**S R Study Material**

# SAMPLE PAPER 2 2024-25

## Class 12 - Chemistry

**Time Allowed: 3 hours** **Maximum Marks: 70**

**General Instructions:**

Read the following instructions carefully.

1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. **All questions are compulsory.**
8. **Use of log tables and calculators is not allowed.**

### Section A

1. Which of the following has highest boiling point? **[1]**

   a) $C_2H_5$-I b) $C_2H_5$-F

   c) $C_2H_5$-Cl d) $C_2H_5$-Br

2. Glucose is: **[1]**

   a) Aldopentose b) Ketopentose

   c) Aldohexose d) Ketohexose

3. Which one of the following compounds has the lowest $pK_a$ value? **[1]**

   a) p-Nitrophenol b) p-Cresol

   c) 2,4,6-Trinitrophenol d) m-Nitrophenol

4. IUPAC name of the following compound is $CH_3 - \underset{\underset{CH_3}{|}}{C}H - OCH_3$ is _____. **[1]**

   a) 2 – methoxy – 2 – methylethane b) 2 – methoxypropane

   c) isopropylmethyl ether d) 1 – methoxy – 1 – methylethane

5. A zero-order reaction is one whose rate is independent of: **[1]**

   a) Presence of light b) Pressure of the reaction

   c) Concentration of the reactant d) Temperature of the reaction

6. Match the items given in column I with that in column II: **[1]**

| Column I | Column II |
|---|---|
| (a) Resistivity | (i) S $cm^2$ $mol^{-1}$ |
| (b) Conductance | (ii) ohm-m |
| (c) Specific Conductance | (iii) Siemens |
| (d) Molar Conductivity | (iv) S $m^{-1}$ |

a) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)

b) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)

c) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

d) (a) - (ii), (b) - (i), (c) - (iii), (d) - (iv)

7. The conversion of an alkyl halide into an alkene by alcoholic KOH is classified as **[1]**

a) a substitution reaction

b) a dehydration reaction

c) a dehydrohalogenation reaction

d) an addition reaction

8. The action of nitrous acid on ethylamine gives mainly: **[1]**

a) ethyl alcohol

b) ethyl nitrite

c) nitroethane

d) ethane

9. Why is the minimum energy needed for an effective collision? **[1]**

a) Enough energy is needed to give off heat in a reaction.

b) Energy is needed to break bonds.

c) A minimum energy is needed, so that the particles will collide many times per second.

d) Energy is needed to orient the particles correctly.

10. The compound which forms acetaldehyde when heated with dilute NaOH is: **[1]**

a) 1, 2 dichloroethane

b) 1, 1, 1 trichloroethane

c) 1 chloroethane

d) 1, 1 dichloroethane

11. Williamson's synthesis is used for the preparation of **[1]**

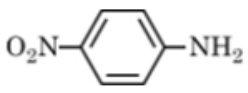
a) aldehydes

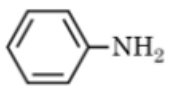
b) ethers

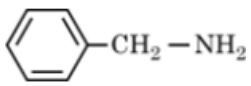
c) alkyl halides

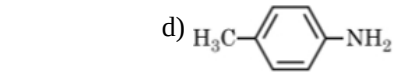
d) alcohols

12. Among the following, which is the strongest base? **[1]**

a) 

b) 

c) 

d) 

13. **Assertion (A):** D(-)-Ribose on consecutive treatment with $\frac{Br_2}{H_2O}, \frac{H_2O_2}{Fe_2(SO_4)_3}$ gives D(-)-erythrose. **[1]**

**Reason (R):** $\frac{Br_2}{H_2O}, \frac{H_2O_2}{Fe^{2+}}$ is used in Ruff degradation method and D(-)-ribose and D(-)-erythrose differ only in one carbon atom.

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 true but R is false.

d) A is false but R is true.

14. **Assertion (A):** Reactivity of ketones is more than aldehydes. **[1]**

**Reason (R):** The carbonyl carbon of ketones is less electrophilic as compared to aldehydes.

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 true but R is false.

d) A is false but R is true.

15. **Assertion (A):** 2-Chloro-3-methylbutane on treatment with alcoholic potash gives 2-methylbut-2-ene as major product. **[1]**

**Reason (R):** The reaction occurs according to Saytzeff rule.

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 true but R is false.

d) A is false but R is true.

16. **Assertion (A):** Tert. butyl methyl ether is not prepared by the reaction of tert. butyl bromide with sodium methoxide. **[1]**

**Reason (R):** Sodium methoxide is a strong nucleophile.

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 true but R is false.

d) A is false but R is true.

## Section B

17. When 19.5 g of F - $CH_2$ – COOH (Molar mass = 78 g $mol^{-1}$), is dissolved in 500 g of water, the depression in freezing point is observed to be $1^oC$. **[2]**

Calculate the degree of dissociation of F - $CH_2$ - COOH.

[Given: $K_f$ for water = 1.86 K kg $mol^{-1}$]

18. Give reasons: **[2]**

a. $E^o$ value for $Mn^{3+}/Mn^{2+}$ couple is much more positive than that for $Fe^{3+}/Fe^{2+}$.

b. Iron has higher enthalpy of atomization than that of copper.

c. $Sc^{3+}$ is colourless in aqueous solution whereas $Ti^{3+}$ is coloured.

19. **Answer the following:** **[2]**

(a) How will you prove that a chemical reaction is of first order? **[1]**

(b) State a condition under which a bimolecular reaction is kinetically first-order reaction. **[1]**

20. Derive an expression for the pH of electrolyte in the following half cell. $PtH_2(1atm)|H^+(aq)$. The reduction potential is - 0.30 V. **[2]**

OR

What are fuel cells? Write the electrode reactions of a fuel cell which uses the reaction of hydrogen with oxygen?

21. Draw the structures of the following compounds. **[2]**

i. 4-Chloropentan-2-one

ii. 3-Bromo-4-phenylpentanoic acid

## Section C

22. a. The standard Gibbs energy $(\Delta rG^\circ)$ for the following cell reaction is -300 kJ $mol^{-1}$: **[3]**

$Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$

Calculate $E^\circ_{cell}$ for the reaction. (Given: 1F = 96500 $mol^{-1}$)

b. Calculate $\lambda^o_m$ for $MgCl_2$ if $\lambda^o$ values for $Mg^{2+}$ ion and $Cl^-$ ion are 106 S $cm^2mol^{-1}$ and 76.3 S $cm^2mol^{-1}$ respectively.

23. Explain the bonding in coordination compounds in terms of Werner's postulates. **[3]**

24. An aromatic compound (A) having molecular formula $C_6H_6O$ on treatment with $CHCl_3$ and KOH gives a mixture two isomers B and C both of B & C give same product D when distilled with Zn dust. Oxidation of D gives E of formula $C_7H_6O_2$ The sodium salt of E on heating with soda lime gives F which may also be obtained by distilling A with zinc dust. Identify compounds A to F giving sequence of reactions.? **[3]**

OR

Explain the following with an example.

i. Kolbe's reaction.
ii. Reimer-Tiemann reaction.
iii. Williamson ether synthesis.
iv. Unsymmetrical ether.

25. A compound **A** ($C_2H_4O$) on oxidation gives **B** ($C_2H_4O_2$). **A** undergoes Iodoform reaction to give yellow precipitate and reacts with HCN to form the compound **C**. **C** on hydrolysis gives 2-hydroxypropanoic acid. Identify the compounds **A**, **B** and **C**. Write down equations for the reactions involved. **[3]**

26. Calculate the potential for half cell containing [$K_2Cr_2O_7$(aq)] = 0.10M, [$Cr^{3+}$ (aq)] = 0.20M and $[H^+(aq)] = 1.0 \times 10^{-4} M$. The half cell reaction is $Cr_2O_7^{2-}(aq) + 14H^+ + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$ Given that $E^\Theta = 1.33V$. **[3]**

27. What happens when **[3]**

i. ethyl chloride is treated with aqueous KOH,
ii. methyl bromide is treated with sodium in the presence of dry ether,
iii. methyl chloride is treated with KCN?

28. A reaction is first order in A and second order in B. **[3]**

i. Write differential rate equation.
ii. How is the rate affected if the concentration of B is tripled?
iii. How is the rate affected when the concentration of both A and B are doubled?

What is the significance of rate constant in the rate expression?

**Section D**

29. **Read the following text carefully and answer the questions that follow:** **[4]**

Proteins are the most abundant biomolecules of the living system. Proteins are the polymers of about twenty different $\alpha$-amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases.

On the basis of their molecular shape, proteins are classified into two types: Fibrous and Globular proteins. Structure and shape of proteins can be studied at four different levels i.e., primary, secondary, tertiary and quaternary, each level being more complex than the previous one. The secondary or tertiary structure of proteins get disturbed on change of pH or temperature and they are not able to perform their functions. This is called

denaturation of proteins.

Answer the following questions:

a. What are essential amino acids? **(1)**

b. What is meant by zwitter ionic form of amino acids? **(1)**

c. i. Give one example each for Fibrous protein and Globular protein.

ii. What type of linkages hold monomers of proteins together? **(2×1 = 2)**

**OR**

c. i. What is the structural feature which characterises a reducing sugar?

ii. What is the structural difference between nucleoside and nucleotide? **(2×1 = 2)**

30. **Read the following text carefully and answer the questions that follow:** **[4]**

Coordination compounds are widely present in the minerals, plant and animal worlds and are known to play many important functions in the area of analytical chemistry, metallurgy, biological systems and medicine. Alfred Werner's theory postulated the use of two types of linkages (primary and secondary), by a metal atom/ion in a coordination compound. He predicted the geometrical shapes of a large number of coordination entities using the property of isomerism. The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds. It, however, fails to describe the optical properties of these compounds. The Crystal Field Theory (CFT) explains the effect of different crystal fields (provided by the ligands taken as point charges) on the degeneracy of d-orbital energies of the central metal atom/ion.

i. When a coordination compound $NiCl_2 \cdot 6H_2O$ is mixed with $AgNO_3$ solution, 2 moles of AgCl are precipitated per mole of the compound. Write the structural formula of the complex and secondary valency for Nickel ion. (1)

ii. Write the IUPAC name of the ionisation isomer of $[Co(NH_3)_5(SO_4)]Cl$. (1)

iii. Using Valence Bond Theory, predict the geometry and magnetic nature of: (2)

1. $[Ni(CO)_4]$
2. $[Fe(CN)_6]^{3-}$

[Atomic number : Ni = 28, Fe = 26]

**OR**

Give reasons: (2)

1. Low spin tetrahedral complexes are not formed.
2. $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex.

[Atomic number : Co = 27, Ni = 28

## Section E

31. **Attempt any five of the following:** **[5]**

(a) Why do transition metals have high enthalpy of hydration? **[1]**

(b) State a consequence of lanthanide contraction shown by transition elements. **[1]**

(c) Write the outer electronic configuration of Cr atom(Z= 24). **[1]**

(d) Name the element which are not really transition elements but are discussed with them. **[1]**

(e) Why do the transition elements exhibit higher enthalpies of atomization? **[1]**

(f) Identify the following: **[1]**

i. Oxo anion of chromium which is stable in acidic medium.

ii. The lanthanoid element that exhibits +4 oxidation state.

(g) Complete the following equations: **[1]**

a. $2MnO_4^- + 5NO_2^- + 6H^+ \longrightarrow$

b. $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow$

32. Why is the mass determined by measuring a colligative property in case of some solutes abnormal? Discuss it with the help of Van't Hoff factor. **[5]**

OR

What are ideal and non-ideal solutions? Explain with suitable diagram the behaviour of ideal solutions.

33. a. Write the reactions involved in the following: **[5]**

i. Hoffmann bromamide degradation reaction

ii. Diazotisation

iii. Gabriel phthalimide synthesis

b. Give reasons:

i. $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.

ii. Aromatic diazonium salts are more stable than aliphatic diazonium salt.

OR

i. Write the structures of main products when benzene diazonium chloride ($C_6H_5N_2^+Cl^-$) reacts with the following reagents :

a. $HBF_4/\Delta$

b. Cu /HBr

ii. Write the structures of A, B and C in the following reactions :

a. $C_6H_5NO_2 \xrightarrow{Sn/HCl} A \xrightarrow[273K]{NaNO_2 + HCl} B \xrightarrow[\Delta]{H_2O} C$

b. $CH_3Cl \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[273K]{HNO_2} C$