

Total number of printed pages – 8

32Chm(T)17/25

2025

CHEMISTRY

(Theory)

Full Marks: 70

Pass Marks: 21

Time: Three hours

All the questions are compulsory.

The figures in the right margin indicate full marks for the questions.

Question Nos. 1-10 are Very Short Answer (VSA) types carrying of 1 mark each.

1. What are enantiomers? 1
2. Suggest one material other than hydrogen that can be used as fuel in fuel cell. 1
3. What is the common oxidation state of Lanthanoids? 1
4. Acetic acid reacts with chlorine in presence of red phosphorus to give chloroacetic acid. Name the reaction. 1
5. Chlorobenzene can not be prepared by reaction of phenol with HCl in presence of ZnCl_2 . Why? 1
6. Why are amines less acidic than alcohols of comparable molecular masses? 1
7. In the reaction $\text{BrO}_3^-(\text{aq}) + 5\text{Br}^-(\text{aq}) + 6\text{H}^+ \rightarrow 3\text{Br}_2(\text{l}) + 3\text{H}_2\text{O}(\text{l})$ how is rate of appearance of bromine related to the rate of disappearance of bromide ion? 1
8. Out of two 0.1 molal solution of glucose and of potassium chloride, why do 0.1 molal solution of potassium chloride have a higher boiling point? 1

P.T.O.

9. For the electrochemical cell $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ the cell produces an electrical potential of 1.1 volt, when $[Zn^{2+}]$ and $[Cu^{2+}]$ are unity. State the direction of flow of current on applying external potential of 1.1 volt. 1

10. In making candy, sucrose is boiled in water with a little lemon juice. Why does the product sweeter than the product obtained from sucrose solution? 1

Question Nos. 11-17 are Objective types carrying of 1 mark each. Choose and rewrite the best answer out of the given alternatives.

11. The optically inactive amino acid is – 1

(A) Alanine (B) Glycine
(C) Valine (D) Aspartic acid

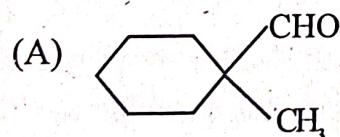
12. Which of the following transition metals of 3d series has lowest melting point? 1

(A) Ti (B) Cr
(C) Fe (D) Mn

13. Maximum amount of solid that can be dissolved in a specified amount of given liquid solvent does not depend upon – 1

(A) Temperature (B) Pressure
(C) Nature of Solute (D) Nature of Solvent

14. Cannizzaro's reaction is not given by – 1



(C) HCHO

(D) CH_3CHO

15. The molar conductivity of a 0.1 mol L^{-1} solution of KCl with electrolytic conductivity 0.0129 S cm^{-1} at 298 K is –

1

- (A) $12.9 \text{ S cm}^2 \text{ mol}^{-1}$ (B) $1.29 \text{ S cm}^2 \text{ mol}^{-1}$
(C) $0.0129 \text{ S cm}^2 \text{ mol}^{-1}$ (D) $129 \text{ S cm}^2 \text{ mol}^{-1}$

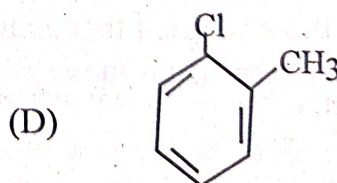
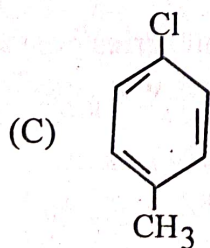
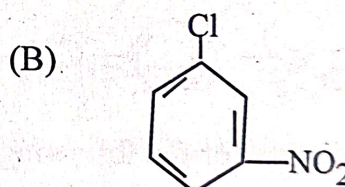
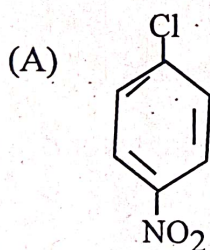
16. The amount of oxalic acid present in a solution can be determined by titrating with KMnO_4 solution in the presence of $\text{dil H}_2\text{SO}_4$. However dil HCl cannot be used in this because HCl .

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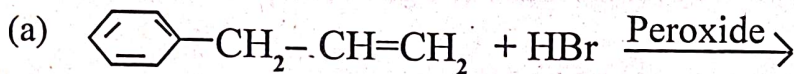
- (A) reduces permanganate to Mn^{2+}
(B) oxidises oxalic acid to CO_2 and H_2O
(C) gets oxidised by oxalic acid to chlorine
(D) furnishes H^+ ions in addition to those from oxalic acid.

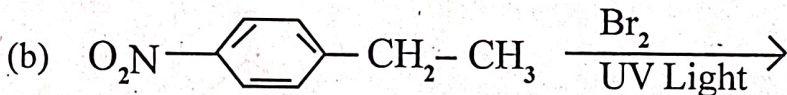
17. Which of the following compounds undergo nucleophilic substitution reaction most easily?

1



Question Nos. 18-27 are short answer (SA-II) types and each carries 2 marks .

18. What is williamson synthesis? Write its one limitation. 2
19. Explain the following :
 - (a) Kohlrausch's law
 - (b) Superconductors 2
20. Arrange the following complexes in correct order for the wavelength of absorption in the visible region giving suitable reason.
 $[\text{Ni}(\text{NO}_2)_6]^{4+}$, $[\text{Ni}(\text{NH}_3)_6]^{2+}$, $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ 2
21. Write differences between order of reaction and its molecularity. 2
22. Determine the moles of CaCl_2 ($i=2.47$) dissolved in 2.5 litre of water such that its osmotic pressure is 0.75 atm at 27°C . 2
23. Give the structure of major product 2
 - (a) 

$$\text{C}_6\text{H}_5\text{CH}=\text{CH}_2 + \text{HBr} \xrightarrow{\text{Peroxide}}$$
 - (b) 

$$\text{O}_2\text{N}-\text{C}_6\text{H}_4-\text{CH}_2-\text{CH}_3 \xrightarrow[\text{UV Light}]{\text{Br}_2}$$
24. Give reasons for the following observations :
 - (a) Benzoic acid does not undergo Friedel Craft reaction.
 - (b) Ethanal is more reactive towards nucleophilic addition reaction than propanone. 2
25. Justify the statement that elements of the first transition series posses properties different from those of heavier transition elements with special reference to –
 - (a) complex formation
 - (b) enthalpies of atomisation 2

26. At the same temperature, hydrogen is more soluble in water than helium. Which of them will have a higher value of K_H and why? 2
27. Outline a scheme for the synthesis of propane starting from isopropylbromide. 2

Question No. 28-33 are Short Answer - I (SA-I) types and each carries 3 marks.

28. (a) (i) Name the organic compound formed when temperature of benzenediazonium chloride solution is raised upto 283K.
- (ii) Write the structure of amine the produced by the Hoffmann degradation of benzamide.
- (iii) Give the IUPAC name of p-Toluidine. 3

Or

- (b) (i) Write short note on Sandmeyer reaction.
- (ii) Name a chemical test to distinguish ethylamine and aniline. 3
29. (a) Show that the relative lowering of vapour pressure is equal to mole fraction of the solute. 3

Or

- (b) Under what conditions do liquid-liquid binary solution show the properties of an ideal solution. 3
30. (a) An ore of chromium is used for preparation of sodium dichromate. Identify the ore and write the balanced chemical equation involved in the preparation of sodium dichromate. 3

Or

(b) Assign reasons for each of the following :

(i) Actinoid contraction is greater from element to element than Lanthanoid contraction.

(ii) The transition metals generally form coloured compounds.

(iii) Cu^+ ion is not stable in aqueous solution. 3

31. (a) (i) Give reactions to suggest the fact that D-glucose contains six carbon atoms in a straight chain and an aldehydic functional group.

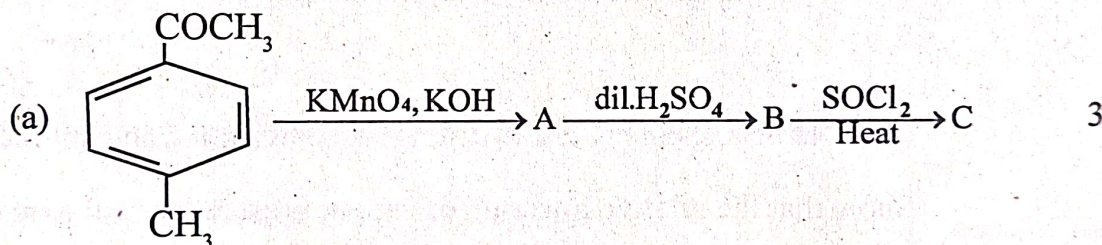
(ii) Which biomolecules act as biocatalyst? 3

Or

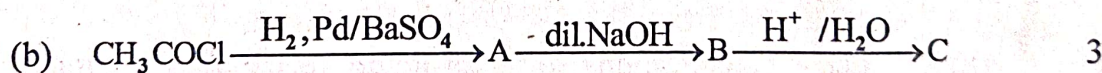
(b) (i) What are the aldopentoses present in nucleic acids?

(ii) Give the function of hormone thyroxine. 3

32. Identify the structures of A, B and C.



Or



33. (a) A lead storage battery has been used for 20 days at the rate of two hours per day by drawing a constant current of 2 amperes. What would be the quantity of H_2SO_4 consumed by the battery ? 3

(Two electrons involved in the reaction)

Or

- (b) By using standard EMF of cell, predict whether the reaction between silver metal and 1 molar sulphuric acid solution is feasible or not. 3
($E^0 \text{Ag}^+/\text{Ag} = +0.80\text{V}$)

Question Nos. 34-36 are Essay (E) types and each carries 5 marks.

34. (a) (i) Explain the bonding in co-ordination compounds in terms of Werner's postulate.
- (ii) $\text{CuSO}_4 \cdot \text{Cl} \cdot 5 \text{NH}_3$ exists in two isomeric forms (A) and (B). Isomer (A) reacts with AgNO_3 to give white precipitate but does not react with BaCl_2 . Isomer (B) gives white precipitate with BaCl_2 but does not react with AgNO_3 .

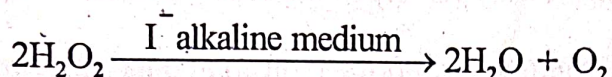
Give the structural formula of isomers (A) and (B). 5

Or

- (b) (i) Discuss briefly the use of co-ordination compounds in metallurgy of gold, estimation of hardness of water and photosynthesis.
- (ii) Name the type of structural isomerism when ambidentate ligands are attached to central metal ion.
- (iii) Why is $[\text{Co}(\text{NH}_3)_6]^{3+}$ called low spin complex? 5
35. (a) (i) Derive the integrated rate equation for a reaction whose rate constant has same unit as the rate of reaction.
- (ii) State a condition under which a bimolecular reaction may be kinetically of first order. 5

Or

- (b) (i) The rate constant of the reaction at temperature 200K is 10 times less than the rate constant at 400K. What is the activation energy of the reaction?
- (ii) The rate expression for the reaction



$$\text{Rate} = k[\text{H}_2\text{O}_2][\text{I}^-]$$

Write the mechanism of the reaction.

5

36. (a) An organic compound (A) $\text{C}_3\text{H}_8\text{O}$ on treatment with Lucas reagent gives compound (B). Oxidation of (A) by CrO_3 gives compound (E) which is resistant to oxidation by mild oxidising agents. When (B) is heated with alcoholic KOH it gives compound (C) which can decolourise bromine water. Compound (C) undergoes hydroboration-oxidation to produce an alcohol (D) $\text{C}_3\text{H}_8\text{O}$. Predict the structure of compounds (A), (B), (C), (D) and (E).

5

Or

- (b) An organic compound (A) $\text{C}_6\text{H}_6\text{O}$ gives orange coloured azo dye with benzenediazonium chloride. When compound (A) reacts with sodium metal gives a salt (B) with liberation of hydrogen gas. Compound (B) on heating with carbon dioxide at 400K under pressure of 4-7 atm gives compound (C). Acidification of (C) gives compound (D). Acetylation of (D) produces compound (E) $\text{C}_9\text{H}_8\text{O}_4$ which is widely used as antipyretic as well as analgesic. Predict the compound (A), (B), (C), (D) and (E).

5