BANGALORE SAHODAYA SCHOOLS COMPLEX ASSOCIATION

PRE-BOARD EXAMINATION (2023-2024)
Grade XII SET 2

Date: _____   **Max. Marks: 70**

Subject: Chemistry   **Time: 3 Hrs**

General Instructions:
Read the following instructions carefully
(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.

SECTION A
The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

Q1. The molar conductance of 0.001M acetic acid is 50 ohm^{-1} cm^2 mol^{-1} . The maximum value of molar conductance is 250 ohm^{-1} cm^2 mol^{-1} . What is its degree of ionisation?
(a) 0.5 %   (b) 2 %   (c) 20 %   (d) 22 %

Q2. In which order the rate of reaction does not depend on the concentration of reactant.
(a) 0.5   (b) 1   (c) 2   (d) 0

Q3. which of the following is a diamagnetic ion? (Atomic number of Sc, V, Mn, and Cu are 21, 23, 25, and 29 respectively.)
(a) V^{2+} (b) Sc^{3+} (c) Cu^{2+} (d) Mn^{3+}

Q4.Anmbidentate ligands like NO_2^- and SCN^- are _____.
(a) Unidentate   (b) didentate   (c) polydentate   (d) has variable denticity.

Q5. Which of the following represents correct variation of the property indicated
(a) BP of $C_2H_5Br > C_2H_5I > C_2H_5Cl$
(b) MP of $p\text{-}C_6H_4Cl_2 > m-C_6H_4Cl_2 > o-C_6H_4Cl_2$
(c) BP of $o-C_6H_4Cl_2 > p-C_6H_4Cl_2 > m-C_6H_4Cl_2$
(d) BP of $CH_3CH_2CH_2CH_2Br > C(CH_3)_3Br > CH_3CH_2\text{-}\underset{\overset{|}{Br}}{CH}\text{-}CH_3$

Q6. Which one of the following statements is correct about sucrose?

(a) It can reduce Tollen's reagent, however cannot reduce Fehling's reagent..

(b) It undergoes mutarotation like glucose and fructose.

(c) It undergoes inversion in the configuration on hydrolysis.

(d) It is laevorotatory in nature.

Q7. Which of the following B group vitamins can be stored in our body?

(a) Vitamin B_1 (b) Vitamin B_2 (c) Vitamin B_6 (d) Vitamine $B_{12.}$

Q8.What is the correct IUPAC name of the given compound?

$$CH_3$$
$$|$$
$$H_3C-CH_2-\ C\ -\ COOH$$
$$|$$
$$CH_3$$
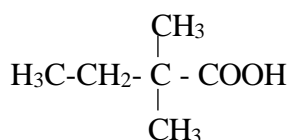
(a) 2,2-Dimethylbutanoic acid   (b) 2-Carboxyl-2-methylbutane

(b) 2-Ethyl-2-methylpropanoic acid   (d) 3-Methylbutanecarboxylic acid.

Q9. CH_3CHO and $C_6H_5CH_2CHO$ can be distinguished chemically by _____.

(a) Benedict's test   (b) Iodoform test

(c) Tollen's reagent test   (d) Fehling's solution test.

Q10.Iodoform test is not given by _____.

(a) ethanol   (b) ethanal   (c) pentan-2-one   (d) pentan-3-one

Q11. How many alcohols with molecular formula $C_4H_{10}O$ are chiral in nature?

(a) 1   (b) 2   (c) 3   (d) 4

Q12.Which of the following haloalkanes is optically active?

(a) 1-Butanol   (b) 1-Propanol   (c) 2-Chlorobutane   (d) 4-Hydroxybutanal

Q13. Arrange the following alkyl halides in the decreasing order of the SN^1 reactivity.

(I) $CH_3CH_2CH_2Cl$ (II) $CH2=CH-CH(Cl)CH_3$ (III) $CH_3CH_2CH(Cl)CH_3$

(a) I>II>III   (b) II > I > III   (c) II > III > I   (d) III > II > I

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In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following:

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement

Q14. Assertion (A) : Conductivity of an electrolyte increases with decrease in concentration.
     Reason (R)   : Number of ions per unit volume decreases on dilution,

Q15. Assertion (A) : Hydrolysis of an ester follows first order kinetics.
     Reason (R)   : Concentration of water remains nearly constant during the course of the reaction.

Q16. Assertion (A): The melting point and solubility of amino acids in water is greater than that of corresponding halo acids.

   Reason (R) : Except glycine, all naturally occurring α amino acids are optically active.

SECTION B

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

Q17. For a 5% of urea (Molar mass= 60g/mol), calculate the osmatic pressure at 300K.
[R= 0.0821 L atm k^{-1} mol^{-1}].

Q18. Calculate molarity and molality of 20% (mass/mass) aqueous solution of KI if density is 1.2 g/cm^3.
(molar mass of KI = 166 g/mol)

Q19.
   (a) Alkylhalides, though polar, are immiscible in water. Justify.

   (b) Name the reactant and reagent required for the manufacture of Freon12.

Q20. (a) Name the reagents required for the conversion of

(i)

   (ii) $CH_3(CH_2)_9COOC_2H_5 \longrightarrow CH_3(CH_2)_9CHO$
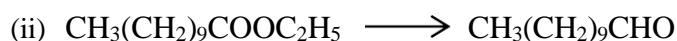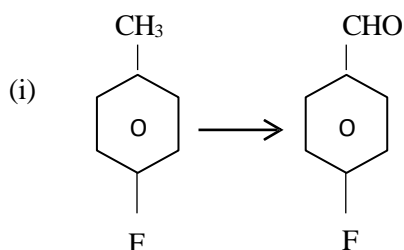
   (b) Arrange the following compounds in increasing order of their reactivity towards nucleophilic addition reactions:

   Benzaldehyde, p-Tolualdehyde, p-nitrobenzaldehyde, Acetophenone.
                          OR
   Give one chemical test to distinguish the following pair of compounds.
   (a) Benzoic acid and Phenol
   (b) Propanal and Propanone

Q21. Name the monosaccharide units present in maltose and draw its Haworth structure.

SECTION C

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

Q22.(a) Using Valence bond theory, explain the bonding and magnetic properties of
         [Mn $(CN)_6$] $^{3-}$. Atomic number of Mn is 25.
   (b) Draw the geometrical isomers of [Co$(NH_3)_3(NO_2)_3$]

Q23. (a) What is corrosion? Give the anode and cathode reaction in the process of rusting.

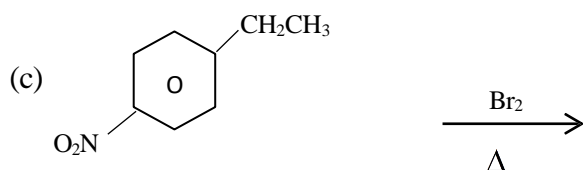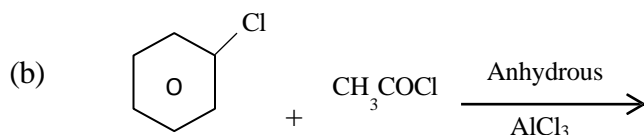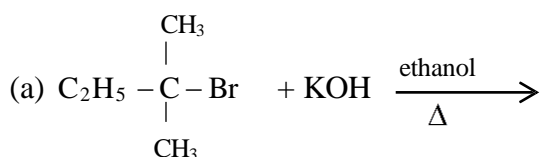   (b) Predict the products of electrolysis of a dilute solution of H_2SO_4 using platinum electrodes.

$$E^o_{S_2O_8^{2-}/SO_4^{2-}} = 1.96V$$

Q24.

      (a) What is van't Hoff factor? What possible value can it have, if the solute undergoes dissociation?

      (b) Henry's law constant for CO_2 is 1648atm at 298K. Calculate the number of moles of CO_2 present in 500ml of soda water, when packed under 2.5 atm CO_2 pressure at 298K.

Q25. Write the major and minor product formed in the following reactions.

(a)
$$C_2H_5 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - Br \;\; + KOH \;\xrightarrow[\Delta]{ethanol}$$

(b)

$+ \; CH_3COCl \xrightarrow[AlCl_3]{Anhydrous}$

(c)

$\xrightarrow[\Delta]{Br_2}$

Q26. Give reasons for the following :

    (a) H_2SO_4 is not used during reaction of alcohols with KI.

    (b) Arylalkylethers undergo electrophilic substitution reaction to form o & p – derivatives.
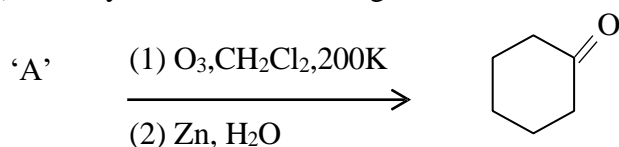
    (c) Alcohols are more soluble in water than hydrocarbons of comparable molecular mass.

Q27. (a) Explain the following reactions:

        (i) Wolff Kishner reduction

        (ii) Cannizzaro reaction.

    (b) Identify 'A' in the following reaction.

'A' $\xrightarrow[\text{(2) Zn, H}_2\text{O}]{\text{(1) O}_3,\text{CH}_2\text{Cl}_2,200\text{K}}$

OR

   (a) Write structure of

     (i) semicarbazone of acetone

     (ii) oxime of cyclohexane carbaldehyde

   (b) Convert benzoicacid to benzophenone

   (c) Write short notes on soda lime decarboxylation.

Q28. Differentiate the following: (2 differences each)
    (a) Fibrous protein and globular protein
    (b) Essential amino acids and non-Essential amino acids.
   (c) DNA and RNA

SECTION- D

The following questions are case based questions and carries 4 marks each. Read the passage and answer the questions that follow:

Q29.

A device used to convert the energy evolved in a redox reaction into electrical energy is called an electrochemical cell. These devices are also called galvanic cells or voltaic cells, after the names of Luigi Galvani (1780) and Alessandro Volta (1800) who were the first to perform experiments on the conversion of chemical energy into electrical energy. How exactly the chemical energy of a redox reaction is converted into electrical energy can be seen from the following example:

Redox reaction between Zn and CuSO4. The reaction is represented as:

$Zn(s) + CuSO4(aq) \rightarrow ZnSO4(aq) + Cu(s)$
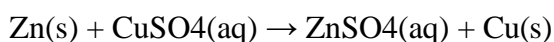
It may also be written in ionic form as: $Zn + Cu2+ \rightarrow Zn2+ + Cu$

The reaction essentially comprises of two half reactions: one for reduction and the other for oxidation.

$Zn(s) \rightarrow Zn2+(aq) + 2e-$ $Cu2+(aq) + 2e- \rightarrow Cu(s)$
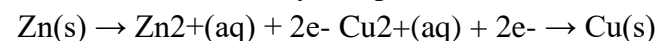
Thus, Zn is oxidized to Zn2+ in the oxidation half reaction and Cu2+ is reduced to Cu in the reduction half reaction. The overall reaction can be obtained by adding the two half reactions.
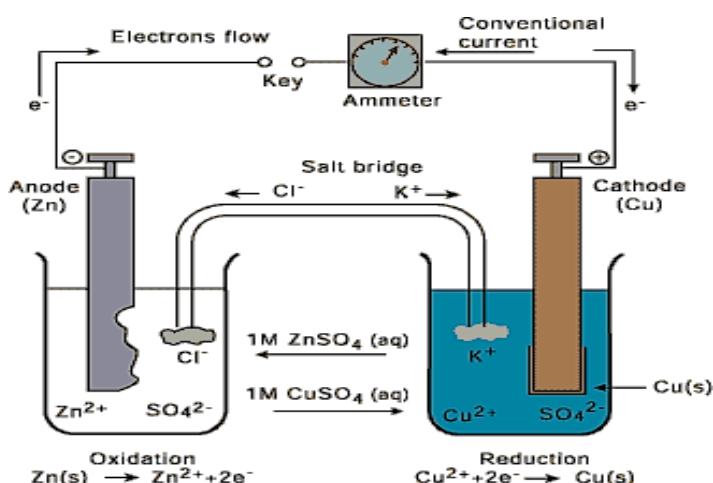
(a) If copper electrode in the above cell is replaced by $Ag/AgNO_3(aq)$ electrode, can KCl be used in the salt bridge? Comment.

(b) Suggest two materials other than hydrogen that can be used as fuels for fuel cell.

(c) Give the construction and working (discharge only) of lead storage battery.

<div align="center">OR</div>

(c) Calculate $\Delta_r G^O$ and Kc for the following reaction taking place in a Galvanic cell

$$2Cr_{(s)} + 3Cd^{2+}_{(aq)} \rightarrow 2Cr^{3+}_{(aq)} + 3Cd_{(s)}$$
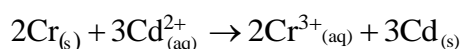
Given $E^O_{Cd^{2+}/Cd} = -0.4V$

         $E^O_{Cr^{3+}/Cr} = -0.74V$

Q30. Valence bond theory considers the bonding between the metal ion and the ligands as purely covalent. On the other hand, crystal field theory considers the metal-ligand bond to be ionic arising from electrostatic interaction between the metal ion and the ligands. In coordination compounds, the interaction between the ligand and the metal ion causes the five d-orbitals to split-up. This is called crystal field splitting and the energy difference between the two sets of energy level is called crystal field splitting energy. The crystal field splitting energy (Δo) depends upon the nature of the ligand. The actual configuration of complexes is divided by the relative values of Δo and P (pairing energy)

If $\Delta o < P$, then complex will be high spin.

If $\Delta o > P$, then complex will be low spin.

Arrangement of ligands in order of their ability to cause splitting Δ is called spectrochemical series. Ligands which cause large splitting (large Δ) are called strong field ligands while those which cause small splitting (small Δ) are called weak field ligands. When strong field ligands approach metal atom/ion, the value of Δo is large, so that electrons are forced to get paired up in lower energy t2g orbitals. Hence, a low-spin complex is resulted from strong field ligand. When weak field ligands approach metal atom/ion, the value of Δo is small, so that electrons enter high energy eg orbitals rather than pairing in low energy t2g orbitals. Hence, a high-spin complex is resulted from weak field ligands. Strong field ligands have tendency to form inner orbital complexes by forcing the electrons to pair up. Whereas weak field ligands have tendency to form outer orbital complex because inner electrons generally do not pair up.

(a) Write the electronic configuration of the central metal ion in $K_4[Fe(CN)_6]$ on the basis of crystal field theory in terms of t_{2g} of e_g.

(b) What will be the correct order for the frequency of absorption in the visible region for the following

$\left[Ni(NO_2)_6\right]^{4-}, \left[Ni(H_2O)_6\right]^{2+}, \left[Ni(NH_3)_6\right]^{2+}$
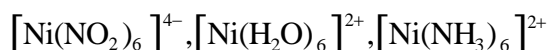
(c) Explain the violet color of $[Ti(H_2O)_6]^{3+}$ complex on the basis of crystal field theory.

OR

Predict whether the compounds are paramagnetic and calculate the magnetic moment of that complex.

(a) Hexaammine chromium (III) ion

(b) Hexaaqua cobalt (III) ion.

SECTION E

The following questions are long answer type and carry 5 marks each. Two questions have internal choice.

Q31. Explain the following:

a) Transition metals exhibit variable oxidation states.

b) Transition metals and their compounds act as a catalyst.

c) Many of the transition elements are known to form interstitial compounds.

d) The metallic radii of the third (5d) series of transition metals are virtually the same as those of the corresponding group member of the second (4d) series.

e) With the same d-orbital configuration (d^4) Cr^{2+} is a reducing agent while Mn^{3+} is an oxidising agent.

Q32.

(a) Decomposition of H_2O_2 in alkaline medium catalysed by iodide ion, takes place as follows:

$H_2O_2 + I^- \rightarrow H_2O + IO^-$ (slow)

$H_2O_2 + I^- \rightarrow H_2O + I^- + O_2$ (fast)
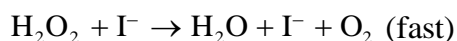
Write the rate equation for reaction and identify the molecularity of elementary reactions.

(b) In a reaction between A and B, the initial rate of reaction (r_o) was measured for different initial concentrations of A and B as given below:

A (mol/L)	0.2	0.2	0.4
B (mol/L)	0.3	0.1	0.05
r_o	5.07×10^{-5}	5.07×10^{-5}	1.43×10^{-4}

What is the order of the reaction with respect to A and B?

(c) The rate of reaction quadruples when the temperature changes from 300K to 320K. Calculate the activation energy for the reaction assuming that it does not change with temperature.
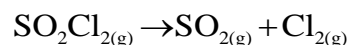
$R = 8.314 J / K /mol$

$Log\ 2 = 0.3010$

OR

(a) What is unit for rate constant of a second order reaction?

(b) The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume.

$$SO_2Cl_{2(g)} \rightarrow SO_{2(g)} + Cl_{2(g)}$$

Time (s)	Total pressure (atm)
0	0.5
100	0.6

Calculate rate constant for the reaction:

$Log\ 5 = 0.6989$

$Log\ 2 = 0.3010$

(c) For first order reaction, show that time required for 99% completion is twice the time required for the completion of 90% of reaction.

Q33.

a) An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with Br_2 and KOH forms compound 'C' of molecular formula C_6H_7N. Write the structures and IUPAC names of compounds A, B and C.

b) Carry out the following conversion:

(i) p-Nitrotoluene to 2-Bromobenzoic acid .

(ii) Nitrobenzene to 1, 3, 5 – Tribromobenzene.

OR

(a) Write the structures of different isomers corresponding to the molecular formula C_3H_9N. Write the IUPAC names of the isomers which will liberate nitrogen gas on treatment with $NaNO_2$ and HCl.

(b) Complete the following

(i) $C_6H_5N_2Cl + HBF_4 \longrightarrow\ ? \xrightarrow{\triangle}\ ? + ? + ?$

(ii) $C_6H_5N_2Cl \xrightarrow[KCN]{CuCN}\ ? + ?$
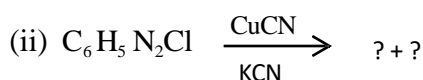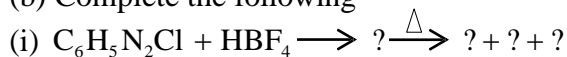
(c) Arrange the following compounds in the decreasing order of basic strength in aqueous medium.

$C_6H_5NH_2, C_6H_5CH_2NH_2, C_2H_5NH_2, (C_2H_5)_2NH, NH_3$