

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 question: Organic compounds containing amine as functional group are present in a vivid variety of compounds, namely amino acids, hormones, neurotransmitters, DNA, alkaloids, dyes, etc. Drugs including nicotine, morphine, codeine and heroin, etc. which have physiological effects on humans also contain amino group in one form or another. Amines are basic because of the presence of lone pair of electrons on nitrogen. Addition of nitrogen into an organic framework leads to the formation of two families of molecules, namely amines and amides. As chemistry students, we must appreciate the versatility of nitrogen.

What are amino acids?

2. Why are amino acids amphoteric?

3. Give one point of difference between acidic and basic amino acid.

4. What are essential amino acids?

5. Name the linkage formed when carboxyl end of one amino acid condenses with amino end of other amino acid.

6. Name the process used for the benefaction of ores if the ore is soluble in some suitable solvent.

7. Give an example of a metal which can be purified by the process of distillation.

8. What type of isomerism is shown by the complex $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$?

9. An organic compound is adsorbed on the surface of silica gel. Name the process of removing the organic compound from silica gel.

10. Calculate the overall order of the reaction whose rate law expression was predicted as:

$$\text{Rate} = k[\text{NO}]^{1/2}[\text{O}_2]^{1/2}$$

11. 50 mL of an aqueous solution of glucose $\text{C}_6\text{H}_{12}\text{O}_6$ (Molar mass: 180 g/mol) contains 6.02×10^{22} molecules. The concentration of the solution will be

- (A) 0.1 M
- (B) 0.2 M
- (C) 1.0 M
- (D) 2.0 M

12. If the standard electrode potential of an electrode is greater than zero, then we can infer that its

- (A) reduced form is more stable compared to hydrogen gas.
- (B) oxidised form is more stable compared to hydrogen gas.
- (C) reduced and oxidised forms are equally stable.
- (D) reduced form is less stable than the hydrogen gas.

13. Total number of unpaired electrons present in Co^{2+} (Atomic number = 27) is

- (A) 2
- (B) 7
- (C) 3
- (D) 5

14. The incorrect statement about interstitial compounds is

- (A) They are chemically reactive.
- (B) They are very hard.
- (C) They retain metallic conductivity.
- (D) They have high melting point.

15. The correct IUPAC name of $\text{CH}_3\text{-C}(\text{CH}_3)(\text{OH})\text{-CH}_2\text{CH}_3$ is

- (A) tert-butyl alcohol
- (B) 2,2-Dimethylpropanol
- (C) 2-Methylbutan-2-ol
- (D) 3-Methylbutan-3-ol

16. Assertion (A): Boiling points of alkyl halides decrease in the order $\text{R-I} > \text{R-Br} > \text{R-Cl} > \text{R-F}$.

Reason (R): Van der Waals forces decrease with increase in the size of halogen atom.

Select the correct answer from the codes:

- (i) Both (A) and (R) are correct, and (R) is the correct explanation of (A).
- (ii) Both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- (iii) (A) is correct, but (R) is incorrect.
- (iv) (A) is incorrect, but (R) is correct.

17. Assertion (A): Low spin tetrahedral complexes are rarely observed.

Reason (R): The orbital splitting energies are not sufficiently large to forcing pairing.

Select the correct answer from the codes (i)-(iv) as defined above.

18. Assertion (A): Albumin is a globular protein.

Reason (R): Polypeptide chain coils around to give a straight chain.

Select the correct answer from the codes (i)-(iv) as defined above.

19. Assertion (A): Bakelite is a thermosetting polymer.

Reason (R): On heating, polymeric chain becomes a long and straight chain.

Select the correct answer from the codes (i)-(iv) as defined above.

20. Assertion (A): o-nitrophenol is a weaker acid than p-nitrophenol.

Reason (R): Intramolecular hydrogen bonding makes ortho isomer weaker than para isomer.

Select the correct answer from the codes (i)-(iv) as defined above.

Section B

21. Give one point of difference between the following:

- (a) Tranquilizers and Analgesics
- (b) Antiseptics and Disinfectants

OR

Differentiate on the basis of chemical composition between cationic and anionic detergents. Also give one example of each category.

22. Give reasons for the following:

- (a) Bond angle C-O-H in alcohol is slightly less than the tetrahedral angle.
- (b) C-OH bond length in CH_3OH is slightly more than the C-OH bond length in phenol.

23. Complete and balance the following chemical equations:

- (a) $\text{MnO}_4^- + \text{H}_2\text{O} + \text{I}^- \rightarrow$
- (b) $\text{MnO}_4^- + \text{H}^+ + \text{I}^- \rightarrow$

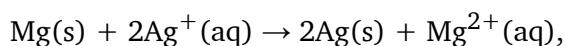
24. Define adsorption isotherm. Give the empirical relationship between the quantity of gas adsorbed by unit mass of solid absorbent and pressure at a particular temperature.

OR

Define shape-selective catalysis. Name the process by which alcohols convert directly into gasoline and give a variety of hydrocarbons.

25. A reaction is first order w.r.t. reactant A as well as w.r.t. reactant B. Give the rate law. Also give one point of difference between average rate and instantaneous rate.

26. For an electrochemical cell



give the cell representation. Also write the Nernst equation for the above cell at 25°C .

27. Predict the state of the solute in the solution in the following situations:

- (a) When 'i' is found to be more than one.
- (b) When 'i' is found to be less than one.

Section C

28. Give the structures of the monomers of the following polymers:

- (a) Teflon
- (b) Glyptal
- (c) Nylon-6

OR

Write the names of monomers of the following polymers:

- (i) $-\text{[NH}-(\text{CH}_2)_6-\text{NH-CO}-(\text{CH}_2)_4-\text{CO}]_n-$
- (ii) $-\text{[CH}_2-\text{CH}=\text{CH}-\text{CH}_2-\text{CH}(\text{C}_6\text{H}_5)-\text{CH}_2]_n-$
- (iii) $-\text{[CH}_2-\text{C}(\text{Cl})=\text{CH}-\text{CH}_2]_n-$

29. Account for the following:

- (a) Aniline is a weaker base compared to ethanamine.
- (b) Aniline does not undergo Friedel-Crafts reaction.
- (c) Only aliphatic primary amines can be prepared by Gabriel Phthalimide synthesis.

30. Justify and arrange the following compounds of each set in increasing order of reactivity towards the asked displacement:

- (a) 1-Bromobutane, 2-Bromobutane, 2-Bromo-2-Methylpropane ($\text{S}_{\text{N}}1$ reaction)
- (b) 1-Bromobutane, 2-Bromobutane, 2-Bromo-2-Methylpropane ($\text{S}_{\text{N}}2$ reaction)

31. (a) Give the IUPAC name and electronic configuration of central metal atom in terms of t_{2g} and e_g of $\text{K}_4[\text{Mn}(\text{CN})_6]$.

(b) What is meant by 'Chelate effect'? Give an example.

OR

Write the hybridisation and magnetic characters of the following complexes:

- (i) $[\text{Fe}(\text{CN})_6]^{4-}$
- (ii) $[\text{CoF}_6]^{3-}$
- (iii) $[\text{Ni}(\text{CO})_4]$

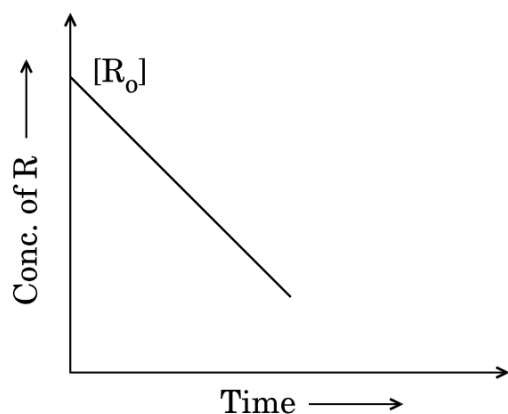
[Atomic number: Fe = 26, Co = 27, Ni = 28]

32. Give the chemical reactions involved in the leaching of alumina from bauxite.

33. Conductivity of $2 \times 10^{-3} \text{ M}$ methanoic acid is $8 \times 10^{-5} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation if Λ_{m}^0 for methanoic acid is $404 \text{ S cm}^2 \text{ mol}^{-1}$.

34. An antifreeze solution is prepared by dissolving 31 g of ethylene glycol (Molar mass = 62 g mol^{-1}) in 600 g of water. Calculate the freezing point of the solution. (K_{f} for water = $1.86 \text{ K kg mol}^{-1}$)

35. (a) Visha plotted a graph between concentration of R and time for a reaction $R \rightarrow P$. On the basis of this graph, answer the following questions:



- Predict the order of reaction.
- What does the slope of the line indicate?
- What are the units of rate constant?

(b) A first order reaction takes 25 minutes for 25% decomposition. Calculate $t_{1/2}$.

[Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$]

OR

- The rate constant for a first order reaction is 60 s^{-1} . How much time will it take to reduce the initial concentration of the reactant to its $1/16^{\text{th}}$ value?
- Write two factors that affect the rate of a chemical reaction.
- Write two conditions for the collisions to be effective collisions.

36. An amorphous solid 'A' which has a crown shaped structure, burns in air to form a gas 'B' which turns lime water milky. 'B' is also produced by roasting of sulphide ores. 'B' undergoes oxidation in the presence of V_2O_5 to give 'C' and to carry out this oxidation low temperature and high pressure is mandatory to get a good yield of 'C'. 'C' is then absorbed in H_2SO_4 to give 'D'. 'D' is then diluted to give a very important compound 'E'. 'E' is largely responsible for the manufacture of variety of compounds in industry. 'E' in concentrated form, when combined with Cu metal, gives compound 'F'.

From this description

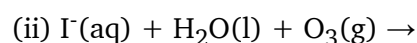
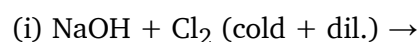
- Elucidate the structure of 'A' to 'F'.
- Give a balanced chemical equation for the conversion of 'E' to 'F'.
- Give two important functions of 'E' in the chemical industry.

OR

(a) Give reasons for the following observations:

- Halogens are strong oxidising agents.
- Noble gases have very low boiling points.
- O and Cl have nearly same electronegativity, yet oxygen forms H bond while Cl doesn't.

(b) Complete and balance the following chemical equations:



37. (a) An organic compound 'A' having molecular formula $C_5H_{10}O$ gives negative Tollens' test, forms n-pentane on Clemmensen reduction but doesn't give iodoform test. Identify 'A' and give all the reactions involved.

(b) Carry out the following conversions:

(i) Propanoic acid to 2-Bromopropanoic acid

(ii) Benzoyl chloride to benzaldehyde

(c) How will you distinguish between benzaldehyde and acetaldehyde?

OR

(a) Complete the following sequence of reactions:

$CH_3COCH_3 \xrightarrow{[Ba(OH)_2]} (A) \xrightarrow{[\Delta, -H_2O]} (B) \xrightarrow{[NaOH, I_2]} (C) + (D)$

(i) Identify (A) to (D).

(ii) Give the IUPAC name of (A).

(b) How can you distinguish between:

(i) Ethanol and Propanone, and

(ii) Benzoic acid and Phenol?