COMMON PRE-BOARD EXAMINATION

CHEMISTRY-Code No. 043

Class-XII-(2025-26)

SET:2

Time allowed: 3 Hrs. **Maximum Marks: 70**

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 very 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

Question No.1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

1. Which of the following is not an essential amino acid? **1**

A. Valine
B. Leucine
C. Lysine
D. Glycine

2. The IUPAC name of the compound $CH_3OCH_2CH(CH_3)_2$ is: **1**

A. 2-Methoxy-2-methylpropane.
B. 1-Methoxy -2-methylpropane
C. Methoxy butane
A. 2-Methoxy propane

3. A 0.5% aqueous solution of KCl (Molar mass= 74.5) was found to freeze at 272.76K. **1**
(K_f of water = 1.86 $KKgmol^{-1}$). The degree of dissociation of KCl at this concentration is:

A. 91.2%
B. 83.6%
C. 79.1%
D. 69.3%

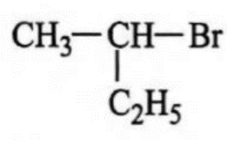
4. The rate determining step during dehydration of alcohols to alkenes by heating with concentrated H_2SO_4 is: **1**

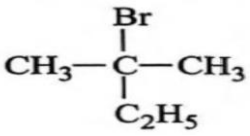
A. Protonation of alcohol molecule.
B. Formation of carbocation.
C. Attack of nucleophile.
D. Elimination of water.

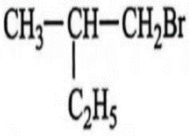
5. The slope in the plot of ln k Vs 1/T is: **1**

A. - k
B. + k
C. $\frac{2.303}{k}$
D. $-E_a / R$

6. Which of the following compounds will give racemic mixture on nucleophilic substitution by OH^- ion? **1**

(i) 

(ii) 

(iii) 

A. (i)
B. (i), (ii), (iii)
C. (ii), (iii)
D. (i), (iii)

7. $CH_3CH_2CH_2Cl \xrightarrow{alc.KOH} B \xrightarrow{HBr} C \xrightarrow{Na,dry\ ether} D$ **1**

In the above reaction, the product D is:

A. Propane
B. Hexane
C. Allyl bromide
D. 2,3-Dimethylbutane

8. Acetone on aldol condensation gives: **1**

A. 4-Hydroxy-3-methyl pentan-2-one.
B. 4-Methylpent-3-en-2-one.
C. 3-Hydroxy-3-methyl-butan-2-one
A. Hex-2-enal

9. The order of basicity of the following amines in aqueous solution is:
CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_3N$, $C_6H_5NH_2$, $C_6H_5CH_2NH_2$

A. $C_6H_5NH_2 < C_6H_5CH_2NH_2 < CH_3NH_2 < (CH_3)_3N < (CH_3)_2NH$
B. $C_6H_5NH_2 < C_6H_5CH_2NH_2 < CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N$
C. $C_6H_5NH_2 < C_6H_5CH_2NH_2 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$
D. $CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N < C_6H_5NH_2 < C_6H_5CH_2NH_2$

10. During electrolysis of aqueous NaCl, the reaction occurring at the anode is: **1**

A. $2Cl^- \rightarrow Cl_2 + 2e^-$
B. $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$
C. $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$
D. $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$

11. The catalytic activity of transition metals is mainly due to: **1**

A. Small size
B. Large atomic mass
C. Availability of vacant d orbitals and variable oxidation states.
D. Presence of unpaired electrons.

12. Which of the following complexes can exhibit optical isomerism? **1**

A. $[Co(en)_3]^{3+}$
B. $[Co(NH_3)_6]^{3+}$
C. $[PtCl_4]^{2-}$
D. $[Ni(CO)_4]$

13. **Assertion (A):** Benzyl chloride is highly reactive towards S_N1 reactions. **1**
Reason (R): The benzyl carbocation formed is resonance stabilized.
Select the most appropriate answer from the options given below:

A. Both A and R are true, and R is the correct explanation of A.
B. Both A and R are true, and R is not the correct explanation of A.
C. A is true but R is false.
D. A is false but R is true.

14. **Assertion (A):** Separation of Zr and Hf is difficult. **1**
Reason (R): Because Zr and Hf lie in the same group of the periodic table.
Select the most appropriate answer from the options given below:

A. Both A and R are true, and R is the correct explanation of A.
B. Both A and R are true, and R is not the correct explanation of A.
C. A is true but R is false.
D. A is false but R is true.

15. **Assertion (A):** The relative lowering of vapour pressure of a solution is equal to the mole fraction of solvent. **1**
Reason (R): According to Raoult's law, the vapour pressure of a solvent in a solution is directly proportional to its mole fraction.
Select the most appropriate answer from the options given below:

A. Both A and R are true, and R is the correct explanation of A.
B. Both A and R are true, and R is not the correct explanation of A.
C. A is true but R is false.

D. A is false but R is true.

16. **Assertion (A):** The C-O-H bond in alcohols is slightly greater than the tetrahedral angle. **1**
Reason (R): This is due to the repulsive interaction between the two lone pair of electrons on oxygen.
Select the most appropriate answer from the options given below:

A. Both A and R are true, and R is the correct explanation of A.
B. Both A and R are true, and R is not the correct explanation of A.
C. A is true but R is false.
D. A is false but R is true.

Section - B

Question No. 17 to 21 are very short answer questions carrying 2 marks each.

17. Identify the structures of A, B, C and D in the following reaction: **2**

$CH_3CH_2CN \xrightarrow{H_3O^+} A \xrightarrow[\Delta]{NH_3} B \xrightarrow{Br_2+NaOH} C \xrightarrow{HNO_2} D$

Attempt either option A or B

18. A. What type of deviation from Raoult's law is expected when phenol and aniline are mixed with each other? What change in net volume of the mixture is expected? Graphically represent the deviation. **2**

OR

B. Define azeotropes. What type of azeotrope is formed by positive deviation from Raoult's law? Give an example.

19. (a) Write the formula of the coordination compound: **2**
Iron(III)hexacyanoferrate(II)

(b)Write the state of hybridization and find the magnetic moment of the complex:
$[Cr(NH_3)_6]^{3+}$ (Atomic number of Cr= 24)

20. Write the chemical equation involved in the following reactions: **2**
(i) Etard reaction (ii) Clemmensen reduction.

21. (a) Write the reactions involved when D-Glucose is treated with acetic anhydride? **2**
What do you infer about the structure of glucose from this reaction?

(b) Give any two reactions of Glucose which cannot be explained by the open chain structure of glucose.

Section - C

Question No. 22 to 28 are short answer questions carrying 3 marks each.

22. **3**

(a) For a reaction $2NH_{3(g)} \xrightarrow{Pt} N_{2(g)} + 3H_{2\,(g)}$

Rate = k

(i) Write the order and molecularity of this reaction.

(ii) What are the rates of productions of N_2 and H_2 if k = 2.5 x10^{-4} molL^{-1}s^{-1}.

(b)How does a catalyst increase the rate of a reaction?

23. **3**

(a) Define Molar conductivity. Explain with a graph how does molar conductivity vary with increase in concentration for a weak electrolyte?

(b) State the law that helps in calculating the limiting molar conductivity of a weak electrolyte.

24. **3**

(a) Give a chemical test to distinguish between Ethylamine and Diethylamine.

(b) Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide. Give reason.

(c) Write structure and name of the product obtained when Benzene diazonium chloride react with phenol.

25. Write equations for the following reactions: **(Attempt any 3)** **3**

(i) Benzyl ethyl ether with HI.

(ii) Bromine in CS_2 with phenol.

(iii) Oxidation of propan-1-ol with alkaline $KMnO_4$ solutions.

(iv) Treating phenol with chloroform in the presence of aqueous NaOH.

26. **3**

A certain reaction is 50% complete in 20 minutes at 27^0C and the same reaction is again 50% complete in 5 minutes at 77^0C. Calculate the activation energy if it is a first order reaction.

[Given R = 8.314JK^{-1}mol^{-1}, log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021]

27. **3**

(a)When mercuric iodide is added to an aqueous solution of KI, the freezing point is raised. Give reason.

(b) Determine the osmotic pressure of a solution prepared by dissolving 2.32 x10^{-2}g of K_2SO_4 in 2L of solution at 25^0C, assuming that K_2SO_4 is completely dissociated. (Molar mass of K_2SO_4 = 174gmol^{-1}, R = 0.0821 LatmK^{-1}mol^{-1})

28. How can the following conversions be carried out? **3**

(i) Ethanol to propanenitrile.

(ii) Chlorobenzene to p-nitrophenol.

(iii) Toluene to benzylalcohol.

Section - D

Question No. 29 and 30 are case-based/data-based questions carrying 4 marks each.

29. In inorganic chemistry, crystal field theory (CFT) describes the breaking of degeneracies of electron orbital states, usually *d* or *f* orbitals, due to a static electric field produced by a surrounding charge distribution This theory has been used to describe various spectroscopies of transition metal coordination complexes, in particular optical spectra. **4**

CFT successfully accounts for some magnetic properties, colors, hydration enthalpies, and spinel structures of transition metal complexes, but it does not attempt to describe bonding. CFT was developed by physicists Hans Bethe[1] and John Hasbrouck van Vleck in the 1930s. CFT was subsequently combined with molecular orbital theory to form the more realistic and complex ligand field theory (LFT), which delivers insight into the process of chemical bonding in transition metal complexes. CFT can be complicated further by breaking assumptions made of relative metal and ligand orbital energies, requiring the use of inverted ligand field theory (ILFT) to better describe bonding.

Answer the following:

(a) What is crystal field splitting energy?

(b) On the basis of crystal field theory, write the electronic configuration of d^4 ion, if $\Delta_o > P$.

(c) (i) If the crystal field splitting energy for an octahedral complex of Co^{3+} is 18,000 cm^{-1}**,** calculate the corresponding tetrahedral field splitting energy for a complex with the same ligands.

(ii) CO is a stronger complexing agent than NH_3. Give reason.

OR

(c) (i) Explain the colour of the complex $[Ti(H_2O)_6]^{3+}$ on the basis of crystal filed theory.

(ii) What will be the correct order for the wavelengths of absorption in the visible region for the following?
$[Ni(NO_2)_6]^{4-}$, $[Ni(NH_3)_6]^{2+}$, $[Ni(H_2O)_6]^{2+}$

30. A biomolecule or biological molecule is loosely defined as a molecule produced by a living organism and essential to one or more typically biological processes. Biomolecules include large macromolecules such as proteins, carbohydrates, lipids, and nucleic acids, as well as small molecules such as vitamins and hormones. A general name for this class of material is biological materials. Biomolecules are an important element of living organisms. They are often endogenous, i.e. produced within the organism, but organisms usually also need exogenous biomolecules, for example certain nutrients, to survive. Most biomolecules are organic compounds, and just four elements—oxygen, carbon, hydrogen, and nitrogen—make up 96% of the human body's mass. But many other elements, such as the various biometals, are also present in small amounts. **4**

Answer the following:

(a) Name the base present in nucleotide of RNA only.

(b) Wha type of linkage is present in nucleic acid?

(c) (i) What is meant by secondary structure of protein?

(ii) Give an example for each of fibrous protein and globular protein.

OR

(c) (i) Why must vitamin C be supplied regularly in diet?

(ii) Name the vitamin responsible for coagulation of blood.

Section - E

Question No. 31 to 33 are long answer type questions carrying 5 marks each.

31. Attempt either A or B

A. (a) A blackish brown coloured solid 'A' when fused with alkali metal hydroxides in the presence of air, produces a dark green coloured compound 'B' which on electrolytic oxidation in alkaline medium gives a dark purple coloured compound C. Identify A, B, C and write the reactions involved. **5**

(b) Complete and balance the equation:
$MnO_4^- + S_2O_3^{2-} + H_2O \rightarrow ?$

(c) Explain why Cu^+ ion is not stable in aqueous solution?

OR

B. (a) Write chemical equations for the following reactions.
(i) Oxidation of nitrite ion by MnO_4^- in acidic solution.
(ii) Acidification of potassium chromate solution.

(b) Account for the following:
(i) Among transition metals, the highest oxidation state is exhibited in oxoanions of a metal.
(ii) Transition metals form interstitial compounds.

(c) Compare the oxidation state of lanthanoids with that of actinoids.

32. Attempt either A or B **5**

A. (a) The chemistry of corrosion is essentially an electrochemical phenomenon. Explain the reactions occurring during the rusting of iron.

(b) Calculate the e.m.f and standard Gibbs free energy for the following cell at 298K.
$Mg(s) \mid Mg^{2+}(0.01M) \parallel Ag^+(0.0001M) \mid Ag(s)$

[Given $E^0_{Mg^{2+}/Mg} = -2.37V$, $E^0_{Ag^+/Ag} = 0.80V$

OR

B. (a) Write anode, cathode and overall reaction in a $H_2 - O_2$ fuel cell.

(b) Resistance of a conductivity cell was filled with 0.1M KCl solution is 85 Ω. If the resistance of the same cell when filled with an aqueous solution of 0.052M unknown electrolyte is 96 Ω. Calculate the conductivity and the molar conductivity of the electrolyte at this concentration. The conductivity of 0.1M KCl solution is 1.29×10^{-2} Scm^{-1}.

33. Attempt either A or B **5**

A. (a) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds B and C. Compound B gives positive Fehling's test and also reacts with I_2

and NaOH solution. Compound C does not give Fehling's test but forms iodoform. Identify the compounds A, B and C. Write the reaction for ozonolysis and the formation of iodoform from C.

(b) Draw the structure of the semicarbazone of Benzaldehyde.

(c) Carboxylic carbon is less electrophilic than Carbonyl carbon of aldehydes and ketones. Give reason.

OR

B. (a) An organic compound A, C_8H_6 on treatment with dil.H_2SO_4 containing mercuric sulphate gives a compound B, which can also be obtained from a reaction of benzene with an acid chloride in the presence of anhydrous $AlCl_3$. The compound B, when treated with iodine in aqueous KOH, yields C and a yellow compound D. Identify A, B, C, D and write the chemical equations for the reaction involved.

(b) Write the structure of oxime of acetone.

(c) Out of p-Tolualdehyde and p-Nitrobenzaldehyde, which one is more reactive towards nucleophilic addition reactions, why?