B.K. Birla Centre For Education

Date: 17-12-2025   PRE BOARD EXAMINATION-II   **Duration**: 3 Hrs
Class: XII   Chemistry (SET-I)   **Total Marks** : 70

### Instructions to the Students
- Write only question numbers clearly outside the margin (1, 2, 3.i, 5.b, 4.c.ii, etc.).
- Do not write questions or any titles. (For ex. - Do not write **II. Answer the following**).
- After every answer, give a one-line space.
- For Multiple choice Questions - Both Option and Answer should be written.
- Bullet points & Sub-points should be written inside the margin.
- Do not fold / staple the paper.
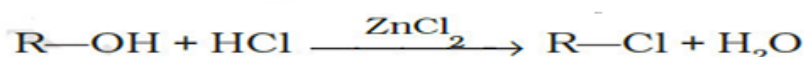
Section A

1. What is the correct order of reactivity of the following towards nucleophilic addition? [1]
   a) Methanal > Ethanal > Acetone
   b) Acetone > Ethanal > Methanal
   c) Methanal > Acetone > Ethanal
   d) Ethanal > Methanal > Acetone

2. Arrange the following compounds in the increasing order of their densities. [1]
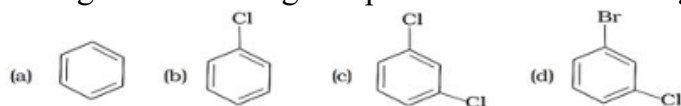
   a) (a) < (b) < (c) < (d)
   b) (a) < (c) < (d) < (b)
   c) (d) < (c) < (b) < (a)
   d) (b) < (d) < (c) < (a)

3. Coordination number of Fe in $[Fe(C_2O_4)_3]^{3-}$ is : [1]
   a) 6   b) 3   c) 4   d) 5

4. Match the following amines with their correct characteristics or reactions: [1]

	Column A (Amines)		Column B (Characteristics/Reactions)
1	Methylamine	A	Forms diazonium salts upon reaction with nitrous acid
2	Aniline	B	Undergoes nucleophilic substitution with alkyl halides
3	Ethylamine	C	Exhibits strong basicity in aqueous solution
4	Benzenediazonium chloride	D	Undergoes electrophilic substitution at ortho/para positions

   a) 1-C 2-B 3-A 4-D   b) 1-D 2-B 3-C 4-A   c) 1-A 2-C 3-B 4-D   d) 1-C 2-D 3-B 4-A

5. The freezing point of one molal KCl solution, assuming KCl to be completely [1] dissociated in water, is : (K_f for water = $1·86$ K kg mol^{-1})
   a) $- 3·72°C$ b) $+ 3·72°C$ c) $- 1·86°C$ d) $+ 2·72°C$

6. Which of the following alkyl halides will undergo S_N1 reaction most readily? [1]
   a) $(CH_3)_3C—F$
   b) $(CH_3)_3C—Cl$
   c) $(CH_3)_3C—Br$
   d) $(CH_3)_3C—I$

7. What is the correct order of reactivity of alcohols in the following reaction? [1]

$$R—OH + HCl \xrightarrow{ZnCl_2} R—Cl + H_2O$$

   a) $1° > 2° > 3°$ b) $1° < 2° > 3°$ c) $3° > 2° > 1°$ d) $3° > 1° > 2°$

8. Furanose ring of fructose is formed due to reaction between : [1]
   a) C_1 and C_5 b) C_2 and C_5
   c) C_1 and C_4 d) C_1 and C_2

9. Which of the following lanthanoids show +2 oxidation state besides the characteristic [1]
   oxidation state +3 of lanthanoids?
   a) Ce   b) Eu   c) Tb   d) Dy

10. Which cell will measure standard electrode potential of copper electrode? [1]
    a) $Pt(s)|\ H_2\ (g, 0.1\ bar)|\ H^+\ (aq., 1\ M) || Cu^{2+}\ (aq., 1M)|\ Cu(s)$
    b) $Pt(s)|\ H_2\ (g, 1\ bar)\ |\ H^+\ (aq., 1\ M) || Cu^{2+}\ (aq., 2M)|\ Cu(s)$
    c) $Pt(s)|\ H_2\ (g, 1\ bar)\ |\ H^+\ (aq., 1\ M) || Cu^{2+}\ (aq., 1M)|\ Cu(s)$
    d) $Pt(s)|\ H_2\ (g, 1\ bar)\ |\ H^+\ (aq., 0.1\ M)|| Cu^{2+}\ (aq., 1M)|\ Cu(s)$

11. What is the correct IUPAC name of the given compound ? [1]

    CH₃
    |
    CH₃—C—CH₂—CH₃
    |
    COOH

    a) 2-carboxyl-2-methylpropanoic acid   b) 2-ethyl-2-methylpropanoic acid
    c) 3-methyl butane carboxylic acid   d) 2, 2-dimethylbutanoic acid

12. Which of the following aldehydes doesnot undergo Cannizzaro's reaction? [1]

    a)   b)   c) HCHO

    d) CH_3CHO

13. **Assertion (A) :** Boiling point of $(C_2H_5)_2NH$ is lower than that of $n\text{-}C_4H_9NH_2$. [1]

    Reason (R) : Hydrogen bonding is much more extensive in $n\text{-}C_4H_9NH_2$ as compared to

    $(C_2H_5)_2NH$.
    a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the
       Assertion (A).
    b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of
       the Assertion (A)
    c) Assertion (A) is true, but Reason (R) is false.
    d) Assertion (A) is false, but Reason (R) is true.

14. **Assertion (A) :** Aquatic species are more comfortable in cold water than in warm water. [1]

Reason (R) : Solubility of oxygen gas in water decreases with increase in temperature.

a) Both Assertion (A) and Reason (R) are true & Reason (R) is the correct explanation of the Assertion (A).

b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

c) Assertion (A) is true, but Reason (R) is false.

d) Assertion (A) is false, but Reason (R) is true.

15. **Assertion (A) :** Alpha (α)- amino acids exist as internal salt in solution as they have [1]
amino and carboxylic acid groups in near vicinity.

Reason (R) : H^+ ion given by carboxylic group (COOH) is captured by amino group (NH_2) having lone pair of electrons.

a) Both (A) and (R) are true and (R) is the correct explanation of (A)

b) Both (A) and (R) are true but (R) is not the correct explanation of (A)

c) (A) is correct but (R) is wrong

d) (A) is wrong but (R) is correct

16. **Assertion (A) :** The conductivity of a electrolytic solutions increases with increase of [1]
temperature.

Reason (R) : Electronic conductance decreases with increase of temperature

a) Both (A) and (R) are true and (R) is the correct explanation of (A)

b) Both (A) and (R) are true but (R) is not the correct explanation of (A)

c) (A) is correct but (R) is wrong

d) (A) is wrong but (R) is correct

Section B

17.I. Answer the following: [2]

i. Teacher asked a student to bring a boiled egg to class to understand the concept of osmosis. Next day teacher placed the egg in a solution containing more than 0.9% sodium chloride solution. What would have happened to that egg when it was placed for some time?

ii. When 50 mL of Ethyl bromide and 50 mL of Ethyl Iodide are mixed, predict whether the volume of the solution is equal to, greater than or less than 100 mL. Give reason to support your answer.

(OR)

17.II. Answer the following: [2]

i. Outer hard shells of two eggs are removed. One of the eggs is placed in saturated solution of sodium chloride and the other egg is placed in pure water. What change will be observed in both the eggs and why?

ii. What would be the value of van't Hoff factor for a dilute solution of K_2SO_4 in water. Assume that K_2SO_4 is completely ionised.

18. a) Imagine that you are studying the age of a dead biological sample in forensic lab. [2]
During the studies, you found that the sample decomposed by following first order kinetics. If 50% of the sample is decomposed in 120 minutes, how long will it take for 90% of the sample to decompose?

b) How does a catalyst affect the rate of reaction?

19. Complete the following reactions: [2]
(i) $C_6H_5N_2Cl + CH_3CH_2OH \longrightarrow$
(ii) $C_6H_5N_2Cl + H_3PO_2 + H_2O \longrightarrow$

20. Write the name and draw the structures of each of the following complex compounds: [2]
(i) $[Co(NH_3)_4(H_2O)_2]Cl_3$
(ii) $[Pt(NH_3)_4][NiCl_4]$

21. Explain the following observations : [2]
(i) The boiling point of ethanol is higher than that of methoxymethane.
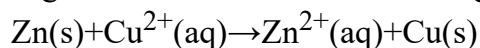(ii) Phenol is more acidic than ethanol.

Section C

22. An aqueous solution of NaOH was made and its molar mass from the measurement of osmotic pressure at 27° C was found to be 25 g mol^{-1}. Calculate the percentage dissociation of NaOH in this solution. [Atomic mass : Na = 23 u, O = 16 u, H = 1 u] [3]

23. Calculate Λ°_m for acetic acid and its degree of dissociation (α) if its molar conductivity is 48.1 Ω^{-1} cm² mol^{-1}. [3]
Given that
Λ°_m (HCI) = 426 Ω^{-1} cm² mol^{-1}
Λ°_m(NaCl) = 126 Ω^{-1} cm² mol^{-1}
Λ°_m (CH$_3$COONa) = 91 Ω^{-1} cm² mol^{-1}

24. Write the structure of the major organic product in each of the following reactions:(any 3) [3]
(i) $CH_3CH_2CH=CH_2 + HBr \xrightarrow{\text{peroxide}}$
(ii) $C_6H_5ONa + C_2H_5Cl \longrightarrow$
(iii) $CH_3CH(Br)CH_2CH_3 + NaOH \xrightarrow{\text{water}}$
(iv) $CH_3CH_2CH_2Cl + NaI \xrightarrow[\text{heat}]{\text{acetone}}$

25. (i) When pyrolusite ore MnO_2 is fused with KOH in presence of air, a green coloured compound (A) is obtained which undergoes disproportionation reaction in acidic medium to give purple coloured compound (B). [3]
(a) Write the formulae of (A) & (B).
(b) What happens when compound (B) is heated.
(ii) What is 'Misch metal' ? Give its one use.

26. Account for the following: - [3]
(a) Ortho nitro phenol is more volatile than para nitro phenol
(b) Phenol is more easily nitrated than benzene.
(c) Sodium metal can be used for drying Di ethyl ether but not ethyl alcohol.

27. Explain the mechanism of acid catalysed hydration of an alkene to form corresponding alcohol. [3]

28. Account for the following: [3]
(i) Name an oxo anion having oxidation number of metal (3d series) equal to its group number.
(ii) In the series Sc (Z = 21) to Zn (Z = 30), the enthalpy of atomisation of zinc is the lowest.
(iii) Most of the transition metals and their compounds act as good catalysts.

Section D

29. A galvanic cell is constructed using Zn/Zn^{2+} and Cu/Cu^{2+} half-cells at 25°C.
$Zn(s)+Cu^{2+}(aq)→Zn^{2+}(aq)+Cu(s)$
The standard electrode potentials are:

$$E^{\circ}_{Zn^{2+}/Zn} = -0.76 \text{ V}, \qquad E^{\circ}_{Cu^{2+}/Cu} = +0.34 \text{ V}$$

29.a. What is the value of n (number of electrons transferred) in the Zn–Cu galvanic cell? [1]

29.b. Write the cell expression for the galvanic cell involving Zn/Zn^{2+} and Cu/Cu^{2+}. [1]

29.c. Calculate the standard Gibbs free energy change ($\Delta G°$) for the Zn–Cu cell. [2]

Given $E°_{cell}$ =1.10 V, n=2, F=96485 C mol^{-1}

(OR)

29.d. Calculate the cell potential at 25°C using the Nernst equation. [2]

Also given E°cell=1.10 V and $\log(0.10)$ = -1

30. 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 levels is called crystal field splitting energy (Δ_0). The actual configuration of complexes depends on the relative values of Δ_0 and P (pairing energy). If $\Delta_0 < P$, then complex will be high spin. If $\Delta_0 > P$, then complex will be low spin.

30.a. What is the nature of the bond between the metal ion and ligands as per valence bond theory? [1]

30.b. What is meant by crystal field splitting? [1]

30.c. How does the magnitude of Δ_0 decide the actual configuration of d orbitals in a coordination entity? [2]
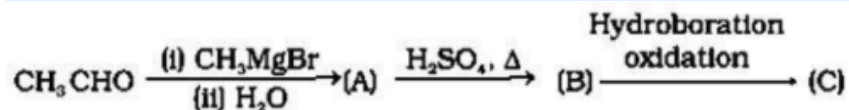
(OR)

30.d. Distinguish between valence bond theory and crystal field theory with respect to bonding. [2]

Section E

31.I. (i) Identify the compounds A, B and C in the following reaction. [5]

$$CH_3CHO \xrightarrow[\text{(ii) } H_2O]{\text{(i) } CH_3MgBr} (A) \xrightarrow{H_2SO_4, \Delta} (B) \xrightarrow{\text{Hydroboration oxidation}} (C)$$

(ii) Draw structures for the derivatives The 2,4-dinitrophenylhydrazone of benzaldehyde

(iii) Why pK_a of F-CH_2COOH is lower than that of Cl–CH_2COOH?

(OR)

31.II. (a) Write the reactions involved in the following: [5]

(i) Clemenson reduction

(ii) Tollen's test

(b) Give reason

(i) Aldehydes are more reactive than ketones for nucleophilic addition reactions.

(ii) The alpha hydrogen of aldehydes and ketones is acidic in nature.

(iii) Carboxylic acids do not give reactions of carbonyl group.

32.I. Explain the following: [5]

(i) Starch and cellulose both contain glucose units as monomers yet they are structurally different.

(ii) Pentaacetate of glucose does not react with hydroxyl amine.

(iii) Write chemical reactions to show that open structure of D-glucose contains the following

(a) Straight chain

(b) 5 alcohol groups

(c) Aldehyde as carbonyl group

(OR)

32.II. I. Identify and give any one point of difference between the carbohydrate present in cane sugar and carbohydrate present in milk. [5]

II. Glucose is an aldohexose and a monosaccharide. Which oxidising agent should be used to bring about oxidation of only the aldehydic group present in glucose?

III. A doctor advises sunlight exposure and vitamin D-rich diet. What deficiency is being treated?

IV. Name the two major molecular shapes formed due to the folding of secondary structure of proteins.

V. Ashish's gums bleed frequently. The doctor's prescription mentioned that Ashish is suffering from scurvy. Help him to identify two food sources to help him recover faster.

33.I. A) Answer the following questions: [5]

(i) The rate of a reaction triples when the temperature changes from 298 K to 318 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature. (Given R = 8.314 $JK^{-1}mol^{-1}$, log 3 = 0.4771)

(ii) For the reaction A + B → C, you find that the rate = $k[A]^2$. Calculate order of the reaction and what does this imply about the mechanism of the reaction?

33.II. i)For the reaction A + B →Product, following data was obtained: [5]

Experiment number	Initial concentration of [A] (mol L–1)	Initial concentration of [B] (mol L–1)	Initial Rate (mol L–1 min–1)
1	0.15	0.15	9.6×10^{-2}
2	0.30	0.15	3.84×10^{-1}
3	0.15	0.30	1.92×10^{-1}
4	0.30	0.30	7.68×10^{-1}

Calculate the following:

(a)The overall order of the reaction

(b)The rate law equation

(c)The value of rate constant

(ii) In a graph ln [reactant] was plotted vs. time, it gave a straight line, predict the order of the reaction also give the expression of its half-life and rate constant.

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