ST. JOSEPH'S ACADEMY, DEHRADUN
IST 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=1·987cal deg^{-1}mol^{-1}=8·314JK^{-1} mol^{-1} =0·0821dm^3 atmK^{-1}mol^{-1},

1 l atm =1dm^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/words from those given in the brackets: [4×1=4]

(ammonia, potassium iodate, formaldehyde, lower, para, oxidises, dia, higher, benzaldehyde, hydroxyl amine, reduces, iodine)

(i) A metal with _____ reduction potential can displace metals with _____ reduction potentials form their salt solutions.

(ii) Ferricyanide ion is _____ magnetic while ferrocynaide ion is _____ magnetic in nature.

(iii) Urotropine is formed by the action of _____ with _____.

(iv) Potassium permanganate_____ potassium iodide to _____.

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

(i) Gabriel phthalimide reaction is used for the preparation of:

(P) primary aromatic amines
(Q) primary aliphatic amines
(R) secondary amines
(S) tertiary amines

(a) only P
(b) only Q
(c) Both R and S
(d) Both P and S

(ii) At same temperature, which pair of the following solutions are isotonic solutions?

(a) 0.2m $BaCl_2$ and 0.2m urea
(b) 0.1m NaCl and 0.1m urea
(c) 0.1m NaCl and 0.1m K_2SO_4
(d) 0.1m $Ba(NO_3)_2$ and 0.1m Na_2SO_4

(iii) Haloform reaction does not takes place with

(a) Propanone
(b) Propan-2-ol
(c) ethanol
(d) 2-chloropropane

(iv) Glucose reacts with an access of phenyl hydrazine to form:

(a) glucose phenyl hydrazone
(b) glucosone
(c) glucosazone
(d) fructose phenyl hydrazone

(v) The co-ordination number and oxidation state of the element 'E' in the complex $[E(NH_3)_4Cl_2]NO_3$ are respectively:

(a) 6 and 3
(b) 6 and 2
(c) 4 and 2
(d) 4 and 3

(vi) Assertion: In monohaloarenes, further electrophilic substitution occurs at ortho- and para- positions.

Reason: Halogen atom is a ring deactivator.

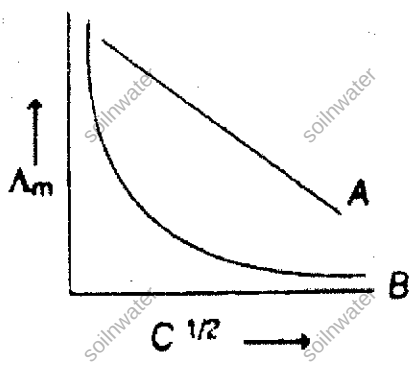
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation for assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

(vii) Assertion: Zn^{2+}, Cd^{2+} and Hg^{2+} salts are colourless.

Reason: Zn^{2+}, Cd^{2+} and Hg^{2+} contain 3d filled subshell and exhibit d-d transition.

(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) Both assertion and reason are false.

(C) Observe the graph shown in the figure between Λ_m vs $\sqrt{C}$ and answer the questions based on the graph. [3×1=3]



(i) The curve B is for KCl or CH_3COOH? Justify your answer.
(ii) What is intercept on Λ_m axis for 'A' equal to?
(iii) What happens to molar conductivity on dilution in case of weak electrolyte and why?

SECTION-B [20 MARKS]

QUESTION 2. [2]

For a chemical reaction at 27^0C, the activation energy is 600R. Calculate the ratio of the rate constant at 327^0C to that of at 27^0C.

QUESTION 3. [2]

Anshu was analyzing an organic compound C_2H_4O which gave red precipitate when heated with Fehling solution, the compound also underwent Aldol condensation in the presence of dilute NaOH. She interpreted the compound to be dimethyl ether. Is she correct? If not, identify the correct compound and state your observation when the above compound is heated with ammoniacal silver nitrate.

QUESTION 4. [2]

Silver acetate is refluxed with bromine in carbon tetra chloride, identify the products formed. What is the above reaction known as?

QUESTION 5. [2]

A radioactive element gets spilled over the floor of a room. Its half life period is 30 days. If its initial activity is 10 times the permissible value, after how many days will it be safe to enter the room?

QUESTION 6. [2]

An aromatic compound (A) on heating with NH_3 and Cu_2O at high pressure gives (B). The compound (B) on treatment with ice cold solution of $NaNO_2$ and HCl gives (C) which on heating with Cu/HCl gives compound (A) again. Identify (A), (B), and (C). Write the name of the reaction for the conversion of (B) to (C).

QUESTION 7. [2]

KCN is highly toxic and is used in the manufacture of rat kill but $K_4[Fe(CN)_6]$ is not poisonous although both the compounds contain CN^-. Why?

QUESTION 8. [2]

A compound 'A' containing C, H and O is unreactive towards sodium. It does not react with Schiff's reagent. It does not react with bases. On refluxing with excess of HI, 'A' yields only one organic product 'B'. On hydrolysis 'B' yields 'C', which can be converted to 'B' by reaction with red P and I_2. The compound 'C' on oxidation with acidified $KMnO_4$ give a carboxylic acid 'D' having 2 carbon atoms. Identify A,B,C,D.

Question 9. [2]

(a) How will you bring about the following conversions?

(i) Acetic acid to acetaldehyde

(ii) Formic acid to acetic acid

OR

(b) An aliphatic compound (A) having molecular formula C_2H_4O on oxidation with acidified $KMnO_4$ gives (B) which gives effervescence with Na_2CO_3. (B) on treatment with $SOCl_2$ gives (C). When (C) reacts with ethanol it gives a sweet smelling liquid (D). Identify A,B,C,D.

QUESTION 10. [2]

0.3605g of a metal is deposited on the electrode by passing 1.2A of current for 15min through its salt solution . The atomic weight of metal is 96. What is the valency of the metal?

QUESTION 11. [2]

Give a chemical test to distinguish between the following:

(i) Phenol and benzoic acid

(ii) iso-propyl alcohol and n-propyl alcohol

SECTION-C [21 MARKS]

Question 12. [3]

(a) $CoClSO_4.5NH_3$ exists in two isomeric forms (A) and (B).Isomer (A) reacts with $AgNO_3$ to give white ppt. but it does not react with $BaCl_2$. Isomer(B) gives white ppt. with $BaCl_2$ but does not react with $AgNO_3$. Answer the following questions:

(i) Identify (A) and (B) and write their IUPAC names.

(ii) Name the type of isomerism involved.

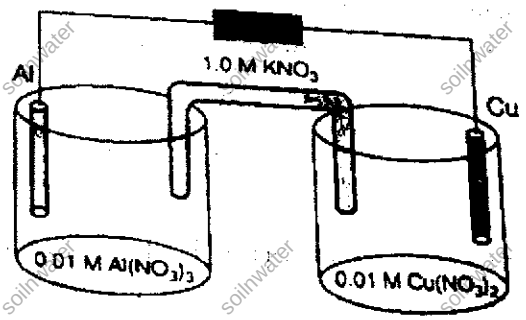
OR

(b) (i) Draw the structure of isomers if any and write the IUPAC name of $[Co(en)_3]^{3+}$.

(ii) Write the hydrate isomer of $[CoCl(H_2O)(NH_3)_4]Cl_2$.

Question 13. [3]

Rohan constructed the following electrochemical cell at 298 K but forgot the concentration of $Al(NO_3)_3$ taken.



(i) Write the cell reaction for the above cell.

(ii) Calculate the concentration of $[Al^{3+}]$, if concentration of $[Cu^{2+}]$ is 0.1M and E_{cell} is 1.88V. [Given $E^0_{(Cu2+/Cu)}$ =0.337V, $E^0_{(Al3+/Al)}$ =-1.66V]

QUESTION 14. [3]

Gauri used phenol, chloroform and caustic soda at 340K to prepare a compound.

(i) Identify the compound formed.

(ii) Name the above reaction.

(iii) If she uses carbon tetrachloride instead of chloroform will there be a change in the major product. If yes, give balanced equation to support your response.

Question 15. [3]

(i) Write the cell reaction taking place at anode and cathode respectively during rusting of iron.

(ii) What is the effect of CO_2 in water on rusting?

Question 16. [3]

Identify the compounds A, B, C, D, E and F in the following sequence of reactions:

$$CH_3COOH \xrightarrow{NH_3} A \xrightarrow{heat} B \xrightarrow{NaOH/Br_2} C \xrightarrow{HNO_2} D \xrightarrow{NaOH} E \xrightarrow{CH_3Br} F$$

QUESTION 17. [3]

(i) Name a fat soluble vitamin and one deficiency disease caused by it.
(ii) What is isoelectric point?
(iii) What is the effect of denaturation on the structure of proteins?

QUESTION 18. [3]

The data in the table given below was obtained in a series of experiments on the rate of the reaction between compounds [A] and [B] at a constant temperature:

Experiment	The initial conc. of [A] in mol dm^{-3}	The initial conc. of [B] in mol dm^{-3}	Initial rate $mol\ dm^{-3}5^{-1}$
1	0.15	0.30	1.10×10^{-4}
2	0.30	0.30	4.40×10^{-4}
3	0.60	0.15	8.80×10^{-4}

Show how this data can be used to deduce the rate expression for the reaction between [A] and [B]. Find their orders. Give the rate law, and also find out the value of k.

SECTION-D [15 MARKS]

QUESTION 19. [5]

(a) (i) An aqueous solution of a non-volatile solute freezes at 272.4K while pure water freezes at 273.0K Determine the following:

(Given K_f =1.86 K kg mol^{-1}, K_b=0.512 K kg mol^{-1} and the vapour pressure of water at 298K =23.756 mm of Hg)

(1) The molality of solution
(2) Boiling point of solution
(3) The lowering of vapour pressureof water at 298K

(ii) A solution containing 1.23 g of calcium nitrate in 10 g of water boils at 100.975^{0}C at 760 mm of Hg. Calculate the van't Hoff factor for the salt at this concentration. (K_b=0.52 K kg mol^{-1}, mol. wt. of calcium nitrate=164 g mol^{-1})

OR

(b) Answer the following questions:

(i) Electrolyte 'A' produces 5 ions in solution whereas electrolyte 'B' is non-electrolyte. If 0.1M solution of 'B' produces the osmotic pressure of 'P' , how much osmotic pressure will be developed by electrolyte 'A'?

(ii) A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass=60) in the same solvent. If the densities of both the solutions is assumed to be equal to 1.0 gcm^{-3}, what is the molar mass of the substance?

(iii) A solution of chloroform and acetone is an example of maximum boiling azeotrope. Give reason.

(iv) If glycerine [$C_3H_5(OH)_3$] and methyl alcohol[CH_3OH] are sold at the same price per kg, which would be cheaper for using as antifreeze solution for car radiators? Give reason also.

(v) Osmotic pressure method is preferred for determining the molecular mass of proteins. Why?

QUESTION 20. [5]

(i) Give reasons:

(1) S_N1 reactions are accompanied by racemization in optically active halides.

(2) Formic acid reduces Tollen's reagent but acetic acid does not.

(3) Acetic acid undergoes HVZ reaction but formic acid does not.

(ii) Arrange the following compounds in increasing order of reactivity towards nucleophilic addition:

(1) Ethanal, Propanal, Propanone, Butanone

(2) Benzaldehyde, p- Tolualdehyde, p-Nitrobenzaldehyde, Acetophenone

QUESTION 21. [5]

(i) How would you account for the following:

(1) Transition elements have high enthalpies of atomization.

(2) The separation of lanthanide elements is difficult.

(3) Transition elements have many irregularities in their electronic configuration.

(ii) Write balanced chemical equation for the reaction between:

(1) acidified $K_2Cr_2O_7$ and $FeSO_4$.

(2) acidified potassium permanganate and oxalic acid.