

SAMPLE PAPER (2022-23)
CHEMISTRY THEORY
(043)

MM: 70

Time: 3 hours

General Instructions:

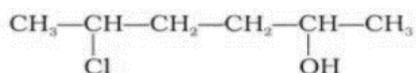
Read the following instructions carefully.

- a) There are **35** questions in this question paper with internal choice.
- b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
- d) SECTION C consists of 5 short answer questions carrying 3 marks each.
- e) SECTION D consists of 2 case- based questions carrying 4 marks each.
- f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- g) All questions are compulsory.
- h) Use of log tables and calculators is not allowed

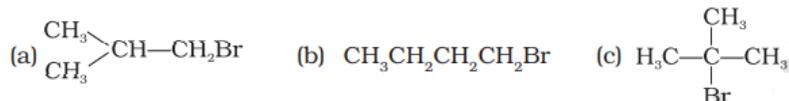
SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Give IUPAC name of the compound given below.



- (i) 2-Chloro-5-hydroxyhexane
 - (ii) 2-Hydroxy-5-chlorohexane
 - (iii) 5-Chlorohexan-2-ol
 - (iv) 2-Chlorohexan-5-ol
2. Arrange the following compounds in increasing order of their boiling points.



- (i) (b) < (a) < (c)
 - (ii) (a) < (b) < (c)
 - (iii) (c) < (a) < (b)
 - (iv) (c) < (b) < (a)
3. When KMnO_4 solution is added to oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after some time because
- (i) CO_2 is formed as the product.
 - (ii) Reaction is exothermic.

- (iii) MnO_4^- catalyses the reaction.
 - (iv) Mn^{2+} acts as auto catalyst.
4. In a reaction, $2X \rightarrow Y$, the concentration of X decreases from 0.50 M to 0.38 M in 10 min. What is the rate of reaction in Ms^{-1} during this interval?
- (i) 2×10^{-4}
 - (ii) 4×10^{-2}
 - (iii) 2×10^{-2}
 - (iv) 1×10^{-2}
5. Which of the statements about solutions of electrolytes is not correct?
- (i) Conductivity of solution depends upon size of ions.
 - (ii) Conductivity depends upon viscosity of solution.
 - (iii) Conductivity does not depend upon solvation of ions present in solution.
 - (iv) Conductivity of solution increases with temperature.

***FOR VISUALLY CHALLENGED LEARNERS**

- *5. While charging the lead storage battery _____.
- (i) PbSO_4 anode is reduced to Pb.
 - (ii) PbSO_4 cathode is reduced to Pb.
 - (iii) PbSO_4 cathode is oxidised to Pb.
 - (iv) PbSO_4 anode is oxidised to PbO_2 .
6. The activation energy in a chemical reaction is defined as
- (i) the difference in energies of reactants and products
 - (ii) the sum of energies of reactants and products
 - (iii) the difference in energy of intermediate complex with the average energy of reactants and products
 - (iv) the difference in energy of intermediate complex and the average energy of reactants.
7. Which of the following compound will not undergo azo coupling reaction with benzene diazonium chloride.
- (i) Aniline
 - (ii) Phenol
 - (iii) Anisole
 - (iv) Nitrobenzene
8. The compounds $[\text{Co}(\text{SO}_4)(\text{NH}_3)_5]\text{Br}$ and $[\text{Co}(\text{SO}_4)(\text{NH}_3)_5]\text{Cl}$ represent
- (i) linkage isomerism
 - (ii) ionisation isomerism
 - (iii) coordination isomerism

(iv) no isomerism

9. Arrange the following compounds in increasing order of boiling point.

Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol

- (i) Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol
- (ii) Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol
- (iii) Pentan-1-ol, butan-2-ol, butan-1-ol, propan-1-ol
- (iv) Pentan-1-ol, butan-1-ol, butan-2-ol, propan-1-ol

10. Which of the following methods of preparation of amines will give same number of carbon atoms in the chain of amines as in the reactant?

- (i) Reaction of nitrite with LiAlH_4 .
- (ii) Reaction of amide with LiAlH_4 followed by treatment with water.
- (iii) Heating alkyl halide with potassium salt of phthalimide followed by hydrolysis.
- (iv) Treatment of amide with bromine in aqueous solution of sodium hydroxide.

11. In Clemmensen Reduction carbonyl compound is treated with _____.

- (i) Zinc amalgam + HCl
- (ii) Sodium amalgam + HCl
- (iii) Zinc amalgam + nitric acid
- (iv) Sodium amalgam + HNO_3

12. Consider a first order gas phase decomposition reaction given below:



The initial pressure of the system before decomposition of A was p_i . After lapse of time 't', total pressure of the system increased by x units and became ' p_t '. The rate constant k for the reaction is given as _____.

- (i) $k = 2.303/t \log p_i/p_i - x$
- (ii) $k = 2.303/t \log p_i/2p_i - p_t$
- (iii) $k = 2.303/t \log p_i/2p_i - 2p_t$
- (iv) $k = 2.303/t \log p_i/p_i + x$

***FOR VISUALLY CHALLENGED LEARNERS**

*12. Rate law can be determined from the balanced chemical equation if _____.

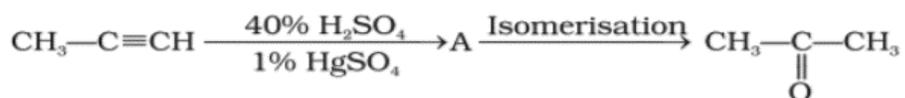
- (i) the reverse reaction is involved.

- (ii) it is an elementary reaction.
- (iii) it is a sequence of elementary reactions.
- (iv) any of the reactants is in excess

13. Indicate the complex ion which shows geometrical isomerism.

- (i) $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]^+$
- (ii) $[\text{Pt}(\text{NH}_3)_3\text{Cl}]$
- (iii) $[\text{Co}(\text{NH}_3)_6]^{3+}$
- (iv) $[\text{Co}(\text{CN})_5(\text{NC})]^{3-}$

14.



Structure of 'A' and type of isomerism in the above reaction are respectively.

- (i) Prop-1-en-2-ol, metamerism
- (ii) Prop-1-en-1-ol, tautomerism
- (iii) Prop-2-en-2-ol, geometrical isomerism
- (iv) Prop-1-en-2-ol, tautomerism

15. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): p-nitrophenol is more acidic than phenol.

Reason (R): Nitro group helps in the stabilisation of the phenoxide ion by dispersal of negative charge due to resonance.

Select the most appropriate answer from the options given below:

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

16. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): D (+) – Glucose is dextrorotatory in nature.

Reason (R): 'D' represents its dextrorotatory nature.

Select the most appropriate answer from the options given below:

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

17. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion: Cu^{2+} iodide is not known.

Reason: Cu^{2+} oxidises I^- to iodine.

Select the most appropriate answer from the options given below:

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

18. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Hoffmann's bromamide reaction is given by primary amines.

Reason (R): Primary amines are more basic than secondary amines.

Select the most appropriate answer from the options given below:

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

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. (i) For a reaction $\text{A} + \text{B} \rightarrow \text{P}$, the rate law is given as follows: $r = k[\text{A}]^{1/2} [\text{B}]^2$. Find the order of this given reaction?

(ii) Find the half-life of the first-order reaction which has a rate constant $k = 5.5 \times 10^{-14} \text{ s}^{-1}$.

20. Give the plausible explanation for the following:

- (a) The two strands in DNA are not identical but are complementary.
- (b) Starch and cellulose both contain glucose unit as monomer, yet they are structurally different.

OR

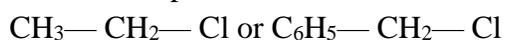
- (a) Glucose doesn't give 2,4-DNP test. Explain.
- (b) Under what conditions glucose is converted to gluconic and saccharic acid?

21. (a) Predict the stereochemistry of the product formed if an optically active alkyl halide undergoes substitution reaction by $\text{S}_{\text{N}}1$ mechanism.

- (b) Write the structures of the products formed when anisole is treated with HI.

OR

- (a) Which of the compounds will react faster in $\text{S}_{\text{N}}1$ reaction with the $-\text{OH}^-$ ion?

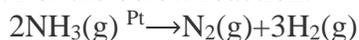


- (b) Why iodoform has appreciable antiseptic property?

22. Explain why $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ has magnetic moment value of 5.92 BM whereas $[\text{Fe}(\text{CN})_6]^{3-}$ has a value of only 1.74 BM.

23. Solutions of two electrolytes 'A' and 'B' are diluted. The Δm of 'B' increases 1.5 times while that of A increases 25 times. Which of the two is a strong electrolyte? Justify your answer.

24. For the below reaction:



Rate = k

- Write the order and molecularity of the above reaction.
- Also write the unit of k.

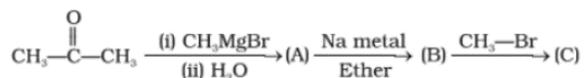
25. What products will be formed on reaction of propanal with 2-methyl propanal in the presence of NaOH. Write the name of the reaction also.

SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

26. (a) Compound 'A' was prepared by oxidation of compound 'B' with alkaline KMnO_4 . Compound 'A' on reduction with lithium aluminium hydride gets converted back to compound 'B'. When compound 'A' is heated with compound B in the presence of H_2SO_4 it produces the fruity smell of compound C to which family the compounds 'A', 'B' and 'C' belong to?

(b) Complete the following reaction sequence.



27. (a) Name the type of isomerism when ambidentate ligands are attached to central metal ion. Give one example of ambidentate ligand.

(b) Why are low spin tetrahedral complexes not formed?

(c) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is blue in colour while CuSO_4 is colourless. Why?

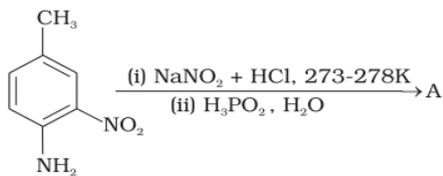
28. (a) Explain the following phenomena with the help of Henry's law.

(i) Painful condition known as bends.

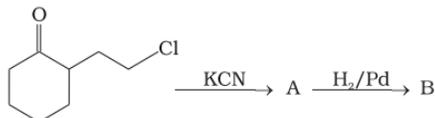
(ii) Feeling of weakness and discomfort in breathing at high altitude.

(b) Why soda water bottle kept at room temperature fizzes on opening?

29. (a) Give the structure of 'A' in the following reaction.



(b) Identify A and B in the following reaction.



30. Compound 'A' with molecular formula $\text{C}_4\text{H}_9\text{Br}$ is treated with aq. KOH solution. The rate of this reaction depends upon the concentration of the compound 'A' only. When another optically active isomer 'B' of this compound was treated with aq. KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both.

(i) Write down the structural formula of both compounds 'A' and 'B'.

(ii) Out of these two compounds, which one will be converted to the product with inverted configuration.

OR

(i) Why can aryl halides not be prepared by reaction of phenol with HCl in the presence of ZnCl_2 ?

(ii) Which of the following compounds would undergo $\text{S}_\text{N}1$ reaction faster and why?



(iii) Allyl chloride is hydrolysed more readily than n-propyl chloride. Why?

SECTION D

Question No. 31 -32 are case-based questions. Each question has multiple choice questions and carries 4 (1+1+1+1) mark each. Read the passage carefully and answer the following questions that follow.

31. Read the passage given below and answer the following questions:

When a protein in its native form, is subjected to physical changes like change in temperature or chemical changes like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity. This is called denaturation of protein.

The denaturation causes change in secondary and tertiary structures but primary structures remain intact. Examples of denaturation of protein are coagulation of egg white on boiling, curdling of milk, formation of cheese when an acid is added to milk.

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) Mark the wrong statement about denaturation of proteins

- (a) The primary structure of the protein does not change
- (b) Globular proteins are converted into fibrous proteins.
- (c) Fibrous proteins are converted into globular proteins.

- (d) The biological activity of the protein is destroyed.
 (ii) Which structure(s) of proteins remains(s) intact during denaturation process?

- (a) Both secondary and tertiary structures (b) Primary structure only
 (c) Secondary structure only (d) Tertiary structure only
 (iii) Cheese is a

- (a) globular protein (b) conjugated protein
 (c) denatured protein (d) derived protein
 (iv) Secondary structure of protein refers to

- (a) mainly denatured proteins and structure of prosthetic groups
 (b) three-dimensional structure, especially the bond between amino acid residues that are distant from each other
 (c) linear sequence of amino acid residues in the polypeptide chain
 (d) regular folding patterns of continuous portions of the polypeptide chain

32. Read the passage given below and answer the following questions:

An ideal solution may be defined as the solution which obeys Raoult's law exactly over the entire range of concentration. The solutions for which vapour pressure is either higher or lower than that predicted by Raoult's law are called non-ideal solutions. Non-ideal solutions can show either positive or negative deviations from Raoult's law depending on whether the A-B interactions in solution are stronger or weaker than A - A and B - B interactions.

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) Which of the following solutions is/are ideal solution(s)?

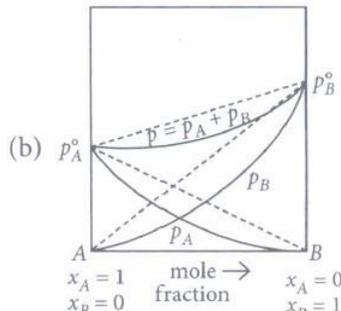
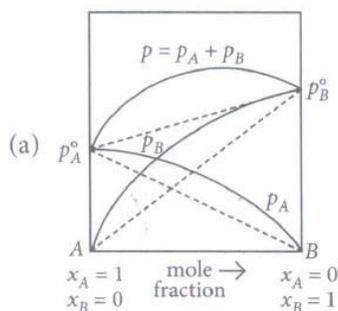
- (I) Bromoethane and iodoethane (II) Acetone and chloroform
 (III) Benzene and acetone (IV) n-heptane and n-hexane

- (a) only 1 (b) I and II (c) II and III (d) I and IV

(ii) Which of the following is not true for positive deviations?

- (a) The A-B interactions in solution are weaker than the A - A and B - B interactions.
 (b) $P_A < P_A^0 X_A$ and $P_B < P_B^0 X_B$
 (c) Carbon tetrachloride and chloroform mixture is an example of positive deviations.
 (d) All of these

(iii) For water and nitric acid mixture which of the given graph is correct?



- (c) Both of these

- (d) None of these

(iv) Water- HCl mixture

I. shows positive deviations II. forms minimum boiling azeotrope

III. shows negative deviations IV. forms maximum boiling azeotrope

(a) I and II

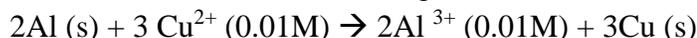
(b) II and III

(c) I and IV

(d) III and IV

SECTION E

33. (a) Calculate E° cell for the following reaction at 298 K:



Given: $E_{\text{cell}} = 1.98\text{ V}$

(b) Using the E° values of A and B, predict which is better for coating the surface of iron [$E^{\circ}(\text{Fe}^{2+}/\text{Fe}) = -0.44\text{V}$] to prevent corrosion and why?

Given: $E^{\circ}(\text{A}^{2+}/\text{A}) = -2.73\text{ V}$; $E^{\circ}(\text{B}^{2+}/\text{B}) = -0.14\text{ V}$

OR

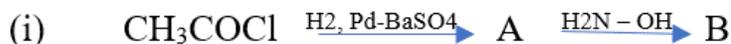
(a) The conductivity of 0.001 mol L^{-1} solution of CH_3COOH is $3.905 \times 10^{-5}\text{ Scm}^{-1}$.

Calculate its molar conductivity and degree of dissociation (α).

Given: $\lambda^{\circ}(\text{H}^+) = 349.6\text{ Scm}^2\text{ mol}^{-1}$ and $\lambda^{\circ}(\text{CH}_3\text{COO}^-) = 40.9\text{ Scm}^2\text{ mol}^{-1}$

(b) Define electrochemical cell. What happens if external potential applied becomes greater than E° cell of electrochemical cell?

34. (a) Write the structures of A and B in the following reactions:



(b) Distinguish between:

(i) $\text{C}_6\text{H}_5 - \text{COCH}_3$ and $\text{C}_6\text{H}_5 - \text{CHO}$

(ii) CH_3COOH and HCOOH

(c) Arrange the following in the increasing order of their boiling points:

CH_3CHO , CH_3COOH , $\text{CH}_3\text{CH}_2\text{OH}$

OR

(a) Write the chemical reaction involved in Wolf-Kishner reduction.

(b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction:

$\text{C}_6\text{H}_5\text{COCH}_3$, CH_3CHO , CH_3COCH_3

(c) Why carboxylic acid does not give reactions of carbonyl group?

(d) Write the following reaction:



(e) A and B are two functional isomers of compound $\text{C}_3\text{H}_6\text{O}$. On heating with NaOH and I_2 , isomer B forms yellow precipitate of iodoform whereas isomer A does not form any precipitate. Write the formulae of A and B.

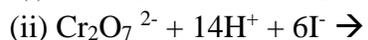
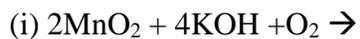
35. (a) Account for the following:

(i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4.

(ii) Cr^{2+} is a strong reducing agent.

(iii) Cu^{2+} salts are coloured while Zn^{2+} salts are white.

(b) Complete the following equations:



OR

The elements of 3d transition series are given as:

Sc Ti V Cr Mn Fe Co Ni Cu Zn

Answer the following:

(i) Write the element which shows maximum number of oxidation states. Give reason.

(ii) Which element has the highest melting point?

(iii) Which element shows only +3 oxidation state?

(iv) Which element is a strong oxidising agent in +3 oxidation state and why?
