

## 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 **37 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 20 are very short answer questions, carrying 1 mark each.
- (iii) Section B: Questions 21 to 27 are short answer questions, carrying 2 marks each.
- (iv) Section C: Questions 28 to 34 are long answer type i questions, carrying 3 marks each.
- (v) Section D: Questions 35 to 37 are long answer type ii questions, carrying 5 marks each.
- (vi) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (vii) Use of calculators is not allowed.

## Section A

**1. Read the given passage and answer the questions 1 to 5 that follow:**

Colloidal particles always carry an electric charge which may be either positive or negative. For example, when  $\text{AgNO}_3$  solution is added to KI solution, a negatively charged colloidal sol is obtained. The presence of equal and similar charges on colloidal particles provide stability to the colloidal sol and if, somehow, charge is removed, coagulation of sol occurs. Lyophobic sols are readily coagulated as compare to lyophilic sols.

What is the reason for the charge on sol particles?

**2.** Why the presence of equal and similar charges on colloidal particles provide stability?

**3.** Why a negatively charged sol is obtained on adding  $\text{AgNO}_3$  solution to KI solution?

**4.** Name one method by which coagulation of lyophobic sol can be carried out.

**5.** Out of KI or  $\text{K}_2\text{SO}_4$ , which electrolyte is better in the coagulation of positive sol?

**6.** Name the method used for the refining of Zinc.

**7.** Out of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$  and  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{Cl}$ , which one is more reactive towards  $\text{S}_{\text{N}}1$  reaction?

**8.** Write an isomer of  $\text{C}_3\text{H}_9\text{N}$  which does not react with Hinsberg reagent.

**9.** What type of protein is present in keratin?

**10.** Name the compound which is added to soap to provide antiseptic properties.

**11.** Which of the following is the most stable complex?

- (a)  $[\text{Fe}(\text{CO})_5]$       (b)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$       (c)  $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$       (d)  $[\text{Fe}(\text{CN})_6]^{3-}$

12. Which of the following is correct for spontaneity of a cell?

- (a)  $\Delta G = -ve$ ,  $E^\circ = +ve$     (b)  $\Delta G = +ve$ ,  $E^\circ = 0$   
(c)  $\Delta G = -ve$ ,  $E^\circ = 0$     (d)  $\Delta G = +ve$ ,  $E^\circ = -ve$

13. For a zero order reaction, the slope in the plot of  $[R]$  Vs. time is

- (a)  $-\frac{k}{2.303}$     (b)  $-k$     (c)  $+\frac{k}{2.303}$     (d)  $+k$   
(where  $[R]$  is the final concentration of reactant)

14. What type of isomerism is shown by the pair  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  and  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$ ?

- (a) Ionization isomerism    (b) Coordination isomerism  
(c) Solvate isomerism    (d) Linkage isomerism

15. Which one is the complementary base of cytosine in one strand to that in other strand of DNA?

- (a) Adenine    (b) Guanine    (c) Thymine  
(d) Uracil

16. **Assertion (A):**  $\text{F}_2$  has low reactivity.

**Reason (R):** F-F bond has low  $\Delta_{\text{bond}} H^\circ$ .

17. **Assertion (A):** Benzoic acid does not undergo Friedel-Crafts reaction.

**Reason (R):** The carboxyl group is activating and undergo electrophilic substitution reaction.

18. **Assertion (A):** Transition metals have low melting points.

**Reason (R):** The involvement of greater number of  $(n - 1)d$  and  $ns$  electrons in the interatomic metallic bonding.

19. **Assertion (A):**  $(\text{CH}_3)_3\text{C-O-CH}_3$  gives  $(\text{CH}_3)_3\text{C-I}$  and  $\text{CH}_3\text{OH}$  on treatment with HI.

**Reason (R):** The reaction occurs by  $\text{S}_{\text{N}}1$  mechanism.

20. **Assertion (A):** For complex reactions molecularity and order are not same.

**Reason (R):** Order of reaction may be zero.

## Section B

21. Write the principle of the following refining methods:

- (a) vapour phase refining
- (b) chromatography

OR

Write chemical equations involved to obtain:

- (i) Cu from  $\text{Cu}_2\text{S}$
- (ii) Ag from  $[\text{Ag}(\text{CN})_2]^-$  complex

22. What happens when:

- (i) a pressure greater than osmotic pressure is applied on the solution side separated from solvent by a semipermeable membrane?
- (ii) acetone is added to pure ethanol?

23. Write the IUPAC name and hybridisation of the following complexes:

- (i)  $[\text{Co}(\text{NH}_3)_6]^{3+}$
- (ii)  $[\text{NiCl}_4]^{2-}$

(Given: Atomic number: Ni = 28, Co = 27)

24. Write the balanced chemical equations involved in the preparation of  $\text{KMnO}_4$  from pyrolusite ore ( $\text{MnO}_2$ ).

OR

Write the balanced ionic equations showing the oxidising action of acidified dichromate ( $\text{Cr}_2\text{O}_7^{2-}$ ) solution with (i) Iron (II) ion and (ii) Tin (II) ion.

25. Write the reactions showing the presence of following in the open structure of glucose:

- (i) five -OH groups
- (ii) a carbonyl group

26. State Henry's law. Calculate the solubility of  $\text{CO}_2$  in water at 298 K under 760 mm Hg.

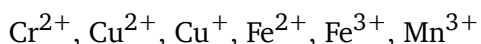
( $K_H$  for  $\text{CO}_2$  in water at 298 K is  $1.25 \times 10^6$  mm Hg)

27. Define the following terms with a suitable example in each:

- (i) Antacids
- (ii) Artificial Sweetener

## Section C

**28.** Following ions are given:



Identify the ion which is

- (i) a strong reducing agent.
- (ii) unstable in aqueous solution.
- (iii) a strong oxidising agent.

Give suitable reason in each.

**29.** The freezing point of a solution containing 5 g of benzoic acid ( $M = 122 \text{ g mol}^{-1}$ ) in 35 g of benzene is depressed by 2.94 K. What is the percentage association of benzoic acid if it forms a dimer in solution?

( $K_f$  for benzene =  $4.9 \text{ K kg mol}^{-1}$ )

**30.** The rate constant for the first order decomposition of  $\text{N}_2\text{O}_5$  is given by the following equation:

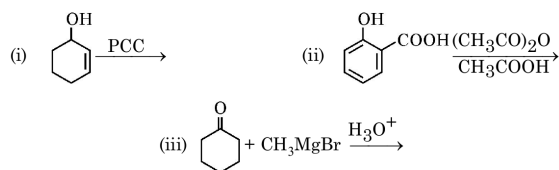
$$k = (2.5 \times 10^{14} \text{ s}^{-1}) e^{-25000 \text{ K}/T}$$

Calculate  $E_a$  for this reaction and rate constant if its half-life period be 300 minutes.

**31.** Write the names and structures of monomers in the following polymers:

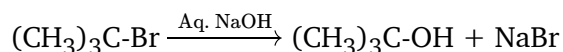
- (a) Buna-S
- (b) Glyptal
- (c) Bakelite

**32.** Write the product(s) of the following reactions:



OR

(a) Write the mechanism of the following  $\text{S}_{\text{N}}1$  reaction:



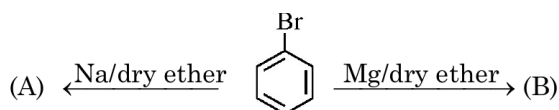
(b) Write the equation for the preparation of 2-methyl-2-methoxypropane by Williamson synthesis.

33. (i) Write the structure of major alkene formed by  $\beta$ -elimination of 2,2,3-trimethyl-3-bromopentane with sodium ethoxide in ethanol.

(ii) Which one of the compounds in the following pairs is chiral?



(iii) Identify (A) and (B) in the following:



OR

How can you convert the following?

(i) But-1-ene to 1-iodobutane

(ii) Benzene to acetophenone

(iii) Ethanol to propanenitrile

34. Arrange the following compounds as directed:

(i) In increasing order of solubility in water:

$(\text{CH}_3)_2\text{NH}$ ,  $\text{CH}_3\text{NH}_2$ ,  $\text{C}_6\text{H}_5\text{NH}_2$

(ii) In decreasing order of basic strength in

aqueous solution:  $(\text{CH}_3)_3\text{N}$ ,  $(\text{CH}_3)_2\text{NH}$ ,  $\text{CH}_3\text{NH}_2$

(iii) In increasing order of boiling point:

$(\text{C}_2\text{H}_5)_2\text{NH}$ ,  $(\text{C}_2\text{H}_5)_3\text{N}$ ,  $\text{C}_2\text{H}_5\text{NH}_2$

35. (a) An organic compound (A) having molecular formula  $C_4H_8O$  gives orange-red precipitate with 2,4-DNP reagent. It does not reduce Tollens' reagent but gives yellow precipitate of iodoform on heating with NaOH and  $I_2$ . Compound (A) on reduction with  $NaBH_4$  gives compound (B) which undergoes dehydration reaction on heating with conc.  $H_2SO_4$  to form compound (C). Compound (C) on ozonolysis gives two molecules of ethanal. Identify (A), (B) and (C) and write their structures. Write the reactions of compound (A) with (i) NaOH/ $I_2$  and (ii)  $NaBH_4$ .

(b) Give reasons:

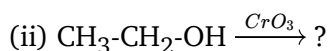
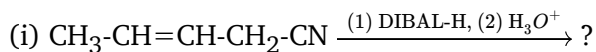
- (i) Oxidation of propanal is easier than propanone.
- (ii)  $\alpha$ -hydrogen of aldehydes and ketones is acidic in nature.

OR

(a) Draw structures of the following derivatives:

- (i) Cyanohydrin of cyclobutanone
- (ii) Hemiacetal of ethanal

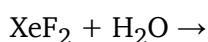
(b) Write the major product(s) in the following:



(c) How can you distinguish between propanal and propanone?

36. (a) Account for the following:

- (i) Tendency to show  $-2$  oxidation state decreases from oxygen to tellurium.
- (ii) Acidic character increases from HF to HI.
- (iii) Moist  $SO_2$  gas acts as a reducing agent.
- (b) Draw the structure of an oxoacid of sulphur containing S-O-S linkage.
- (c) Complete the following equation:



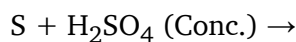
OR

(a) Among the hydrides of group 16, write the hydride:

- (i) Which is a strong reducing agent.
- (ii) Which has maximum bond angle.
- (iii) Which is most thermally stable.

Give suitable reason in each.

(b) Complete the following equations:



37. (a) The electrical resistance of a column of 0.05 M KOH solution of length 50 cm and area of cross-section  $0.625 \text{ cm}^2$  is  $5 \times 10^3 \text{ ohm}$ . Calculate its resistivity, conductivity and molar conductivity.

(b) Predict the products of electrolysis of an aqueous solution of  $\text{CuCl}_2$  with platinum electrodes.

(Given:  $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34 \text{ V}$ ,  $E^0_{1/2\text{Cl}_2/\text{Cl}^-} = +1.36 \text{ V}$ ,  $E^0_{\text{H}^+/\text{H}_2(\text{g}),\text{Pt}} = 0.00 \text{ V}$ ,  $E^0_{1/2\text{O}_2/\text{H}_2\text{O}} = +1.23 \text{ V}$ )

OR

(a) Calculate e.m.f. of the following cell:

$\text{Zn(s)} \mid \text{Zn}^{2+} (0.1 \text{ M}) \parallel \text{Ag}^+ (0.01 \text{ M}) \mid \text{Ag(s)}$

Given:  $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$ ,  $E^0_{\text{Ag}^+/\text{Ag}} = +0.80 \text{ V}$

[Given:  $\log 10 = 1$ ]

(b) X and Y are two electrolytes. On dilution molar conductivity of X increases 2.5 times while that of Y increases 25 times. Which of the two is a weak electrolyte and why?