INDIAN SCHOOL SOHAR
PRE-BOARD I EXAMINATION (2023-2024)
CHEMISTRY (043)
SET 1

CLASS: XII   MAX.MARKS: 70
DATE: 05/12/23   TIME   : 3 HOURS

General Instructions:

(a)   There are 33 questions in this question paper with internal choice.

(b)   Section A consists of 16 multiple-choice questions carrying 1 mark each.

(c)   Section B consists of 5 short answer questions carrying 2 marks each.

(d)   Section C consists of 7 short answer questions carrying 3 marks each.

(e)   Section D consists of 2 case-based questions carrying 4 marks each.

(f)   Section E consists of 3 long answer questions carrying 5 marks each.

(g)   All questions are compulsory.

(h)   Use of log tables and calculators is not allowed.

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SECTION-A

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The following questions are Multiple-choice Choice Questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1.   The product of the following reaction is:

$\xrightarrow[\text{(ii) } H_2SO_4]{\text{(i) } Na_2Cr_2O_7}$ Product
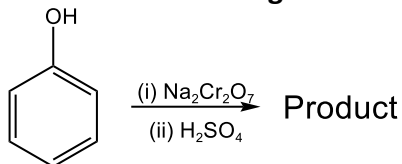
(a) Benzene   (b) Benzoquinone
(c) Picric acid   (d) Salicylaldehyde

2.   **25 ml of a solution of barium hydroxide on titration with 0.1 molar solution of hydrochloric acid gave a titre value of 35 ml, the molarity of the barium hydroxide solution will be:**
(a) 0.07   (b) 0.14
(c) 0.28   (d) 0.35

3.   **On the basis of crystal field theory, the electronic configuration of d^4 in an octahedral field when $\Delta_0 > P$**
(a) $t^3_{2g} e^1_g$ (b) $t^2_{2g} e^2_g$
(c) $t^1_{2g} e^3_g$ (d) $t^4_{2g} e^0_g$

4.   **Misch metal is an alloy of**
(a) La   (b) Th
(c) Ac   (d) none of these

5.   **What will be the molar conductivity of Al^{3+} ions at infinite dilution if the molar conductivity of $Al_2(SO_4)_3$ is 858 S cm^2 mol^{-1} and the ionic conductance of SO_4^{2-} is 160 S cm^2 mol^{-1} at infinite dilution?**
(a) 189 S cm^2 mol^{-1} (b) 698 S cm^2 mol^{-1}
(c) 1018 S cm^2 mol^{-1} (d) 429 S cm^2 mol^{-1}

6.   **Which of the following does not react with the Heinsberg reagent?**
(a) $C_2H_5NH_2$ (b) $(C_2H_5)_2NH$
(c) $(C_2H_5)_3N$ (d) CH_3NH_2

7. **The product Y in the following reaction sequence is:**

(a)

NHOH

(b)

NH₂

(c)
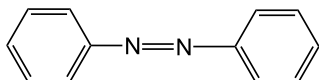
—N=N—
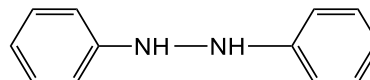
(d)

—NH—NH—
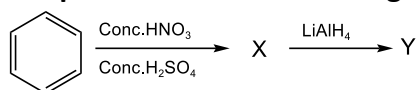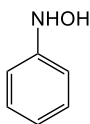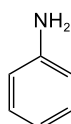
8. **The disease caused due to a deficiency of vitamin B₁ is:**
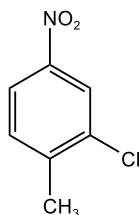   (a) Beri-Beri   (b) Scurvy
   (c) Rickets   (d) Pernicious anemia

9. **The correct IUPAC name of the following compound is:**

   (a) 5-Chloro-4-methyl-1-nitrobenzene   (b) 2- Methyl-5-nitro-1-chlorobenzene
   (c) 3- Chloro-4-methyl-1-nitrobenzene   (d) 2- Chloro-1-methyl-4-nitrobenzene

10. **For the reaction A + 2B ⟶ C + D, the rate law is given by r = k[A][B]², the concentration of A is kept constant while that of B is doubled. The rate of the reaction will:**
    (a) doubled   (b) become half
    (c) not change   (d) quadruple

11. **200 ml of an aqueous solution of a protein contains 1.26 g of protein. The osmotic pressure of this solution at 300 K is 2.57 x 10⁻³ bar. The molar mass of the protein will be:**
    (R= 0.083 L bar mol⁻¹ K⁻¹)
    (a) 51022 g mol⁻¹   (b) 122041 g mol⁻¹
    (c) 61038 g mol⁻¹   (d) 31011g mol⁻¹

12. **An alcohol on oxidation is found to give CH₃COOH and CH₃CH₂COOH. The structure of the alcohol is:**
    (a) CH₃CH₂CH₂OH   (b) (CH₃)₂C(OH)CH₂-CH₃
    (c) CH₃(CH₂)₃CH₂OH   (d) CH₃CH(OH)CH₂CH₂CH₃

    In the following questions (Q. No. 13 to 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices:
    (a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
    (b) Assertion and reason both are correct statements but the reason is not the correct explanation for assertion.
    (c) Assertion is a correct statement but the reason is wrong.
    (d) Assertion is a wrong statement but the reason is correct.

13. **Assertion:** Ortho and para-nitrophenols can be separated by steam distillation.
    Reason: Ortho isomer associates through intramolecular hydrogen bonding while para isomer associates through intermolecular hydrogen bonding.

14. **Assertion:** Order and molecularity are the same.
    Reason: Order is determined experimentally and molecularity is the sum of the stoichiometric coefficient of the rate-determining elementary step.
15. **Assertion:** Proteins are made up of α- amino acids.
    Reason: During denaturation, secondary and tertiary structures of proteins are not destroyed.
16. **Assertion:** $La(OH)_3$ is more basic than $Lu(OH)_3$.
    Reason: The basic character of hydroxides of lanthanoids decreases on moving from La^{3+} to Lu^{3+}.

SECTION-B

This section contains 5 questions with internal choice in one question. The following questions are very short answer types and carry 2 marks each.

17. Explain what is meant by the following: 2x1
    (i) peptide linkage
    (ii) pyranose structure of glucose

OR

    (a) Amino acids show amphoteric behavior. Why?
    (b) What are biocatalysts? Give an example.

18. (a) Draw one of the geometrical isomers of the complex $[Pt(en)_2Cl_2]^{2+}$ that is optically inactive.   2x1
    (b) Why a solution of $[Ni(H_2O)_6]^{2+}$ is green while a solution of $[Ni(CN)_4]^{2-}$ is colourless?
   (Atomic no: of Ni = 28)

19. (a) Cutting onions taken from the refrigerator is more comfortable than cutting onions at room temperature. Why?   2x1
    (b) What type of azeotrope is formed by the negative deviation from Raoult's law? Give an example.

20. (a) p-dichlorobenzene has a higher melting point than those of o- and m-isomers. Give reason.   2x1
    (b) Write the equation for the oxidation of chloroform by air and light.

21. Observe the graph and answer the following questions.
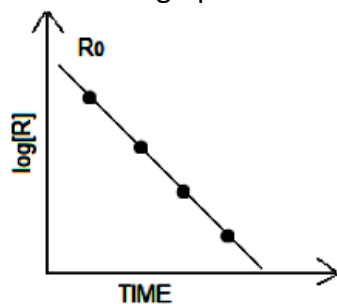
                                                                                              2x1

    (a) If slope is equal to -2.0×10^{-6} sec^{-1}, what will be the value of rate constant?
    (b) How does the half-life of zero order reaction related to its rate constant?

SECTION-C

This section contains 7 questions with internal choice in one question. The following are short answer types and carry 3 marks each.

22. (a) What is the basic structural difference between starch and cellulose?   3x1
    (b) Write the reaction involved when D-glucose is treated with Br_2 water.
    (c) If one strand of DNA has the sequence ---A T G C T T C A---, what is the sequence of the bases in the complementary strand?
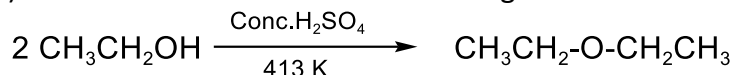
23. Write the equations involved in the
        (i) acetylation of salicylic acid.
        (ii) reaction of phenol with bromine water.   3x1
        (iii) conversion of formaldehyde to ethanol.

(a) Write the mechanism of the following reaction:

$$2\ CH_3CH_2OH \xrightarrow[413\ K]{Conc.H_2SO_4} CH_3CH_2\text{-}O\text{-}CH_2CH_3$$

2+1

(b) How will you distinguish between Propanol and tert- butyl alcohol?

24. The freezing point of a solution containing 5 g of benzoic acid (M= 122 g mol^{-1}) in 35 g of benzene is depressed by 2.94 K. What is the percentage association of benzoic acid if it forms a dimer in solution? (K$_f$ for benzene = 4.9 K kg mol^{-1})   1x3

25. (a) Arrange the following in the decreasing order of their acidic strengths: 3x1
      Benzoic acid, 4- Nitrobenzoic acid, 3,4- Dinitrobezoic acid, 4- Methoxybenzoic acid.
    (b) Oxidation of toluene with CrO$_3$ to benzaldehyde is carried out in the presence of acetic anhydride. Give reason.
     (c) Give the mechanism of cyanohydrin formation when carbonyl compounds react with HCN in the presence of alkali.

26. Calculate the emf and ΔG of the following cell at 298 K: Zn$_{(s)}$| Zn^{2+}(0.01 M) || Ag$^+$(0.001 M) | Ag$_{(s)}$ 1x3
    Given: $E^0_{Zn^{2+}/Zn} = -0.76$ V and $E^0_{Ag^+/Ag}$= +0.80 V, F= 96500 [log 2= 0.3010, log 3 = 0.4471]

27. A first-order reaction is 50 % completed in 30 minutes at 27 ^{0}C and in 10 minutes at 47 ^{0}C. Calculate the activation energy (E$_a$) for the reaction. [Given R = 8.314 J K^{-1}mol^{-1}, log 2= 0.3010, log 3= 0.4771,   1x3
    log 4= 0.6021, log 5 = 0.6991]

28. How would you convert the following?
     (a) Prop-1-ene to 1-flouropropane   3x1
     (b) Ethanol to Propane nitrile
   (c) Benzene to diphenyl

SECTION-D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks. Read the passage carefully and answer the questions that follow.

29. **Read the passage given below and answer the questions which follow:**

Amines are usually formed from nitro compounds, halides, amides, imides, etc. They exhibit hydrogen bonding which influences their physical properties. In alkyl amines, a combination of electron-releasing, steric, and hydrogen bonding factors influence the stability of the substituted ammonium cations in polar protic solvents and thus affect the basic nature of amines. In aromatic amines electron releasing and withdrawing groups respectively increase and decrease the basic character. The influence of the number of hydrogen atoms in nitrogen atom on the type of reactions and nature of products is responsible for the identification and distinction between primary, secondary and tertiary amines. The presence of the amino group in the aromatic ring enhances the reactivity of the aromatic amines. Aryl diazonium salts provide advantageous methods of producing aryl halides, cyanides, phenols and arenes by reductive removal of the diazo group.

 Answer the following questions:

(a)Arrange the following in the increasing order of their pK$_b$ values in aqueous solution:
    C$_2$H$_5$NH$_2$, (C$_2$H$_5$)$_2$NH, (C$_2$H$_5$)$_3$N
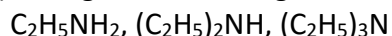
(b) How will you convert Bromoethane to Propanamine?

(c) An aromatic compound **'A '**of molecular formula C$_7$H$_6$O$_2$ on treatment with aqueous ammonia and heating forms compound **'B'**. Compound **'B'** on heating with Br$_2$ and aqueous KOH gives a compound **'C'** of molecular formula C$_6$H$_7$N. Write the reactions involved and the structures of **A, B** and **C**.

OR

Complete the following reactions giving the main products.

(i)

$$H_3PO_3 + H_2O \longrightarrow$$

(ii)

   CH_2NH_2 + $CHCl_3$ $\xrightarrow{\text{Ethanolic KOH}}$
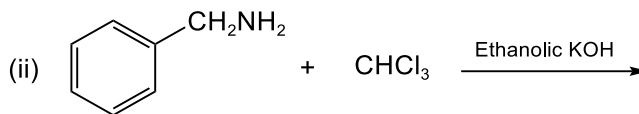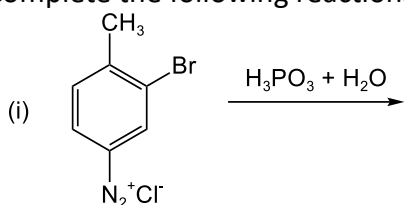
30. **Read the passage given below and answer the questions which follow:**

In coordination compounds, metals show two types of linkages primary and secondary. Primary valencies are ionisable and are satisfied by negatively charged ions. Secondary valances are non-ionisable and are satisfied by neutral or negative ions having lone pair of electrons. Primary valencies are non-directional while secondary valencies decide the shape of the complexes. Valance bond theory based on hybridization helps in determining the shape of complexes, magnetic properties, and outer or inner orbital complexes.

Answer the following questions:

(a) What are the primary and secondary valencies of cobalt in [CoBr$_2$(en)$_2$]Cl?

(b) Write the formula of Potassium tetracyanidonickelate (II)

(c) Write the hybridization, shape and magnetic behavior of [CoF$_4$]$^{2-}$.

OR

(i) Write the IUPAC name of [PtCl(NO$_2$)(NH$_3$)$_4$]SO$_4$

(ii)One mole of the coordination compound CrCl$_3$.6 H$_2$O reacts with an excess of AgNO$_3$ solution to yield two moles of AgCl$_{(s)}$. Write the formula of the compound.
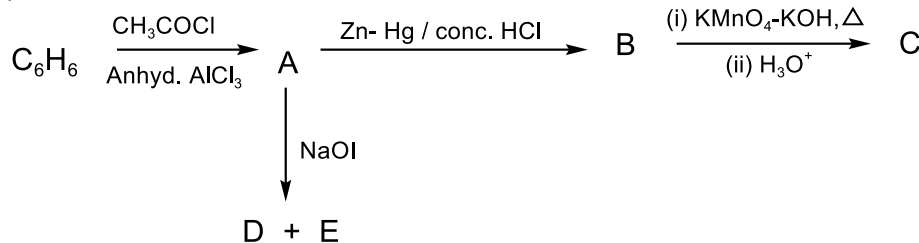
SECTION-E

The following questions are long answer types and carry 5 marks each. All questions have an internal choice.

31. (a) A ketone **A**(C$_4$H$_8$O), which undergoes a haloform reaction gives compound **B** on reduction. **B** on heating with sulphuric acid gives a compound **C** which forms monozonide **D**. **D** on hydrolysis in the presence of zinc dust gives only **E**. Identify **A, B, C, D** and **E**. Write the reactions involved. Give the iodoform reaction of compound **A**.   3+1+1

(b) Give a simple test to distinguish between acetophenone and benzophenone.

(c) How will you convert Ethanol to 3-Hydroxybutanal?

OR

(a) Write the structures and IUPAC names of **A, B, C, D** and **E** in the following reaction:

$$C_6H_6 \xrightarrow[\text{Anhyd. AlCl}_3]{CH_3COCl} A \xrightarrow{\text{Zn- Hg / conc. HCl}} B \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) KMnO}_4\text{-KOH,}\triangle} C$$

3+1+1

A $\xrightarrow{\text{NaOI}}$ D + E

(b) What is Formalin? What is its use?

(c) Write the chemical reactions to illustrate the Rosenmund reduction reaction.

32. (a) The electrical resistance of a column of 0.05 M KOH solution of 50 cm and area cross-section 0.625 cm^2 is 5 x 10^3 ohm calculate its resistivity, conductivity and molar conductivity.   3+2

(b) Write the name of the cell, which is generally used in hearing aids. Write the reactions taking place at the anode and the cathode of the cell.

OR

(a) (i) Predict the products of electrolysis of an aqueous solution of copper sulphate with platinum electrodes. Write the electrode reactions involved. 3+2

(ii) Calculate the time to deposit 1.27 g of copper at the cathode when a current of 2 A was passed through the solution of copper sulphate.

(b) Solutions of two electrolytes **A** and **B** are diluted. The Λ_m of B increases 1.5 times while that of **A** increases 25 times.

(i) Which of the two is a strong electrolyte? Justify your answer.

(ii) Graphically show the behaviour of **A** and **B**

33. Attempt any five of the following

(a) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements.

(b) The enthalpies of atomization of the transition metals are high. Give reason.

(c) Write the reactions involved in the preparation of $Na_2Cr_2O_7$ from Na_2CrO_4. 5x1

(d) Which of the following ions will have a magnetic moment value of 1.73 BM?
  Sc^{3+}, Ti^{3+}, Ti^{2+}, Cu^{2+}, Zn^{2+}

(e) Complete and balance the following equation: $MnO_4^- + I^- + H^+ \longrightarrow$

(f) Copper has an exceptionally positive $E^0_{M^{2+}/M}$ value. Why?

(g) Write the formula of an oxo-anion of chromium and manganese in which it shows the oxidation state equal to its group number.

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