

## Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

Maximum Marks: 70

### General Instructions

- (i) This question paper contains **35 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 18 are multiple choice questions, carrying 1 mark each.
- (iii) Section B: Questions 19 to 25 are very short answer questions, carrying 2 marks each.
- (iv) Section C: Questions 26 to 30 are short answer questions, carrying 3 marks each.
- (v) Section D: Questions 31 to 32 are case-based questions, carrying 4 marks each.
- (vi) Section E: Questions 33 to 35 are long answer questions, carrying 5 marks each.
- (vii) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (viii) Use of calculators is not allowed.

## Section A

1. An  $\alpha$ -helix is a structural feature of:

- (A) Sucrose (B) Starch  
(C) Polypeptides (D) Nucleotides

2. The glycosidic linkage involved in linking the glucose units in amylose part of starch is:

- (A)  $C_1-C_4$   $\alpha$  linkage (B)  $C_1-C_4$   $\beta$  linkage  
(C)  $C_1-C_6$   $\alpha$  linkage (D)  $C_1-C_6$   $\beta$  linkage

3.  $Ag^+(aq) + e^- \rightarrow Ag(s); E^\circ = +0.80\text{ V}$

$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s); E^\circ = -0.44\text{ V}$

Find the  $E^\circ_{\text{cell}}$  for:

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

- (A) 1.16 V (B) -1.16 V  
(C) 2.04 V (D) 1.24 V

4. A first order reaction takes 30 minutes for 50% completion. The value of rate constant  $k$  would be:

- (A)  $2.5 \times 10^{-1} \text{ min}^{-1}$  (B)  $2.75 \times 10^{-1} \text{ min}^{-1}$   
(C)  $1.25 \times 10^{-3} \text{ min}^{-1}$  (D)  $2.31 \times 10^{-2} \text{ min}^{-1}$

5. Which of the following is least basic?

- (A)  $(CH_3)_2NH$  (B)  $NH_3$   
(C)  $C_6H_5NH_2$  (D)  $(CH_3)_3N$

6.  $CH_3CONH_2$  on reaction with  $NaOH$  and  $Br_2$  in alcoholic medium gives:

- (A)  $CH_3COONa$  (B)  $CH_3NH_2$   
(C)  $CH_3CH_2Br$  (D)  $CH_3CH_2NH_2$

7. In the reaction  $R-OH + HCl \xrightarrow{ZnCl_2} RCl + H_2O$ , what is the correct order of reactivity of alcohol?

- (A)  $1^\circ < 2^\circ < 3^\circ$  (B)  $1^\circ > 3^\circ > 2^\circ$   
(C)  $1^\circ > 2^\circ > 3^\circ$  (D)  $3^\circ > 1^\circ > 2^\circ$

8. The colligative property used for the determination of molar mass of polymers and proteins is:

- (A) Osmotic pressure (B) Depression in freezing point  
(C) Relative lowering in vapour pressure (D) Elevation in boiling point

9. Low concentration of oxygen in the blood and tissues of people living at high altitude is due to:

- (A) high atmospheric pressure (B) low temperature  
(C) low atmospheric pressure (D) low temperature and high atmospheric pressure both

10. Which of the following is affected by catalyst?

- (A)  $\Delta H$  (B)  $\Delta G$   
(C)  $E_a$  (D)  $\Delta S$

11. The compounds  $[Co(SO_4)(NH_3)_5]Br$  and  $[Co(Br)(NH_3)_5]SO_4$  represent:

- (A) optical isomerism (B) linkage isomerism  
(C) ionisation isomerism (D) coordination isomerism

12. The synthesis of alkyl fluoride is best obtained from:

- (A) Free radicals (B) Swartz reaction  
(C) Sandmeyer reaction (D) Finkelstein reaction

13. The most common and stable oxidation state of a Lanthanoid is:

- (A) +2 (B) +3  
(C) +4 (D) +6

14. The order of the reaction  $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \xrightarrow{h\nu} 2\text{HCl}(\text{g})$  is:

- (A) 2 (B) 1  
(C) 0 (D) 3

15. Assertion (A):  $(\text{C}_2\text{H}_5)_2\text{NH}$  is more basic than  $(\text{C}_2\text{H}_5)_3\text{N}$  in aqueous solution.

Reason (R): In  $(\text{C}_2\text{H}_5)_2\text{NH}$ , there is more steric hindrance and +I effect than  $(\text{C}_2\text{H}_5)_3\text{N}$ .

Select the correct answer:

- (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.

16. Assertion (A): The molecularity of the reaction  $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$  appears to be 2.

Reason (R): Two molecules of the reactants are involved in the given elementary reaction.

Select the correct answer:

- (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.

17. Assertion (A): Acetylation of aniline gives a monosubstituted product.

Reason (R): Activating effect of  $-\text{NHCOCH}_3$  group is more than that of amino group.

Select the correct answer:

- (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.

18. Assertion (A): EDTA is used to determine hardness of water.

Reason (R): EDTA is a bidentate ligand.

Select the correct answer:

- (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.

## Section B

19. A solution is prepared by dissolving 10 g of non-volatile solute in 200 g of water. It has a vapour pressure of 31.84 mm Hg at 308 K. Calculate the molar mass of the solute.

(Vapour pressure of pure water at 308 K = 32 mm Hg)

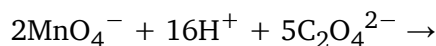
20. Explain briefly:

- (a) Carbylamine reaction
- (b) Gabriel phthalimide synthesis

21. How would you account for:

(a) The  $E^\circ$  value for the  $\text{Mn}^{3+}/\text{Mn}^{2+}$  couple is much more positive than that for  $\text{Cr}^{3+}/\text{Cr}^{2+}$  couple or  $\text{Fe}^{3+}/\text{Fe}^{2+}$  couple.

(b) Complete the following equation:

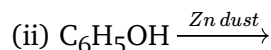
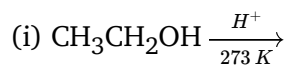


22. (a) On diluting two electrolytes 'A' and 'B', the  $\Lambda_m$  of 'A' increases 25 times while that of 'B' increases by 1.5 times. Which of the two electrolytes is strong? Justify your answer graphically.

OR

(b) The electrical resistance of a column of 0.05 mol  $\text{L}^{-1}$  NaOH solution of diameter 1 cm and length 50 cm is  $5.55 \times 10^3$  ohm. Calculate the conductivity.

23. (a) Predict the products of the following reactions:

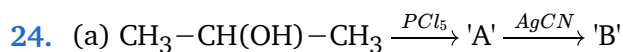


OR

(b) Give reasons for the following:

(i) p-nitrophenol is more acidic than p-methylphenol.

(ii)  $(\text{CH}_3)_3\text{C}-\text{Br}$  on reaction with  $\text{NaOCH}_3$  gives alkene as the main product and not an ether.



Identify 'A' and 'B' in the above reactions.

25. Define denaturation of protein. What is the effect of denaturation on the structure of protein?

## Section C

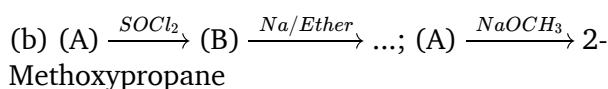
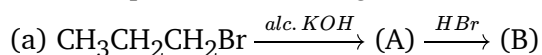
26. Give reason:

(a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.

(b) Aquatic animals are more comfortable in cold water than in warm water.

(c) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.

27. Complete the following reactions:



28. How do you convert the following: (Any three)

(a) Phenol to 2-Hydroxybenzaldehyde

(b) Anisole to 2-Methoxyacetophenone

(c) Propene to Propan-2-ol

(d) Ethanol to Ethanal

29. (a) What are the hydrolysis products of (i) Lactose, (ii) Maltose?

(b) Give the basic structural difference between starch and cellulose.

30. (a) Explain why:

(i) Carboxyl group in benzoic acid is meta directing.

(ii) Sodium bisulphite is used for the purification of aldehydes and ketones.

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

OR

(b) An organic compound 'A', having the molecular formula  $\text{C}_3\text{H}_8\text{O}$  on treatment with Cu at 573 K, gives 'B'. 'B' does not reduce Fehling's solution but gives a yellow precipitate of the compound 'C' with  $\text{I}_2/\text{NaOH}$ . Deduce the structures of A, B and C.

**31(i). Case Study:** In coordination compounds, metals show two types of linkages, primary and secondary. Primary valencies are ionisable and are satisfied by negatively charged ions. Secondary valencies 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.

(i) If  $\text{PtCl}_2 \cdot 2\text{NH}_3$  does not react with  $\text{AgNO}_3$ , what will be its formula?

**31(ii).** (ii) What is the secondary valency of  $[\text{Co(en)}_3]^{3+}$ ?

**31(iii).** (iii) (1) Write the formula of Iron(III)hexacyanidoferrate(II).

(2) Write the IUPAC name of  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ .

OR

(iii) Write the hybridization and magnetic behaviour of  $[\text{Ni}(\text{CN})_4]^{2-}$ . [Atomic number: Ni = 28]

**32(i). Case Study:** The rate of reaction is concerned with decrease in concentration of reactants or increase in the concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. Mathematical representation of rate of reaction is given by rate law. Rate constant and order of a reaction can be determined from rate law or its integrated rate equation.

(i) What is average rate of reaction?

**32(ii).** (ii) Write two factors that affect the rate of reaction.

**32(iii).** (iii) (1) What happens to rate of reaction for zero order reaction?

(2) What is the unit of k for zero order reaction?

OR

(iii) (1) For a reaction  $\text{P} + 2\text{Q} \rightarrow \text{Products}$ , Rate =  $k[\text{P}]^{1/2}[\text{Q}]^1$ . What is the order of the reaction?

(2) Define pseudo first order reaction with an example.

## Section E

**33.** Assign reason for each of the following:

- (i) Manganese exhibits the highest oxidation state of +7 among the 3d series of transition elements.
- (ii) Transition metals and their compounds are generally found to be good catalysts in chemical reactions.
- (iii)  $\text{Cr}^{2+}$  is reducing in nature while with the same d-orbital configuration ( $d^4$ )  $\text{Mn}^{3+}$  is an oxidising agent.
- (iv) Zn has lowest enthalpy of atomization.
- (v)  $\text{Cu}^+$  is unstable in an aqueous solution.

**34.** (a) (i) Carry out the following conversions:

- (1) Ethanal to But-2-en-1-al
- (2) Propanoic acid to 2-chloropropanoic acid
- (ii) An alkene with molecular formula  $\text{C}_5\text{H}_{10}$  on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling test and also reacts with iodine and NaOH solution. Compound 'C' does not give Fehling solution test but forms iodoform. Identify the compounds 'A', 'B' and 'C'.

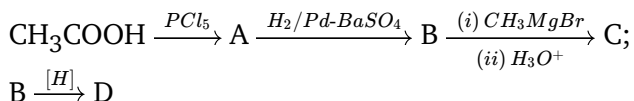
OR

(b) (i) Distinguish with a suitable chemical test:

- (1)  $\text{CH}_3\text{COCH}_2\text{CH}_3$  and  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
- (2) Ethanal and Ethanoic acid

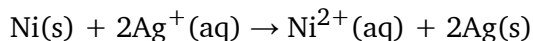
(ii) Write the structure of oxime of acetone.

(iii) Identify A to D.



**35.** (a) (i) State Kohlrausch's law of independent migration of ions. Write an expression for the limiting molar conductivity of acetic acid according to Kohlrausch's law.

(ii) Calculate the maximum work and  $\log K_c$  for the given reaction at 298 K:



Given:  $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}$ ,  $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80 \text{ V}$ ;  
 $1 \text{ F} = 96500 \text{ C mol}^{-1}$

OR

(b) (i) State Faraday's first law of electrolysis.

How much charge, in terms of Faraday, is required for the reduction of 1 mol  $\text{Cu}^{2+}$  to Cu?

(ii) Calculate emf of the following cell at 298 K for



$[E^\circ_{\text{cell}} = +2.71 \text{ V}, 1 \text{ F} = 96500 \text{ C mol}^{-1}, \log 10 = 1]$

- End of Question Paper -