

KENDRIYA VIDAYLAYA SANGATHAN, RANCHI REGION

Pre-board I (2024-25)

CHEMISTRY THEORY (043) SET III

Max. Marks: 70

Time: 3 hours

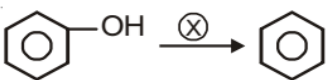
GENERAL INSTRUCTIONS:

Read the following instructions carefully.

- There are 33 questions in this question paper with internal choice.
- SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 5 short answer questions carrying 2 marks each.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case-based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.
- Use of log tables and calculators is not allowed.

SECTION A

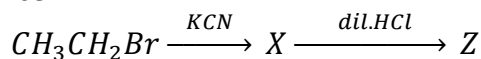
The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section

- Q. 1 Best method for preparing primary amines from alkyl halides without changing the number of carbon atoms in the chain is
- Hoffmann bromamide reaction
 - Gabriel phthalimide synthesis
 - Sandmeyer reaction
 - Reaction with NH_3
- Q. 2 Molar conductance of $NaCl$, HCl and CH_3COONa at infinite dilution are 126.45, 425.16 and $91 \text{ ohm}^{-1} \text{ cm}^2$ respectively. The equivalent conductance of CH_3COOH at infinite dilution would be
- $101.38 \text{ ohm}^{-1} \text{ cm}^2$
 - $253.62 \text{ ohm}^{-1} \text{ cm}^2$
 - $389.71 \text{ ohm}^{-1} \text{ cm}^2$
 - $678.90 \text{ ohm}^{-1} \text{ cm}^2$
- Q. 3 
- The reagent \otimes required for above conversion is
- $LiAlH_4$
 - Zn
 - Phenol
 - $KMnO_4$
- Q. 4 For the Reaction, $A + 2B \longrightarrow AB_2$, the order w.r.t Reactant A is 2 and w.r.t. reactant B is 1. What will be the change in the rate of reaction if concentration of A is doubled and B is halved?
- Increase 4 Times
 - Decrease 4 Times
 - Increases 2 times
 - No Change
- Q. 5 The unit of rate constant and rate of reaction are same for
- First Order
 - Zero Order
 - Second Order
 - Third Order
- Q. 6 The Spin Only magnetic Moment in a strong Ligand field of a d^6 ion of an octahedral Complex is :
- 4.9 BM
 - 0 BM
 - 1.73 BM
 - 2.83 BM
- Q. 7 The hybridization involved in complex $[Ni(CN)_4]^{2-}$
- d^2sp^2
 - d^2sp^3
 - dsp^2
 - sp^3
- Q. 8 From Sc (Z = 21) to Zn (Z = 30) in 3d series, the lowest value of enthalpy of atomisation is for
- Cu
 - V
 - Ni
 - Zn

Q. 9 Which of the following pairs of ions are coloured in aqueous solution?

- a) Ni^{2+} & Ti^{3+} b) Sc^{+3} & Ti^{3+}
c) Ni^{2+} & Sc^{+3} d) Sc^{+3} & Cu^+

Q. 10 Identify Z in the following sequence



- a) CH_3COOH b) CH_3COCl
c) CH_3CONH_2 d) CH_3CH_2COOH

Q. 11 Methanol and ethanol can be distinguished by

- a) Lucas Test b) Iodoform Test
c) Victor Meyer's Test d) All of these

Q. 12 Which of the following bases is not present in DNA?

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

Q. 13 Given below are two statements labelled as Assertion (A) and Reason (R) (R)

Assertion (A) : Aliphatic 1° amines can be prepared by Gabriel phthalimide synthesis.

Reason (R) : Aryl halides undergo nucleophilic substitution with anion formed by phthalimide.

Select the most appropriate answer from the options given below:

- a) Both A and R are true, and R is the correct explanation of A
b) Both A and R are true, but R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true

Q. 14 Given below are two statements labelled as Assertion (A) and Reason (R) (R)

Assertion (A) : Sucrose is called an invert sugar.

Reason (R) : On hydrolysis, sucrose bring the change in the sign of rotation from dextro (+) to laevo(-)

Select the most appropriate answer from the options given below:

- a) Both A and R are true, and R is the correct explanation of A
b) Both A and R are true, but R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true

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

Assertion (A): Phenols give o-nitrophenol and p-nitrophenol on nitration with cone. HNO_3 and H_2SO_4 mixture.

Reason (R): -OH group in phenol is o-,p-directing

Select the most appropriate answer from the options given below:

- a) Both A and R are true, and R is the correct explanation of A
b) Both A and R are true, but R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true

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

Assertion (A): The rate of reaction increases with an increase in temperature.

Reason (R): The number of effective collisions increases with an increase in temperature.

Select the most appropriate answer from the options given below:

- a) Both A and R are true, and R is the correct explanation of A
b) Both A and R are true, but R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true

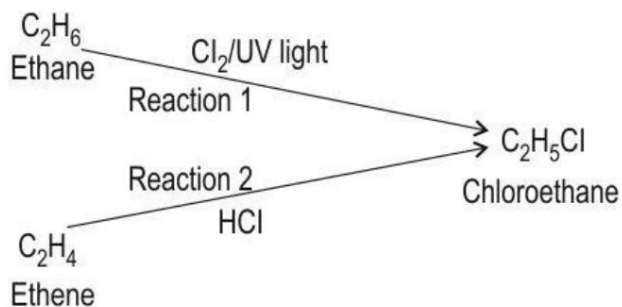
SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

- Q 17. a) What type of deviation is shown by a mixture of chloroform and acetone? Give reason.
 b) Two liquids A and B boil at 145 °C and 190 °C respectively. Which of them has higher vapour pressure at 80 °C?

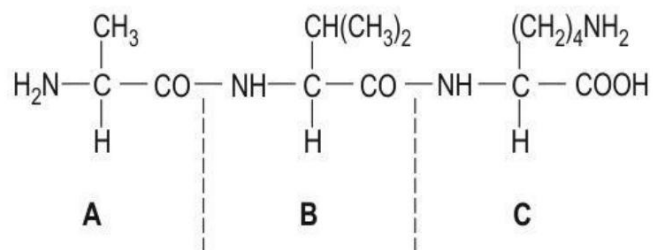
OR

- a) In non-ideal solution, what type of deviation shows the formation of maximum boiling azeotropes?
 b) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers. Give reason.
- Q 18. a) Solutions of two electrolytes 'A' and 'B' are diluted. The limiting molar conductivity of 'B' increases to a smaller extent while that of 'A' increases to a much larger extent comparatively. Which of the two is a strong electrolyte? Justify your answer.
 b) State the relationship amongst cell constant of a cell, resistance of the solution in the cell and conductivity of the solution
- Q 19. Give the reason for the following:
 a) Cu & Ag are transition metals although they have completely filled d-orbitals
 b) Transition metals and their salts are generally colored
- Q 20. Haloalkanes are important compound which are produced at scale for industrial purpose. To increase the efficiency and reduce the cost of production, scientists use different combinations of reactants and reaction conditions.
 You are given two different compounds that can be used to make C_2H_5Cl as shown below.



Which out of two reactants will you choose and why?

- Q 21. Shown below is the tripeptide formed by three amino acids A, B, C.

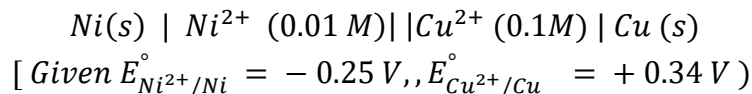


- (i) Is it possible to get the original amino acids from this structure? If yes, how?
 (ii) What will be the structure of the amino acid B in the aqueous solution?

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

Q 22. Calculate E.M.F. of the following cell at 298 K:



Write the overall cell reaction

Q 23. The resistance of a conductivity cell when filled with 0.05 M solution of an electrolyte X is 100 ohms at 40°C. e same conductivity cell filled with 0.01 M solution of electrolyte Y has a resistance of 50 ohms. e conductivity of 0.05 M solution of electrolyte X is $1.0 \times 10^{-4} S cm^{-1}$.

Calculate

(i) Cell constant

(ii) Conductivity of 0.01 M Y solution

(iii) Molar conductivity of 0.01 M Y solution

Q 24. Account for the following:

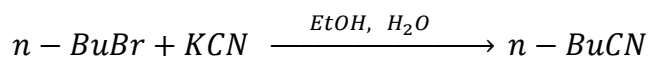
- Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.
- Manganese exhibits the highest oxidation state of +7 among the 3rd series of transition elements.
- Although 'F' is more electronegative than 'O', the highest Mn fluoride is MnF_4 , whereas the highest oxide is Mn_2O_7 .

Q 25. How do you **convert**?

- 2-bromobutane to but-2-ene
- Benzyl chloride to 2-phenylethanoic acid
- Methyl magnesium bromide to 2-methylpropan-2-ol

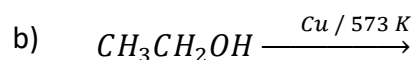
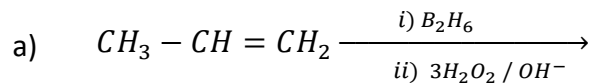
OR

a) Write the **mechanism** of the following reaction:



b) Write the Chemical Equation when: Chlorobenzene is treated with CH_3COCl in presence of anhydrous $AlCl_3$.

Q 26. Compute the following reaction equations:



- Q 27. Write a chemical test to distinguish between:
- Acetophenone and Benzophenone
 - Ethanal and Propanal
 - Propanone and propanal.
- Q 28. a) What happens when D-glucose is treated with bromine water?
 b) Give one Example of each globular and fibrous Protein.
 c) Define denaturation of protein.

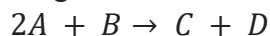
SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow

- Q 29. Most of the chemical reactions are accelerated by increase in temperature. For example, in decomposition of N_2O_5 , the time taken for half of the original amount of material to decompose is 12 min at $50^\circ C$, 5 h at $25^\circ C$ and 10 days at $0^\circ C$. You also know that in a mixture of potassium permanganate ($KMnO_4$) and oxalic acid ($H_2C_2O_4$), potassium permanganate gets decolourised faster at a higher temperature than that at a lower temperature. All the molecules in the reacting species do not have the same kinetic energy. Since it is difficult to predict the behaviour of any one molecule with precision, Ludwig Boltzmann and James Clark Maxwell used statistics to predict the behaviour of large number of molecules.
- The rate of a first order reaction increases from 2×10^{-2} to 4×10^{-2} when the temperature changes from 300 K to 310 K. Calculate the activation energy (E_a).
 ($\log 2 = 0.301$, $\log 3 = 0.4771$, $\log 4 = 0.6021$)
 - Draw the plot of $\ln k$ vs $1/T$ for a chemical reaction.
 - What is the relation between slope and E_a ?

OR

In a chemical reaction, the rate law expresses how the rate of the reaction depends on the concentration of the reactants. For the reaction $2A + B \rightarrow C + D$, the rate of formation of product D can be determined through experimental data by observing how the initial rates change with varying concentrations of reactants A and B. By comparing multiple experimental trials and analyzing the relationship between the concentrations of A and B and the rate of formation of D, we can deduce the reaction order with respect to each reactant. Understanding these dynamics is key to determining how changes in reactant concentrations influence the reaction speed and help in predicting reaction behavior in various scenarios. The following results have been obtained during the kinetic studies of the reaction :



Exp. No.	[A]	[B]	Initial rate of formation of D
1.	0.1 M	0.1 M	$6 \times 10^{-3} M \text{ min}^{-1}$
2.	0.3 M	0.2 M	$7.2 \times 10^{-2} M \text{ min}^{-1}$
3.	0.3 M	0.4 M	$2.88 \times 10^{-1} M \text{ min}^{-1}$
4.	0.4 M	0.1 M	$2.40 \times 10^{-2} M \text{ min}^{-1}$

- Write the rate law expression. Also find the order of reaction
- What is the unit of rate constant for the above reaction
- Calculate the rate of formation of D when $[A] = 0.5 \text{ mol L}^{-1}$ and $[B] = 0.2 \text{ mol L}^{-1}$

Q 30. Aromatic amines are an important class of organic compounds that contain an amine group attached to an aromatic ring. Aniline, the simplest aromatic amine, is often used in the synthesis of dyes, drugs, and other organic compounds. One of the key reactions of aniline is its reaction with nitrous acid under cold conditions (273 K) to form a diazonium salt. This diazonium salt can undergo various substitution reactions, including Sandmeyer reactions, to introduce different functional groups onto the aromatic ring.

Consider aniline $C_6H_5NH_2$ undergoing the following reaction:

1. Aniline is treated with sodium nitrite and hydrochloric acid at 273 K to form compound 'X'.
2. Compound 'X' is then reacted with copper(I) chloride in presence of HCl to form compound 'Y'.
3. Additionally, compound 'X' can also react with phenol in alkaline medium to form a brightly colored azo dye, compound 'Z'
 - a) Identify compounds 'X' and 'Y', and describe the reaction involved in the formation of 'Y'.
 - b) Why Y do not undergo Gabriel phthalimide reaction
 - c) Why Aniline do not undergo Friedel Craft Reaction.

SECTION E

The following questions are long answer types and carry 5 marks each. All questions have an internal choice

Q 31.

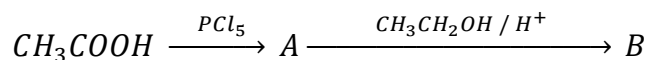
- a) Calculate the mass of NaCl (molar = 58.5 g mol^{-1}) to be dissolved in 37.2 g of water to lower the freezing point by 2°C , assuming that NaCl undergoes complete dissociation.
($K_f \text{ for water} = 1.86 \text{ K kg mol}^{-1}$) 3
- b) Calculate the molarity of 9.8 % (w/w) solution of H_2SO_4 if the density of the solution is 1.02 g/ml. (Molar mass of $H_2SO_4 = 98 \text{ g/mol}$). 2

Q 32. Compare the following complexes with respect to **IUPAC names, shapes, magnetic moment, magnetic behaviour** and **hybridization** involved :

- a. $[Ni(CN)_4]^{2-}$
- b. $[Co(NH_3)_6]^{3+}$

Q 33. Answer the following the Questions

- a) Write a Short note on : **Clemmensen Reaction or Wolf-Kishner Reaction**
- b) Write a Short note on : **Rosenmund reduction.**
- c) Write a Short note on : **Aldol Condensation**
- d) Giving a chemical equation for the following process: **Decarboxylation Reaction**
- e) Predict the products of the following reaction:



OR

How would you obtain

- a. Propanone to Propene
- b. Bromobenzene to 1-phenylethanol
- c. Butan-1-ol to butanoic acid
- d. Bromobenzene to benzoic acid
- e. Ethylchloride to ethanoic acid