\ atm=1 dm^3\ atm=101{\cdot}3\ J$.

1 Faraday=96500 coulombs. Avogadro's number= $6{\cdot}023\times10^{23}$.

SECTION-A [14 MARKS]

Question 1.

(A) Fill in the blanks by choosing the appropriate word/words from those given in the brackets. [4×1=4]

(1, 2, 3, 4, 5, 6, benzaldehyde, benzoic acid, bezoin, chlorobenzene, maximum, minimum, strongest, weakest)

(i) F_2 is the _____ oxidizing agent because it possesses the _____ value of standard electrode potential.

(ii) In order to make an octahedral complex of Co^{3+} ion with EDTA _____ number of EDTA molecules will be required as the denticity of EDTA is _____.

(iii) The primary and secondary valencies in the complex ion, dichloridodioxalatochromium (III) are _____ and _____ respectively.

(iv) Toluene on oxidation with chromyl chloride in CCl_4 gives _____which on heating with alcoholic KCN solution produces _____.

(B) Select and write the correct alternative from the choices given below: [7×1=7]

(i) The compound that gives oxime with hydroxyl amine is:

(a) $CH_3\ CO\ CH_3$
(b) CH_3COOH
(c) $CH_3COO\ CH_3$
(d) CH_3COCl

THIS PAPER CONSISTS OF SIX PRINTED SIDES

(ii) Which of the following has β - D glucose as its monosaccharide unit :

(a) maltose
(b) starch
(c) sucrose
(d) cellulose

(iii) Silver acetate is refluxed with bromine in CCl_4. The products formed are silver bromide, carbon dioxide and :

(a) Bromoethane
(b) Bromomethane
(c) Methane
(d) Ethane

(iv) Which of the following configurations of ions has zero CFSE in both strong and weak ligand fields?

(a) d^{10}
(b) d^8
(c) d^6
(d) d^4

(v) Water retention or puffiness due to high salt intake occurs due to:

(a) Diffusion
(b) Osmosis
(c) Reverse Osmosis
(d) Vapour pressure difference

(vi) Assertion: Separation of Zr and Hf is difficult
Reason: Because Zr and Hf lie in the same group of the periodic table.

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

(vii) Assertion: Formic acid reduces Tollen's Reagent
Reason: Compounds containing - CHO group reduce Tollen's reagent.

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

(C) The solubility of a gas in liquid depends upon the nature of the gas, nature of the solvent, temperature and pressure. The dissolution of a gas in liquid is an exothermic process. Henry studied quantitatively the effect of pressure on the solubility of a gas in a liquid. Henry's Law finds wide applications in our daily life. [3]

(i) Why do gases tend to be less soluble in liquid as the temperature is raised?
(ii) What do you understand by 'bends'?
(iii) Mole fraction of an inert gas in its saturated solution is 1.2×10^{-6}. What is the pressure of the inert gas in the above the solution? (Given $K_H = 144.96$ K bar)

SECTION-B [20 MARKS]

Question 2. [2]

Aqueous copper sulphate solution and aqueous silver nitrate solution are electrolysed by 1 ampere current for 10 minutes in separate electrolytic cells. Will the mass of copper and silver deposited on the cathode be same or different? Explain your answer. (Atomic wt. Cu = 63.5, Ag =108)

Question 3. [2]

An organic compound (A) on treatment with ethyl alcohol gives a carboxylic acid (B) and compound (C). Hydrolysis of (C) under acidified condition gives (B) and (D). Oxidation of (D) with $KMnO_4$ also gives (B). (B) on heating with $Ca(OH)_2$ gives (E) having molecular formula C_3H_6O. (E) does not give Tollens' test and does not reduce Fehling's solution but forms 2,4-dinitrophenylhydrazone. Identify (A), (B), (C), (D) and (E).

Question 4. [2]

Compound 'A' with molecular formula C_4H_9Br is treated with aq. KOH solution. The rate of this reaction depends upon the concentration of the compound 'A' only. When another optically active isomer 'B' of this compound was treated with aq. KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both.

(a) Write down the structural formula of both compounds 'A' and 'B'

(b) Out of these two compounds, which one will be converted to the product with inverted configuration.

Question 5. [2]

(a) In the graph of log of concentration of reactant v/s time if, slope = -2.0×10^6/s , what will be the value of rate constant ?

(b) For the reaction : $2NH_3(g) \xrightarrow{(Pt)} N_2(g) + 3H_2(g)$, rate =k. Write the order of this reaction.

Question 6. [2]

Sneha carried out bromination of aniline and obtained compound (A) while, Smitha acetylated aniline before its bromination and obtained compound (B).

Identify compounds (A) and (B).

Why do Sneha and Smitha obtain different products? Explain.

Question 7. [2]

A coordination compound has the formula $CoCl_3.4NH_3$. It does not liberate ammonia but precipitates chloride ions as silver chloride. Give the IUPAC name of the complex and write its structural formula.

Question 8. [2]

Consider the compound given within brackets.

[Sodium phenoxide, bromomethane, bromobenzene, sodium methoxide].

Raj was provided with the above compounds and asked to prepare methoxybenzene. Name the compounds Raj used and justify his choice. Also give the name of the reaction and balanced equation to represent the above preparation.

Question 9. [2]

(i) Identify compounds A and B in the following conversions:

(a) $C_6H_5Br \xrightarrow[\text{dry ether}]{Mg} A \xrightarrow{CO_2,\ H_3O^+} B$

(b) $C_6H_5COOH \xrightarrow{SOCl_2} A \xrightarrow[H_2]{Pd,\ BaSO_4} B$

OR

(ii) Giving reasons arrange the following compounds in increasing order of the property indicated :

(a) Acetaldehyde, acetone, methyl tert-butyl ketone (reactivity towards HCN).

(b) Benzoic acid, 4-nitrobenzoic acid, 4-methoxy benzoic acid (increasing order of pKa values).

Question 10. [2]

Conductivity of 2×10^{-3} M methanoic acid is 8×10^{-5} S cm^{-1}. Calculate its molar conductivity and degree of dissociation if λ^o_m for methanoic acid is 404 S cm^2 mol^{-1}.

Question 11. [2]

Write a chemical test to distinguish between the following pairs of compounds:

(i) Phenol and Aniline.

(ii) Benzaldehyde and Acetaldehyde.

SECTION-C [21 MARKS]

Question 12. [3]

Identify compounds A, B and C in the following reactions:

(i) $CH_3COOH \xrightarrow{NH_3/\ \Delta} A \xrightarrow{Br_2/KOH\ (aq)} B \xrightarrow{CHCl_3 + \text{alc. } KOH} C$

(ii) $C_6H_5N_2^+BF_4^- \xrightarrow[\Delta]{NaNO_2,Cu} A \xrightarrow{Sn/HCl} B \xrightarrow{H_2SO_4} C$

Question 13. [3]

According to Collision Theory of chemical reactions, the rate of reaction depends upon the frequency and the fraction of molecules undergoing effective collisions.

(i) State the factors that govern the occurrence of effective collisions.

(ii) Write a quantitative relationship between rate constant and temperature of a given reaction system.

(iii) Given that the temperature coefficient for saponification of ethyl acetate by NaOH is 1.75, calculate the activation energy of the reaction.

Question 14. [3]

Give reasons:

(i) Carboxylic acids do not give the characteristic reactions of carbonyl group.

(ii) Old samples of ether must be purified before use.

(iii) Aliphatic amines are stronger bases than aromatic amines.

Question 15. [3]

(i) $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex. Explain.

(ii) Name the type of structural isomerism exhibited by $[Co(NH_3)_5Cl]SO_4$ and write the formula of the isomer.

Question 16. [3]

(i)

(a) One half-cell in a voltaic cell is constructed from a silver wire dipped in silver nitrate solution of unknown concentration. Its other half-cell consists of a zinc electrode dipped in 1.0 M solution of zinc nitrate. A voltage of 1.48 volts is measured for this cell. Use this information to calculate the concentration of silver nitrate used.

$[E^0_{Zn^{2+}/Zn} = -0.76\ V, \quad E^0_{Ag^+/Ag} = +0.80\ V]$

(b) One day John's mother noticed that the water pipeline of her house was getting rusted. She did not want excavation of the pipe. She asked her son as he was a student of science, to suggest some method so that further rusting stops.
What do you think John must have suggested to his mother and why?

OR

(ii) The standard reduction potential of the following electrodes are given below. Answer the questions that follow:

Electrodes	SRP Value
Fe^{2+}/ Fe	-0.44V
Mg^{2+}/ Mg	-2.37V
I_2/ $2I^-$	+0.54V
Ag^+/ Ag	+0.88V

(a) Which substance/s could be used to convert iodide ions to iodine?

(b) From the given reactions which reaction is spontaneous and why?

i) $Fe^{2+} + 2Ag \rightarrow 2Ag^{1+} + Fe$

ii) $Fe^{2+} + Mg \rightarrow Mg^{2+} + Fe$

(c) Why does a dry cell become dead after a long time even if it has not been used?

Question 17. [3]

Answer the following questions:

(i) Write a reaction to show that all carbon atoms in glucose are linked in a straight chain.
(ii) Name the purine and pyrimidine bases found in DNA and RNA.
(iii) Classify insulin and myosin as fibrous and globular proteins. Also differentiate between them with respect to their sensitivity to temperature and pH changes.

Question 18. [3]

For the reaction : $2H_2 + 2NO \rightleftharpoons 2H_2O + N_2$, the following rate data was obtained :

S.No.	[NO] mol L^{-1}	[H_2] mol L^{-1}	Rate mol L^{-1} sec^{-1}
1	0.40	0.40	4.6×10^{-3}
2	0.80	0.40	18.4×10^{-3}
3	0.40	0.80	9.2×10^{-3}

Calculate the following:

(i) The overall order of the reaction
(ii) The rate law
(iii) The value of rate constant (k).

SECTION-D [15 MARKS]

Question 19. [5]

(i)

(a) Convert:

1. Acetone to acetoxime
2. Chlorobenzene to phenol
3. Formaldehyde to acetaldehyde

(b) Write chemical equations to illustrate the following name reactions:

1. Wolff-Kishner reduction
2. Cannizzaro reaction

OR

On Kumbh Mela Solar Eclipse festivals and other social events, fairs are held on the banks of holy rivers for some stipulated days. Lakhs of people participate in these fairs to pay homage to their deities. For the convenience of pilgrims, make-shift toilets are made in the fair area by the district administration. In and around these toilets a white aromatic compound (powder) is often sprinkled.

(a)

1. Give the IUPAC name and structure of the compound contained in the white powder.
2. Are there any harmful effects of the compound contained in the white powder? Comment.

(b)

1. Write a chemical equation of the reaction of formaldehyde and ammonia.
2. What is observed when benzoic acid is treated with neutral ferric chloride solution?
3. Write the reaction for the preparation of aniline from phthalimide.

Question 20. [5]

(i) Give reasons for the following:

(a) Mn^{2+} is more resistant than Fe^{2+} towards oxidation.

(b) Transition elements form alloys.

(c) La^{3+} (Z=57) and Lu^{3+} (Z=71) do not show colour in solution.

(ii) Write balanced equations for the reaction of :

(a) Acidified potassium dichromate with potassium iodide solution.

(b) Acidified potassium permanganate with ferrous sulphate solution.

Question 21. [5]

(i) If benzoic acid (molar mass = 122 g mol^{-1}) is associated into a dimer when dissolved in benzene and the osmotic pressure of a solution of 6.1 g of benzoic acid in 100 ml of benzene is 6.5 atm at 27°C, then what is the percentage association of benzoic acid ? (Given R=0.0821 atm L K^{-1} mol^{-1}).

(ii) Explain why equimolar aqueous solutions of sodium chloride and sodium sulphate are not isotonic.

(iii) The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order given below. Explain why?

Acetic acid < trichloroacetic acid < trifluoroacetic acid.