

- Define free energy. Derive an expression to relate Gibbs free energy change with work. [Q.N. 25, 2060]
- State second law of thermodynamics. How would you explain the law in the light of entropy change? [Q.N. 24, 2059]
- Discuss the criteria of spontaneity, non spontaneity and equilibrium of exothermic and endothermic reactions on the basis of free energy and entropy change. [Q.N. 25, 2058]
- State and explain second law of thermodynamics. [Q.N. 24, 2057]

Long Questions

(All questions are of equal value, 10 marks each.)

- How is the free energy change of a reaction related with the enthalpy change and entropy change? Discuss the criteria of spontaneity and non-spontaneity of a reaction on the basis of its free energy change? 2+3 [Q.N. 32 (a), 2070 'D']
- Write short notes on : $2 \times 5 = 10$
 - Prediction for the feasibility of reaction in terms of ΔG and ΔS . [Q.N.33(iv), 2072'E']
 - Second Law of thermodynamics [Q.N. 33 (a), Set 'C' 2071]
 - Second Law of thermodynamics [Q.N. 33 (a), Set 'D' 2071]
 - Spontaneity in light of entropy change, enthalpy change and free-energy change [Q.N.33(a), 2070 'Supp']

Numerical Problems

- Calculate ΔS and ΔG for conversion of ice into water when they are equilibrium at 0°C ($\Delta H = 4\text{kJ/mole}$) 1+1 [Q.N.6, 2072'D']
[Ans: $\Delta S = 14.7 \text{ Jmol}^{-1}\text{K}^{-1}$, $\Delta G = 0$]
- State first law of thermodynamics. What are its advantages and limitations? The enthalpies of formation of $\text{CO}_2(\text{g})$, $\text{H}_2\text{O}(\text{l})$ and $\text{CH}_4(\text{g})$ are -393.5 , -286.2 and -74.8 kJmol^{-1} respectively. Calculate the enthalpy of combustion of methane.
[Ans: 891.1 kJ/mol] [1+1+1+2] [Q.N.32 (a), 2072'E']
- Give the physical meaning of entropy. Write its unit. [Q.N. 6, Set 'B' 2069]
[Ans: $\text{JK}^{-1} \text{ mol}^{-1}$]

Unit 7: Chemical Kinetics

Very Short Questions

(All questions are of equal value, 2 marks each.)

- What is meant by instantaneous rate of reaction? Write the expression for the rate of the following reaction: 1+1 [Q.N.7, 2072'C']
 $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$
- Define the terms: (i) activated complex (ii) rate of reaction 1+1 [Q.N.7, 2072'D']
- The following hypothetical reaction is second order, $\text{A} + \text{B} \rightarrow \text{Z}$
Write possible rate law expression. [2] [Q.N.7, 2072'E']
- Define 1st order reaction and write the unit of rate constant in the first order reaction. 1+1 [Q.N.7, Supp. 2071]
- For a hypothetical reaction $\text{A} + \text{B} \rightarrow \text{Z}$, the rate of reaction is doubled when concentration of A is doubled but there is no effect of change in concentration of B.
(i) Write down the rate law. [Q.N.7(i), 2070 'Supp']
[Ans : $\text{rate} = k [\text{A}]^2 [\text{B}]^0$]
(ii) What is the unit of rate constant ? 1+1 [Q.N.7(ii), 2070 'Supp']
[Ans : s^{-1}]

6. Identify reaction orders if the units of rate constant are:
 a) min^{-1}
[Ans: first order]
 b) $\text{mol L}^{-1} \text{min}^{-1}$ [Q.N. 7, Set 'C' 2071]
[Ans: zero order]
7. Rate of reaction is doubled when concentration of A is doubled but there is no effect in rate with change in concentration of B.
 a) Write rate law
[Ans: rate = $k[A]^1 [B]^0$]
 b) Find out unit of rate constant of the reaction 1+1 [Q.N. 7, Set 'D' 2071]
[Ans: S^{-1}]
8. Draw energy profile diagram for catalyzed and uncatalyzed reactions. [Q.N. 7, 2070 'D']
9. What is meant by effective collision of reacting species? Mention any one condition for a collision. [Q.N. 7, Set 'A' 2069]
10. What is the order of reaction whose rate constant has same unit as the rate of reaction? [Q.N. 15, 2067]
11. Write the rate expression for the following reaction:
 $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$ [Q.N. 15, 2066]
12. Write the possible rate Law equations of the following Second order reaction:
 $\text{P} + \text{Q} \rightarrow \text{Product}$ [Q.N.15, 2065]
13. Draw a labelled energy profile diagram to show the influence of catalyst in the rate of chemical reaction. [Q.N. 18, 2064]
14. How does a Catalyst increase rate of reaction? [Q.N. 16, 2061]
15. Give one example of a reaction where order and molecularity are equal. [Q.N. 18, 2059]
16. Identify the order of the reaction if the unit of its rate constant is $\text{lit mol}^{-1} \text{S}^{-1}$. [Q.N. 18, 2058]
17. Give the rate law for a reaction which is second order in A and zero order in B. [Q.N. 18, 2057]
18. Give the factors which influence the rate of a reaction. [Q.N. 3, 2056]
19. The reaction $\text{X} + \text{Y} \rightarrow \text{products}$ is a second order reaction. Write three different rate law expressions which may be true to the above reaction. [Q.N. 5, 2055]
20. What is meant by rate of a chemical reaction? [Q.N. 6, 2054]
21. What is an activation energy? [Q.N. 11, 2053]
22. Define the half life of a reaction. [Q.N. 16, 2053]
23. Give a chemical reaction to show reaction of first order. [Q.N. 5, 2052]

Short Questions

(All questions are of equal value, 5 marks each.)

- Define the rate of chemical reaction. How do concentration, temperature, catalyst and surface area of reactants affect the rate of reaction? [Q.N. 25, 2059]
- Define rate of reaction. Distinguish between order and molecularity of a reaction. [Q.N. 24, 2058]
- What is meant by the term rate of reaction? How is it expressed? 5[Q.N. 25(a), 2053]

Long Questions

(All questions are of equal value, 10 marks each.)

- Distinguish between order and molecularity of reaction. What is meant by second order reaction? Write its unit. [Q.N. 32 (a), 2070 'C']
- Distinguish between order and molecularity of a reaction. Write the units of first and second order reactions. [Q.N. 30 (a), Supp. 2069]
- Define rate law and rate of a reaction. How does temperature, catalyst, concentration of reactant and surface area of reactant affect the rate of reaction. [Q.N. 30(a), Set 'A' 2069]
- Define the terms:

| | |
|------------------------------------|--|
| (i) First order reaction | (ii) rate law |
| (iii) Effective collision | (iv) Activation energy |
| (v) Half-life period of a reaction | (vi) Instantaneous rate. [Q.N. 32(a), Set 'B' 2069] |

5. Write short notes on :
- Order and Molecularity of reaction [Q.N.33(a), 2072'D']
 - Rate of chemical reaction and Rate Law. [Q.N.31(iv), 2068]
 - Collision theory of reaction rate. [Q.N. 31(ii), 2067]
 - Factors affecting on reaction rate. [Q.N.31(iv), 2065]
 - Effect of temperature and catalyst on the rate of reaction [Q.N.31(i), 2063]
 - Collision theory of reaction rate [Q.N. 30(b), 2054]
6. In a reaction $H_2 + I_2 \rightleftharpoons 2HI$ the rate of disappearance of I_2 is found to be 10^{-6} mole per litre per second. What would be corresponding rate of appearance. HI . [Q.N. 27(a), 2054]

Numerical Problems

1. Give any four points of difference between molecularity and order of a chemical reaction. What is meant by pseudo first order reaction? Write an example of it.
 $4+2+1.5+1+1.5$ [Q.N.30, 2072'C']

The experimental data for the reaction



| Expt no. | Initial concentration of | | Rate of reaction mol L ⁻¹ sec ⁻¹ |
|----------|--------------------------|-------------------------|--|
| | [A] mol L ⁻¹ | [B] mol L ⁻¹ | |
| 1 | 0.1 | 0.1 | 7×10^{-3} |
| 2 | 0.3 | 0.2 | 8.4×10^{-2} |
| 3 | 0.3 | 0.4 | 3.36×10^{-1} |
| 4 | 0.4 | 0.1 | 2.8×10^{-2} |

Determine:

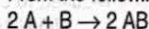
- Over all order of reaction
 - Rate law equation
 - Calculate the rate of formation of C when concentration of [A] and [B] are 0.6 mol L^{-1} and 0.3 mol L^{-1} respectively.
- [Ans : (i) $1 + 2 = 3$, (ii) Rate = $k[A]^1 [B]^2$ (iii) Rate = $0.378 \text{ mol L}^{-1} \text{ s}^{-1}$]
2. For the reaction $Cl_2 + 2NO \rightarrow 2NOCl$, the data obtained are:

| Exp. no. | Initial Concentration of | | Initial rate of r x n mol L ⁻¹ s ⁻¹ |
|----------|--|--------------------------|---|
| | [Cl ₂] mol L ⁻¹ | [NO] mol L ⁻¹ | |
| 1 | 0.020 | 0.010 | 2.40×10^{-4} |
| 2 | 0.020 | 0.030 | 2.16×10^{-3} |
| 3 | 0.040 | 0.030 | 4.32×10^{-3} |

Determine:

- Order of reaction with respect to Cl_2 and NO and the overall reaction.
 [Ans: 1 and 2 respectively, overall order = 3]
 - If the concentration of Cl_2 is $[0.50] \text{ mol L}^{-1}$ and NO is $[0.40] \text{ mol L}^{-1}$, What is the rate?
 [Ans: $9.6 \text{ mol L}^{-1} \text{ s}^{-1}$] $[3+2]$ [Q.N.32 (b), 2072'E']
3. Define the term $1+1+1+2$ [Q.N.24, Supp. 2071]
- rate law equation
 - instantaneous rate
- What will be the initial rate of a reaction if its rate constant is $1 \times 10^{-3} \text{ min}^{-1}$ and the concentration of the reactant is 0.2 mol L^{-1} . How much the reactant will be converted into the product in 500 minute ?
 [Ans : 39.33%]
4. What is instantaneous rate of reaction? How do concentration and surface area of reactant affect the rate of reaction? A first order reaction will takes 100 minutes to complete 60% of reactant into product. What time will it take to complete 90% of reactant into product?
 $1+2+2$ [Q.N. 24, Set 'D' 2071]
 [Ans : 251.42 min]

12. From the following experimental data for the reaction:



| Experiment | [A], mol L ⁻¹ | [B], mol L ⁻¹ | Rate, mol L ⁻¹ s ⁻¹ |
|------------|--------------------------|--------------------------|---|
| 1 | 0.5 | 0.5 | 1.6×10^{-4} |
| 2 | 0.5 | 1 | 3.2×10^{-4} |
| 3 | 1 | 1 | 3.2×10^{-4} |

- (i) Find overall order of reaction.

[Ans: $0 + 1 = 1$]

- (ii) Find the rate constant.

[Q.N. 30(b), Set 'A' 2069]

[Ans: $3.2 \times 10^{-4} \text{ s}^{-1}$]

13. Write the rate law for a first order reaction. What is the unit of the reaction?

[Ans: s^{-1}]

[Q.N. 7, Set 'B' 2069]

14. The following data are given for the reaction



| Expt No. | [X], mol L ⁻¹ | [Y], mol L ⁻¹ | Rate of formation of (Z) mol L ⁻¹ s ⁻¹ |
|----------|--------------------------|--------------------------|--|
| 1 | 0.1 | 0.1 | 7.0×10^{-3} |
| 2 | 0.3 | 0.2 | 8.4×10^{-2} |
| 3 | 0.3 | 0.4 | 3.36×10^{-1} |
| 4 | 0.4 | 0.1 | 2.8×10^{-2} |

- (i) Calculate the order of reaction with respect to X and Y.

[Ans: 1 & 2 respectively]

- (ii) Half-life of reaction with respect to X.

[Ans: 0.099s]

- (iii) The rate of formation of 'Z'

when [X] = 0.6 mol L^{-1}

[Y] = 0.3 mol L^{-1}

[Q.N. 32(b), Set 'B' 2069]

[Ans: $0.378 \text{ mol L}^{-1} \text{ s}^{-1}$]

15. Define the half-life period of a reaction. The half-life periods of two reactions A and B are 3.21×10^2 min and 569 min respectively. Which of these is a faster reaction?

[Ans: Reaction A is faster]

[Q.N.16, 2068]

16. What is the rate law of reaction? How does order of a reaction differ from molecularity of a reaction. Rate of reaction $A + B \rightarrow P$, is given below as a function of different initial concentration of A and B.

| [A] mol L ⁻¹ | [B] mol L ⁻¹ | Rate mol L ⁻¹ |
|-------------------------|-------------------------|--------------------------|
| 0.01 | 0.01 | 0.005 |
| 0.02 | 0.01 | 0.010 |
| 0.01 | 0.02 | 0.005 |

- (i) Determine the order of reaction with respect to A and B respectively.

- (ii) What is overall order of reaction?

- (iii) Write rate Law equation.

- (iv) Find the value of rate constant.

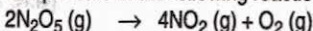
- (v) What is the half-life of A?

[Q.N. 30, 2066]

(Ans: (i) 1 & 0 respectively, (ii) $1 + 0 = 1$, first order (iii) $\text{rate} = k[A]^1[B]^0$,

(iv) 0.5 time^{-1} , (v) 1.386 time)

17. Define instantaneous rate of reaction. Compare the rate of reaction of all the components of the following reaction:



Find the rate of each component in mol S⁻¹, when 2.24 litre of O₂ at NTP are produced in 30 minutes.

[Q.N. 25, 2064]

[Ans: Rate of disappearance of $\text{N}_2\text{O}_5 = 1.11 \times 10^{-4} \text{ mol s}^{-1}$

Rate of formation of $\text{NO}_2 = 2.22 \times 10^{-4} \text{ mol s}^{-1}$

Rate of formation of $\text{O}_2 = 5.55 \times 10^{-5} \text{ mol s}^{-1}$]

18. The half life period of first order reaction is 3 hours. Find the time required to complete 87.5% of the reaction. [Q.N.16, 2063]
[Ans: $t = 9.002 \text{ hr}$]
19. Define zero order reaction and find the unit of its rate constant. [Q.N.17, 2063]
[Ans: $\text{mol L}^{-1} \text{ s}^{-1}$]
20. What is half life period of a reaction? Calculate the half life period of a first order reaction when the rate constant is 5 year^{-1} . [Q.N. 17, 2062]
[Ans: 50.6 days]
21. The rate of a reaction, $A + B \rightarrow \text{Product}$ is given below as a function of different initial concn of A and B. 2+3=5

| Expt | [A] mole L^{-1} | [B] mol L^{-1} | Initial rate mol $\text{L}^{-1} \text{ min}^{-1}$ |
|------|--------------------------|-------------------------|---|
| 1. | 0.01 | 0.01 | 0.005 |
| 2. | 0.02 | 0.01 | 0.010 |
| 3. | 0.01 | 0.02 | 0.005 |

Determine the order of reaction with respect to A and B.

What is the half life of A in the reaction?

[Q.N. 25, 2062]

[Ans : Reaction is 1st order with respect to A and zero order with respect to B. Half life of A = 1.386 minute]

22. Suppose that the rate law for the reaction $A \rightarrow B$ has been found to be of the form $\text{Rate} = k[A]^m$. From the following data, determine the overall order of the reaction and the order with respect to A.

| Initial Concentration of A (M) | Initial Rate (M/s) |
|--------------------------------|---------------------|
| 0.05 | 3×10^{-5} |
| 0.10 | 12×10^{-5} |
| 0.20 | 48×10^{-5} |

5 [Q.N. 25, 2061]

[Ans : order of reaction with respect to A is 2 and the over all order of the reaction is also 2]

23. What is meant by order of a reaction? State the order of reaction having rate constant $2 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$. 5
[Ans: Zero order] [Q.N. 16, 2060]

24. For the gaseous reaction,



it is found that, $\text{rate} = K[A]^2 [B]^1$.

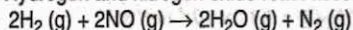
How many times does the rate of reaction increase or decrease if (a) the partial pressure of both A and B are doubled. (b) the partial pressure of A doubles but that of B remains constant. (c) the volume of reacting vessel is doubled (d) an inert gas is added which doubles the overall pressure whilst the partial pressure of A and B remains constant. (e) the temperature rises by 30°C . 5x2=10 [Q.N. 30, 2060]

[Ans : (a) rate increases by 8 folds (b) rate increases by 4 folds (c) rate decreases by 4 folds (d) no change in the rate of reaction (e) rate increases by 8 to 27 folds.]

25. Calculate the half-life period of a first order reaction when the rate constant is 5 year^{-1} . [Q.N. 7, 2056]
[Ans: 50.6 days]

26. (a) List the factors that affect the rate of a reaction.

(b) Hydrogen and nitrogen oxide react according to the following equation:



Experiments were performed at 800°C in order to determine the order of reaction and the following results were obtained.

| Initial concentration of nitrogen oxide (mole litre ⁻¹) | Initial concentration of hydrogen (mole litre) | Initial rate of production of nitrogen (mole litre ⁻¹ Sec ⁻¹) |
|---|--|---|
| 6x10 ⁻³ | 1x10 ⁻³ | 3x10 ⁻³ |
| 6x10 ⁻³ | 2x10 ⁻³ | 6x10 ⁻³ |
| 6x10 ⁻³ | 3x10 ⁻³ | 9x10 ⁻³ |
| 1x10 ⁻³ | 6x10 ⁻³ | 0.5x10 ⁻³ |
| 2x10 ⁻³ | 6x10 ⁻³ | 2x10 ⁻³ |
| 3x10 ⁻³ | 6x10 ⁻³ | 4.5x10 ⁻³ |

- a) What is the order of this reaction with respect to (i) nitrogen oxide (ii) hydrogen ?
 b) Write the rate equation for the reaction of nitrogen oxide with hydrogen.
 c) What is the unit of rate constant, K ?
 d) Why are chemists interested in obtaining order of reaction and rate equations ? 10.

[Q.N.28, 2055]

[Ans : (a) The reaction is 1st order with respect to H₂ and 2nd order with respect to nitric oxide (d) mol⁻² L² s⁻¹]

Section B: Organic Chemistry

Unit 8: Aromatic Hydrocarbon

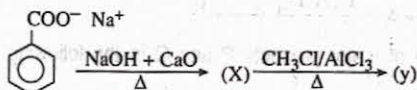
Very Short Questions

(All questions are of equal value, 2 marks each.)

- How would you prepare benzene from:
 - Ethyne
 - Sodium benzoate

1+1 [Q.N.8, 2072'C']
- State Huckel's rule for aromaticity. 2 [Q.N.8, 2072'D']
- COONa

Identify A and B of the above reaction. [1+1] [Q.N.8, 2072'E']
- What are aromatic compounds according to Huckel's rule ? 2 [Q.N.8, Supp. 2071]
- Write resonance hybrid structure of arene containing meta director and ortho director substituents of each. [Q.N. 8, Set 'C' 2071]
- State Huckel's rule for aromaticity. [Q.N. 8, Set 'D' 2071]
- Why is benzene called aromatic compound according to Huckel's rule ? [Q.N.8, 2070 'Supp']
- What happens when:
 - Sodium benzoate is heated with soda-lime. [Q.N. 8 (i), 2070 'C']
 - Phenol is heated with zinc dust. [Q.N. 8 (ii), 2070 'C']
 - Benzene is heated with acetic anhydride in presence of anhydrous AlCl₃. [Q.N. 8 (i), 2070 'D']
 - Sodium benzoate is heated with sodalime. [Q.N. 8 (ii), 2070 'D']
- How would you obtain benzene from (i) Sodium benzoate (ii) Toluene [Q.N. 8, Supp. 2069]
- Identify (X) and (Y) in the following reaction and give their names.



2[Q.N. 8, Set 'B' 2069]

11. How would you obtain benzene from:

i) phenol

ii)

Chlorobenzene

[Q.N. 8, Set 'A' 2069]

12. Write an example of each of the following reactions giving appropriate conditions :
 (i) Friedel craft acylation [Q.N. 5(i), 2062]
13. Write an example of each of the following reaction :
 (i) Hoffmann's hypobromamide reaction [Q.N. 6(ii), 2064]
 (ii) Friedel Craft acylation [Q.N. 5(ii), 2060]
14. Write an example of Friedel Craft acylation. [Q.N. 5, 2057]

Short Questions*(All questions are of equal value, 5 marks each.)*

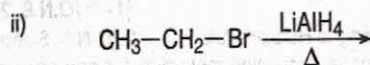
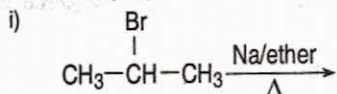
1. Write short notes on :
 (a) Laboratory preparation of anhydrous methanoic acid. [Q.N.31(i), 2065]
 (b) Lab-preparation of formic acid. [Q.N. 31(a), 2062]
 (c) Friedel-craft's reaction [Q.N. 28(a), 2053]

Long Questions*(All questions are of equal value, 10 marks each.)*

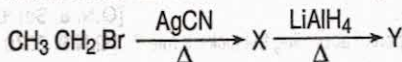
1. Show your acquaintance with the following:
 (a) Friedel Craft's reaction [Q.N.30(b-II), 2056]

Unit 9: Haloalkanes and Haloarenes**9.1. Haloalkanes****Very Short Questions***(All questions are of equal value, 2 marks each.)*

1. A haloalkane (M) reacts with aq. NaOH to give isopropyl alcohol. What major product would you get when (M) is heated with Na in presence of dry ether? [Q.N.9, 2072'C']
2. Give the major products in the following questions: 1+1 [Q.N.9, 2072'D']

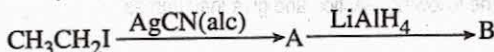


3. Give the IUPAC name of X and Y in the following reaction sequence. 1+1 [Q.N.9, Supp. 2071]

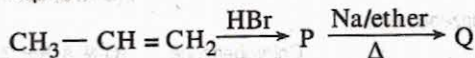


4. Starting from iodomethane, how would you prepare:
 i) ethane ii) ethene 1+1 [Q.N. 9, Set 'C' 2071]
5. Write down the structure of secondary haloalkane of $\text{C}_3\text{H}_7\text{X}$. What happens when the secondary haloalkane is heated with Na in presence of dry ether? [Q.N. 9, Set 'D' 2071]

6. Identify the major products A and B and give their IUPAC name. [Q.N.9, 2070 'Supp']



7. Write down the IUPAC name of major products P and Q in the following reaction sequence



[Q.N. 9, 2070 'C']

8. Name A and B in the following reaction, [Q.N. 9, Supp. 2069]

$$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{Br} \xrightarrow[\Delta]{\text{alc. KOH}} (\text{A}) \xrightarrow{\text{HBr}} (\text{B})$$
9. Convert 1-chloropropane into 2-chloropropane 2 [Q.N. 9, Set 'A' 2069]
10. Identify the major products A and B in the following reaction. 1+1 [Q.N.2,2068]

$$\text{C}_2\text{H}_5\text{Br} \xrightarrow[\text{dry ether}]{\text{Mg}} \text{A} \xrightarrow{\text{H}_2\text{O}} \text{B}$$
11. Identify A and B in the following reaction: [Q.N. 2, 2066]

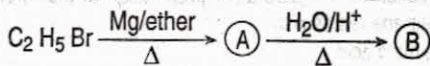
$$\text{CH}_3-\text{CH}_2-\text{Br} \xrightarrow[\Delta]{\text{alc. KOH}} \text{A} \xrightarrow[\text{(ii) Zn/H}_2\text{O}]{\text{(i) O}_3} \text{B}$$
12. Identify 'A' and write its IUPAC name in the following reaction: [Q.N.2, 2065]

$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}-\text{Br} \\ | \\ \text{CH}_3 \end{array} + \text{Na} \xrightarrow[\Delta]{\text{dry ether}} \text{A} + \text{NaBr}$$
13. What happens when :
 (i) Chloroform is heated with Silver powder. [Q.N.3(ii), 2065]
14. Identify (X) and (Y) in the following reaction:

$$\text{X} \xrightarrow{\text{Mg/dry ether}} \text{Y} \xrightarrow[\text{(ii) H}_2\text{O/H}^+]{\text{(i) CO}_2} \text{Propanoic acid}$$
 [Q.N.2, 2063]
15. Write the action of :
 i. Monohydroxy benzene with trichloro methane in presence of alcoholic NaOH. [Q.N.3(ii), 2063]
16. A Primary haloalkane (x), if allowed to react with KCN yields a compound (y), which on acidic hydrolysis gave propanoic acid. Identify (x) and (y). [Q.N. 2, 2062]
17. Convert bromoethane to ethyne. [Q.N. 2, 2060]
18. Why does chloroform not give white precipitate with aqueous silver nitrate? [Q.N. 2, 2058]
19. Why is chloroform stored in a dark brown bottle? [Q.N. 15, 2056]
20. Give the uses of chloroform. [Q.N. 19, 2056]

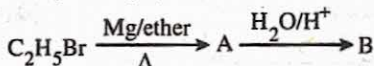
Short Questions*(All questions are of equal value, 5 marks each.)*

1. Describe laboratory method of preparation of chloroform. How does chloroform react with acetone? 4+1 [Q.N.27, 2072'C']
2. Give the chemical reaction for the preparation of trichloromethane from ethanal. What happens when it is heated with silver powder? Identify the product (A) and write its IUPAC name 2+1+2 [Q.N.27, 2072'D']
3. How is trichloromethane prepared in the laboratory from propanone in pure and dry state? Write its action with oxygen. [4+1] [Q.N.24, 2072'E']
4. How would you obtain 1+1+1+1 [Q.N.27, Supp. 2071]
 (i) ethane from bromoethane (ii) ethylene from trichloromethane
 Identify the major product (A) and (B) in the following reaction sequence.



Give reactions to convert (A) into ethanoic acid.

5. A haloalkene P reacts with aq.KOH to give Q. The compound Q on oxidation with $K_2Cr_2O_7/H^+$ gives R and R undergoes clemenson reduction to produce S. The compound P reacts with sodium in presence of dry ether to form 2,3-dimethyl butane, write chemical reactions involved and identify P, Q, R and S. [Q.N. 27, Set 'C' 2071]
6. How would you obtain:
- ethane from bromoethane
 - ethyne from trichloromethane
- Identify the major product A and T in the following reaction sequence:



- Give reactions to convert A into ethanoic acid. [Q.N. 27, Set 'D' 2071]
7. How is trichloromethane prepared in the laboratory? Write its action on acetone. [Q.N.26, 2070 'Supp']
8. Write any three methods of preparation of iodoethane. What happens when iodoethane is heated with:
- Sodium in presence of dry ether
 - aq. NaOH. 3+2 [Q.N. 24, 2070 'D']
9. How is Chloroform prepared in the laboratory? Chloroform is stored in dark brown air tight bottle containing a little ethyl alcohol. Give reason. [Q.N. 27, Supp. 2069]
10. Starting from trichloromethane, how would you prepare:
- ethyne
 - Methane
 - Chloropicrin
 - Carbonyl chloride
 - Chloretone [Q.N. 23 Set 'B' 2069]
11. How is trichloromethane prepared in the laboratory? Give a chemical equation for the conversion of chloroform into ethyne. [Q.N.22, 2068]
12. Give the chemical reactions for the Laboratory Preparation of trichloromethane. [Q.N. 22(a), 2066]
13. Why is trichloromethane stored in dark-brown airtied bottle? [Q.N. 22(b), 2066]
14. Starting from Methyl magnesium bromide (CH_3MgBr) how would you prepare:
- Methane [Q.N.21(v), 2065]
15. How is trichloromethane prepared in laboratory? How does it react with propanone? [Q.N.22, 2065]
16. Write the chemical reactions involved in the lab. preparation of chloroform from ethanol. Why does chloroform not give white precipitate with aqueous $AgNO_3$? Write two important uses of chloroform. [Q.N. 21, 2062]
17. How is trichloromethane (chloroform) prepared in the lab? [Q.N. 27, 2055]
18. Describe the laboratory preparation of chloroform. [Q.N. 21, 2053]
19. Describe the laboratory preparation of ethyl iodide from ethyl alcohol with PI_3 or red phosphorus and iodine. [Q.N. 22, 2052]
20. What happens when :
- Chloroform is allowed to react with NaOH solution. [Q.N. 24(a), 2052]

Long Questions

(All questions are of equal value, 10 marks each.)

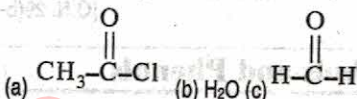
1. Starting from CH_3MgI , how would you prepare ethanol. Convert
- ethanol into propanol
 - ethanal into propanone 2+3[Q.N. 31(b), Set 'C' 2071]
2. Give a suitable chemical reaction for the laboratory preparation of trichloromethane. What happens when chloromethane reacts with
- phenol
 - nitric acid
 - Silver powder
 - atmospheric air. [Q.N. 31(b), 2070 'C']

3. Describe the preparation of pure and dry chloroform in the laboratory. Give its action upon:
- heated silver
 - aq. KOH
 - aniline in presence of aqueous NaOH.

Write two important uses of chloroform.

[Q.N.28, 2063]

4. How is Grignard reagent prepared? What precautions should be taken for preparation of Grignard reagents? How does $\text{CH}_3\text{CH}_2\text{MgBr}$ react with



Show the final product after aqueous work-up.

[Q.N. 28, 2061]

5. An organic compound A on catalytic reduction gives B, B on chlorination gives C, C on heating with sodium metal in presence of ether gives D, D on chlorination gives 2 chlorobutane as a major product. Give names for A, B, C, and D. [Q.N. 27, 2053]

6. Write short notes on :

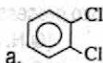
- Laboratory preparation of trichloromethane [Q.N.33(b), Supp. 2071]
- Laboratory preparation of chloroform [Q.N. 33 (b), Set 'C' 2071]
- Laboratory preparation of trichloromethane [Q.N. 33 (b), Set 'D' 2071]
- Friedel-crafts alkylation [Q.N. 32(d) Set 'A' 2069]
- Lab preparation of chloroform. [Q.N. 31(ii), 2064]
- Lab. preparation of chloroform. [Q.N. 31(d), 2058]
- Lab. preparation of Chloroform. [Q.N. 31(d), 2057]
- Wurtz reaction [Q.N. 31(c), 2056]
- Inductive effect. [Q.N. 31(d), 2056]
- Inductive effect. [Q.N. 31(d), 2055]
- Markownikoff rule [Q.N. 28(c), 2053]

9.2 Haloarenes

Very Short Questions

(All questions are of equal value, 2 marks each.)

- Why is nucleophilic substitution difficult in haloarenes? [2] [Q.N.9, 2072 'E']
- Convert 1-bromopropane to 2-bromopropane. [Q.N. 9, 2070 'D']
- What happens when chlorobenzene is:
 - treated with chloral in acidic medium.
 - heated with Ni-Al in alkaline medium. [Q.N. 9, Set 'B' 2069]
- How would you convert chlorobenzene into :
 - DDT
 - Toluene [Q.N. 2, 2067]
- Why is nucleophilic substitution reaction in chlorobenzene difficult as compared to chloroethane? [Q.N. 2, 2064]
- Why is it difficult to undergo nucleophilic substitution in haloarene? [Q.N. 2, 2059]
- Write the name of the following components according to the IUPAC rule. [Q.N. 18(a), 2056]



Short Questions

(All questions are of equal value, 5 marks each.)

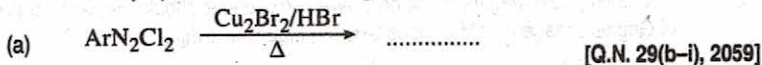
- Write any three methods of preparation of chlorobenzene. How does it react with:
 - Chloral and
 - Methyl chloride in the presence of dry ether. [Q.N. 27, Set 'A' 2069]

2. Write two chemical reactions for the preparation of chlorobenzene. Why does it give ortho and para products during electrophilic substitution reaction? Give its action on chloral. [Q.N. 23, 2060]

Long Questions

(All questions are of equal value, 10 marks each.)

1. Predict the major products of the following reaction:



Unit 10: Alcohols and Phenols

10.1. Alcohols

Very Short Questions

(All questions are of equal value, 2 marks each.)

- Write a structural formula of secondary alcohol of $\text{C}_3\text{H}_8\text{O}$ and give its method of preparation using Grignard reagent. 1+1 [Q.N.10, 2072'C']
- How would you obtain: [Q.N.11 (ii), 2072'C']
 - methoxyethane from ethano
- Write down the structural formula and IUPAC name of tert. Butyl alcohol. 1+1 [Q.N.10, 2072'D']
- Prepare butan-2-ol and 2-methyl propan-2-ol by using CH_3MgBr . [1+1] [Q.N.10, 2072'E']
- Name any suitable secondary alcohol that gives iodoform test and write the test reaction. 1+1 [Q.N.10, Supp. 2071]
- Write structure of tertiary alcohol of $\text{C}_4\text{H}_{10}\text{O}$ and give its IUPAC name. [Q.N. 10, Set 'C' 2071]
- Write down the secondary and tertiary alcohol of $\text{C}_4\text{H}_{10}\text{O}$ and give their IUPAC name. [Q.N.10, 2070 'Supp']
- What is the laboratory test of ethanol? [Q.N. 10, 2070 'D']
- Name the isomer of $\text{C}_3\text{H}_8\text{O}$ which undergoes iodoform test. [Q.N. 3, 2067]
- How would you obtain ethanol from Cane sugar? Write reaction only. [Q.N. 3, 2066]
- What happens when :
 - Ethanol is heated with iodine in presence of aq. NaOH. [Q.N.3(i), 2065]
- Convert ethanol to propanoic acid. [Q.N. 4, 2064]
- What happens when the product obtained by dehydrogenation of ethanol is allowed to react with Tollen's reagent? [Q.N. 3, 2064]
- Write the action of :
 - Propan-2-ol with PCl_5 [Q.N. 3(i), 2062]
- Alcohols of low molecular weight are moderately soluble in water, whereas ethers of about the same molecular weight are not. Explain. [Q.N. 3, 2061]
- Identify the organic compounds A, B, C and D. [Q.N. 3, 2060]

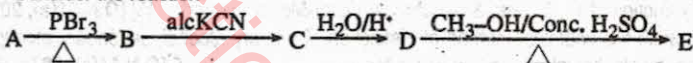
$$(\text{CH}_3)_2\text{CHOH} \xrightarrow{\text{PCl}_5} \text{A} \xrightarrow{\text{alc. KOH}} \text{B} \xrightarrow{\text{Ozonolysis}} \text{C} + \text{D}$$
- Write a chemical reaction for the preparation of primary alcohol by oxo process. [Q.N. 3, 2059]
- Why is the boiling point of ethanol higher than its isomer methoxy methane? [Q.N. 4, 2059]
- Write a chemical reaction for the preparation of a primary alcohol by 'oxo' process. [Q.N. 3, 2058]
- What action takes place when excess of ethanol is heated with conc. Sulphuric acid at about 140°C ? [Q.N. 4, 2058]

21. What is fermentation ? [Q.N. 16, 2056]
 22. Why is boiling point of ethanol greater than that of ethoxyethane ? [Q.N. 16, 2055]

Short Questions

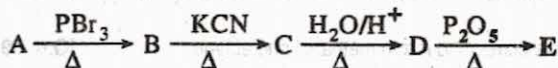
(All questions are of equal value, 5 marks each.)

1. A monohydric alcohol reacts with PBr_3 to give 'B'. The compound B, if heated with alc. KOH, gives 'C'. C on ozonolysis produces ethanol and methanol as major products. The compound 'A' also responds to iodoform test. Identify A, B and C with reactions involved. What happens when 'B' is heated with sodium in presence of dry ether? [5] [Q.N.23, 2072'E']
2. How is ethanol prepared from (i) ethyne (ii) 1,1 - dichloroethane. Convert ethanol into propanone. What is the laboratory test of carbonyl compounds? [1+1+2+1] [Q.N.25, 2072'E']
3. A dihydric alcohol $\text{C}_2\text{H}_6\text{O}_2$ (A) undergoes stepwise oxidation with $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+$ to give a dicarboxylic acid $\text{C}_2\text{H}_2\text{O}_4$ (B) as a final product. Identify (A) and (B) with reactions and give their IUPAC name. [Q.N. 10, 2070 'C']
4. Write down the isomeric alcohols of $\text{C}_3\text{H}_8\text{O}$ and IUPAC name. Explain Victor-Meyer's method to distinguish them. 2+3 [Q.N. 28, 2070 'C']
5. Consider the reaction



Compound A is the primary alcohol which gives iodoform test. Identify compounds A, B, C, D and E with suitable reactions. [Q.N. 29, Supp. 2069]

6. Write down two isomers of monohydric alcohol from $\text{C}_3\text{H}_8\text{O}$ and give their IUPAC name what chemical test would you apply to distinguish them. Write the chemical reaction for it. How would you convert the one isomer to the another and vice versa ? [Q.N. 21, 2067]
7. Write down the oxidation of Primary Secondary and Tertiary alcohols. How would you convert Propan-1-ol into Propan-2-ol? [Q.N. 21, 2066]
8. Starting from Methyl magnesium bromide (CH_3MgBr) how would you prepare:
 (i) ethanol [Q.N.21(i), 2065]
 (ii) propan-2-ol [Q.N.21(ii), 2065]
 (iii) 2-methyl propan-2-ol [Q.N.21(iv), 2065]
9. What is meant by Grignard's reagent ? How could you convert a primary alcohol to Grignard's reagent ? By using a suitable Grignard's reagent how would you synthesise:
 (i) 2-methyl propan-2-ol (ii) ethanoic acid ? [Q.N. 21, 2064]
10. An alcohol (A), reacts with thionyl chloride to produce (B), which on dehydrohalogenation yielded a compound (C). The compound (C), on ozonolysis gave the mixture of ethanal and methanal. If the alcohol, (A) responses positive iodoform test, identify A, B and C. How could you convert the above compound, (B) into propanone ? [Q.N. 23, 2064]
11. What action takes place when :
 i. Ethanol is heated with conc. H_2SO_4 at about $160-170^\circ\text{C}$? [Q.N.22(v), 2063]
12. Write down the oxidation products of primary, secondary and tertiary alcohols. [Q.N. 21, 2061]
13. Describe Victor Meyer's method for the distinction between 1° , 2° and 3° alcohols. [Q.N. 21, 2060]
14. (i) Consider a reaction,



The compound A is a primary alcohol which gives positive iodoform test. Identify the organic compounds A, B, C, D and E.

(ii) Convert the above compound D into ethanoic acid.

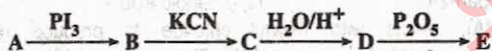
[Q.N. 22, 2060]

15. A secondary alcohol (x) reacts with PCl_5 to give an alkyl halide (y), which on dehydrohalogenation yields an alkene (z). The alkene (z) upon ozonolysis gives the mixture of ethanal and methanal. Identify X, Y and Z. Suggest your answer with chemical reaction. [Q.N. 21, 2059]
16. What happens when :
 (a) Ethyl alcohol is treated with acetic acid [Q.N. 24(b), 2052]
 (b) Ethanol is heated with conc H_2SO_4 [Q.N. 23(c), 2053]

Long Questions

(All questions are of equal value, 10 marks each.)

1. Describe Victor Meyer's method to distinguish propan-2-ol and 2-methyl propan-2-ol. Give a reaction to show that the H-atom of the -OH in alcohol is weakly acidic. 5+1+2+2 [Q.N.32, 2072'C']
 Cover the followings:
 i) Propan-1-ol into Propan-2-ol ii) ethanal into propanone.
2. Describe Victor Meyer's method to distinguish propan-2-ol and 2-methyl propan-2-ol. Why is phenol more acidic than alcohol? How would you convert ethanal into propanone and vice-versa? 5+1+4 [Q.N.32, 2072'D']
3. Distinction of 1° , 2° and 3° alcohol by Victor-Meyer method. [5] [Q.N.31(a), 2072'E']
4. Explain the chemical method of distinction of primary alcohol, secondary alcohol and tertiary alcohol introduced by Victor Meyer. 5 [Q.N.31(a), 2070 'Supp']
5. Write down the oxidation products of primary, secondary and tertiary alcohols. [Q.N. 32 (a), Supp 2069]
6. Describe Victor Meyer's method to distinguish primary, secondary and tertiary alcohols. [Q.N. 32, Set 'A' 2069]
7. How would you distinguish between propanol and propan-2-ol by Victor-Meyer's method? Give suitable method of conversion of propanol into propan-2-ol. [Q.N. 30 (a), Set 'B' 2069]
8. How will you make a distinction of primary, secondary and tertiary alcohol by the Victor Meyer Method? [Q.N.28(a), 2068]
9. Write the Victor Meyer's test of distinction of primary, secondary and tertiary alcohols. [Q.N.29.(b), 2065]
10. Describe Victor Meyer's method for the distinction between primary, secondary and tertiary alcohols. [Q.N.29(a), 2063]
11. (a) Consider a chemical reaction :



The compound, A is a primary alcohol which gives iodoform test. Identify the organic compounds A, B, C, D and E; giving complete reaction.

- (b) Describe Victor Meyer's method for the distinction between 1° , 2° and 3° alcohols. [Q.N. 29, 2062]
12. Consider the following reaction
- $$A \xrightarrow[\Delta]{\text{PCl}_5} B \xrightarrow[\text{dry ether}]{\text{Mg}} C \xrightarrow{\text{CO}_2} D \xrightarrow[\Delta]{\text{H}_2\text{O}/\text{H}^+} E$$
- The compound, A is a primary alcohol, which on oxidation gives ethanal. Identify A, B, C, D and E.
 Convert the above compound A into methanol and ethyne. [Q.N. 29, 2058]
13. Write short notes on :
 (a) Distinction of 1° , 2° and 3° alcohol by Victor-Meyer's method. [Q.N.33(d), 2072'D']
 (b) Distinction between 1° , 2° and 3° alcohols by Victor Meyer's method. [Q.N. 33 (c), 2070 'D']

- (c) Fermentation of ethyl alcohol. [Q.N. 31 (iv), 2067]
 (d) Fermentation [Q.N.31(iv), 2063]
 (e) Distinction between 1°, 2° and 3° alcohols by Victor Meyer method. [Q.N.31(a), 2059]
 (f) Victor Meyer's method for distinction between primary, secondary and tertiary alcohols. [Q.N. 31(c), 2055]
 (g) Use of Grignard's reagent in the synthesis of 1°, 2°, 3° alcohols. [Q.N. 30(d), 2054]

10.2. Phenol**Very Short Questions***(All questions are of equal value, 2 marks each.)*

- How would you obtain:
(i) anisole from phenol [Q.N.11(i), 2072°C]
- What happens when phenol is treated with:
a) benzene diazonium chloride
b) Methanal in acidic medium [Q.N. 10, Set 'D' 2071]
- How is picric acid prepared? Write its one use. [Q.N. 14, 2070 'C']
- Why is phenol more acidic than alcohol? [Q.N. 12, Supp. 2069]
- Starting from phenol, how would you prepare methoxy benzene? [Q.N. 10, Set 'B' 2069]
- Why is phenol more acidic than aliphatic alcohol? [Q.N.3, 2068]
- Why is phenol more acidic than aliphatic alcohol? [Q.N. 8, 2067]
- Write the action of:
(i) Monohydroxy benzene with aqueous bromine. [Q.N. 3(ii), 2062]
- Show your acquaintance with Reimer-Tiemann's reaction. [Q.N. 7, 2061]
- Write the reaction between phenol and aq. Br₂. [Q.N. 3, 2057]
- Give the IUPAC name of the following compounds:
b) CH₂=CHCH₂OH [Q.N. 11(b), 2054]

Short Questions*(All questions are of equal value, 5 marks each.)*

- What happens when:
(i) sodium phenolate reacts with iodomethane? [Q.N. 22(v), 2064]
- What action takes place when:
(i) Phenol reacts with ethanoyl chloride? [Q.N.22(iv), 2063]
- Convert the following organic compounds:
(i) Phenol to m-nitrobenzoic acid [Q.N. 22(i), 2062]
- How is phenol prepared from (a) aniline and (b) benzene? How do you explain that the OH group of phenol is ortho/para directing? [Q.N. 23, 2061]
- How could you synthesise?
(a) toluene from phenol. [Q.N. 22(a), 2059]
- Convert the following organic compounds:
(a) Benzene to m-bromophenol. [Q.N. 22(a), 2058]
- Write the chemical equation, with conditions for the following reaction.
a) Phenol is coupled with benzene diazonium chloride [Q.N. 23(c), 2057]
- An aromatic compound A on reduction yields parent hydrocarbon B. B on nitration gives C. C on reduction in acidic solution gives D. On coupling with diazonium salts, D gives diazoaminobenzene. Give names for A, B, C and D. Write the chemical reactions involved. [Q.N. 27, 2052]

Unit 11: Ethers

11.1 Aliphatic Ethers

Very Short Questions

(All questions are of equal value, 2 marks each.)

1. Write IUPAC name of $\text{CH}_3\text{OCH} \begin{matrix} \text{CH}_3 \\ \text{CH}_3 \end{matrix}$ and use Williamson's synthesis method for its preparation. 1+1 [Q.N.11, 2072'D']
2. How is unsymmetrical ether prepared by Williamson's ether synthesis? [2] [Q.N.11, 2072'E']
3. What are unsymmetrical ethers? Give Williamson's synthesis to prepare unsymmetrical ethers. 1+1 [Q.N.11, Supp. 2071]
4. Write an unsymmetrical ether of $\text{C}_3\text{H}_8\text{O}$. How would you prepare the ether by using Williamson's synthesis method? [Q.N. 11, Set 'C' 2071]
5. Prepare $\text{CH}_3\text{—O—CH}_2\text{—CH}_3$ by using Williamson's ether synthesis. [Q.N. 11, 2070 'D']
6. What is unsymmetrical ether? Write an example and IUPAC name. [Q.N. 11, 2070 'C']
7. How is Methoxy ethane obtained from ethoxy ethane? [Q.N. 10, Supp. 2069]
8. Give an example of Williamson's etherification. [Q.N. 10, Set 'A' 2069]
9. Name the isomer of $\text{C}_2\text{H}_6\text{O}$ which reacts with excess HI, gives Iodomethane as major product and write reaction for it? [Q.N. 11, Set 'B' 2069]
10. Write chemical equation for the reactions taking place when:
 - i) Sodium phenoxide reacts with iodomethane.
 - ii) Ethoxyethane is exposed to light and air. [Q.N. 5, 2068]
11. What is Williamson's etherification reaction? [Q.N. 6, 2066]
12. Give reason:
 - (i) It is dangerous to boil sample of ether stored for a long time. [Q.N.6(i), 2065]
 - (ii) Ether is stored in a bottle containing iron wire. [Q.N.6(ii), 2065]
13. There are three possible isomeric ethers of $\text{C}_4\text{H}_{10}\text{O}$. One of them is ethoxy ethane. Write other two isomers and give their IUPAC name. [Q.N. 8, 2064]
14. Write the sequence of chemical reactions for the conversion of ethoxy ethane to methoxy ethane. [Q.N. 4, 2062]
15. Write IUPAC names of ethers represented by the molecular formula $\text{C}_5\text{H}_{12}\text{O}$. [Q.N. 2, 2061]
16. What is the action of ethoxy ethane on: (i) PCl_5 and (ii) aq. HI (cold)? [Q.N. 4, 2060]
17. Write the structure of 2-methoxy propane. [Q.N. 4, 2057]
18. What is the functional group of ether and amide. [Q.N. 15, 2053]

Short Questions

(All questions are of equal value, 5 marks each.)

1. Write down suitable chemical reaction for the preparation of ethoxyethane from ethanol. How is ethoxyethane converted into methoxy ethane? What happens when ethoxy ethane is heated with: 1+2+1+1 [Q.N.28, Supp. 2071]
 - (i) air
 - (ii) conc. H_2SO_4
2. Write down suitable chemical reaction for the preparation of ethoxy ethane from ethanol. How is ethoxy ethane converted into methoxy ethane? What happens when ethoxy ethane is heated with: 1+2+1+1 [Q.N. 26, Set 'C' 2071]
 - i) air
 - ii) conc. H_2SO_4
3. Write down suitable chemical reaction for the preparation of ethoxy ethane from ethanol. How is ethoxy ethane converted into methoxy ethane? What happens when ethoxy ethane is heated with: 1+2+1+1 [Q.N. 28, Set 'D' 2071]
 - i) air
 - ii) conc. H_2SO_4 .
4. How is ethoxyethane prepared in the laboratory in pure and dry state? 5 [Q.N. 23, 2070 'D']

5. Describe laboratory preparation of ethoxy ethane with a neat and labelled diagram. [Q.N. 28, Set 'A' 2069]
6. How is ethoxy ethane prepared in the laboratory? Write Williamson's synthesis for the preparation of an unsymmetrical ether. [Q.N. 24, Set 'B' 2069]
7. Convert the following:
(i) Ethoxyethane into methoxy ethane. [Q.N.23(ii), 2065]
8. Describe the preparation of ethoxyethane in the laboratory. [Q.N.23, 2063]
9. Convert the following organic compounds :
(a) Ethoxy ethane to ethanoyl chloride. [Q.N. 22(b), 2058]

Long Questions

(All questions are of equal value, 10 marks each.)

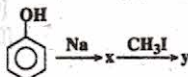
1. Predict the major products of the following reactions:
(a) $C_2H_5-O-C_2H_5 \xrightarrow[0^\circ C]{\text{Conc. HCl}} \dots\dots\dots$ [Q.N. 29(b-iv), 2059]
2. Write short notes on :
(a) Laboratory preparation of ethoxyethane [Q.N.33(iii), 2072'E']
(b) Laboratory preparation of ethoxy ethane [Q.N.33(b), 2070 'Supp']
(c) Laboratory preparation of ethoxyethane. [Q.N. 31(iii), 2068, Q.N. 33 (d), 2070 'C']
(d) Laboratory preparation of ethoxyethane. [Q.N. 31(i), 2066]
(e) Lab. preparation of diethyl ether. [Q.N. 31(iv), 2060]

11.2 Aromatic Ether

Very Short Questions

(All questions are of equal value, 2 marks each.)

1. Give correct chemical reaction for the preparation of:
a) anisole
b) 2-methoxy propane [Q.N. 11, Set 'D' 2071]
2. Starting from CH_3ONa , how would you prepare methoxy benzene ? What happens when methoxy benzene is treated with excess HI? [Q.N.11, 2070 'Supp']
3. Prepare $\text{C}_6\text{H}_5\text{OCH}_3$ by using Williamson's ether synthesis. [Q.N. 11, 2070 'D']
4. How is Methoxy benzene prepared from phenol? [Q.N. 12, Set 'A' 2069]
5. Name the compound (X) and (Y) in the following reaction: [Q.N. 7, 2067]



6. How would you prepared methoxybenzene from phenol ? [Q.N. 8, 2066]
7. Write the action of :
i. Sodium phenolate with iodomethane. [Q.N.3(i), 2063]
8. Write the structure of (i) anisole [Q.N. 4, 2057]

Short Questions

(All questions are of equal value, 5 marks each.)

No questions have been asked in this chapter yet.

Unit 12: Aldehydes and Ketones

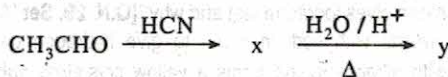
12.1 Aliphatic Aldehydes and Ketones

Very Short Questions

(All questions are of equal value, 2 marks each.)

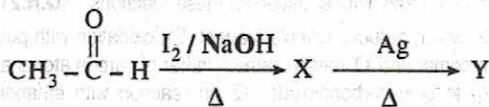
1. Write an example of: 1+1[Q.N.12, 2072'C']
 i) Rosenmund's reduction ii) Cannizzaro's reaction
2. What happens when: Propanone is treated with dilute NaOH solution. [Q.N.12(i), 2072'E']
3. How is ethanal converted into propanone ? 2 [Q.N.12, Supp. 2071]
4. Give an application of each:
 a) DNP test
 b) Tollen's test. [Q.N. 12, Set 'C' 2071]
5. Starting from propanone, how would you prepare 2-hydroxy-2methyl propanoic acid? 2
[Q.N. 12, Set 'D' 2071]
[Q.N.12, 2070 'Supp']
6. How does methanal reacts with
 (i) ammonia (ii) conc.NaOH.
7. How does methanal react with
 i. NH₃ ii. Conc. NaOH [Q.N. 12, 2070 'D']
8. Give an example of each of:
 i) Tollen's test ii) Cannizzaro's reaction [Q.N. 11, Supp. 2069]
9. Give a reaction for each:
 i) DNP test
 ii) Cannizzaro's reaction [Q.N. 12, Set 'B' 2069]
10. How is 3-hydroxybutanal obtained from ethanal ? [Q.N.4, 2068]
11. Write an examples of each of the followings:
 i) Cannizzaro's reaction. [Q.N.7(i), 2068]
12. Identify the product (A) and give its one important use in the following :
 $\text{HCHO} + \text{NH}_3 \rightarrow \text{A} + \text{H}_2\text{O}$ [Q.N. 4, 2067]
13. Write an example of each of the followings:
 (i) Carbonylation reaction. [Q.N. 4(ii), 2066]
14. Give balanced chemical equations for the followings:
 (i) Ethanal is heated with Iodine and aqueous NaOH. [Q.N. 5(i), 2066]
 (ii) Propanone is heated with hydrazine in presence of glycerol. [Q.N. 5(ii), 2066]
15. Write a reaction of each of the following:
 (i) Tollen's test [Q.N.4(i), 2065]
 (ii) Cannizzaro's reaction [Q.N.4(ii), 2065]
16. Write the action of :
 (i) methanal with ammonia [Q.N. 5(i), 2064]
 (ii) propanone with sodium bisulphite [Q.N. 5(ii), 2064]
17. What happens when :
 i. Ethanal reacts with semicarbazide ? [Q.N.6(ii), 2063]
18. Write an example of each of the following reactions giving appropriate conditions :
 (i) Cannizzaro reaction [Q.N. 5(ii), 2062]
19. Suggest a suitable chemical test to distinguish ethanal from propanone. Give chemical reaction too. [Q.N. 6, 2062]
20. Write the action of (i) ammonia with methanal (ii) acetone with hydrazine. [Q.N. 7, 2060]
21. What happens when ethanal is warmed with Tollen's reagent? [Q.N. 6, 2059]

22. Identify the products (x) and (y) in the following reaction.



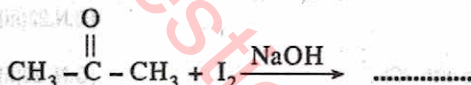
[Q.N. 6, 2058]

23. Identify X and Y in the following reaction



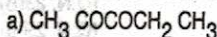
[Q.N. 2, 2057]

24. Give an example (with formula) each from aliphatic and aromatic aldehydes, which give aldol condensation reaction. [Q.N. 6, 2057]
 25. What reagent is used to diagnose diabetes in human urine? [Q.N. 17, 2056]
 26. What is functional group present in a compound that gives a positive Tollen's test? Write an equation showing the reaction involved in a positive Tollen's test. [Q.N. 12, 2055]
 27. Complete and balance the following equation:



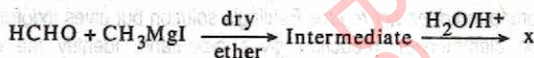
[Q.N. 13, 2055]

28. Give the IUPAC name of the following compounds.



[Q.N. 11(a), 2054]

29. Identify the product X in the reaction.



[Q.N. 14, 2054]

30. What is Tollen's reagent? What happens when acetaldehyde is heated with Tollen's reagent? [Q.N. 6, 2053]

Short Questions

(All questions are of equal value, 5 marks each.)

1. An aliphatic compound (A) reacts with SOCl_2 to give (B). (B) on reduction with H_2 in presence of Pd/BaSO_4 to give (C). When HCN is added to (C), produces (D). On hydrolysis of (D) in acidic medium forms (E). Compound (C) given iodoform test and produces silver mirror with Tollen's reagent Identify (A), (B), (C), (D), (E) and write reaction involved. 5 [Q.N.29, 2072'D']
2. Write any three methods of preparation of ethanal. How would you convert ethanal into (i) 3-hydroxybutanal (ii) 2-hydroxy-2-methylpropanoic acid [Q.N.28, 2070 'Supp']
3. An organic compound (A) reacts with HCN to give (B). On hydrolysis (B) in acidic medium gives (C). Compound (A) also produces propane when treated with zinc-amalgam and HCl. Identify (A), (B) and (C) with reactions and give their IUPAC names. What product would you expect when (A) is treated with trichloromethane in alkaline medium. 5 [Q.N. 29, 2070 'C']
4. An Organic compound (A) reacts with PBr_3 to give (B). Compound B produces (C) when heated with alc. KOH. The compound (C) undergoes ozonolysis to yield ethanal and methanal as major products. The compound 'A' responses Iodoform test. Identify A,B,C, and write reactions involved. How is (A) obtained from CH_3MgBr .

[Q.N. 25, Set 'B' 2069]

5. Write the functional isomers of C_3H_6O with their IUPAC name. Also, give a chemical test to distinguish them which one gives Iodoform test and why? [Q.N. 29, Set 'A' 2069]
6. An organic compound (A) reacts with sodium metal to give hydrogen gas. The compound (A) on treatment with alkaline iodine forms a yellow crystalline substance and on oxidation with acidified dichromate forms an aldehyde with molecular formula C_2H_4O . Identify the compound and write equation for these reactions. [Q.N.21, 2068]
7. An organic compound 'P' which reduces Tollen's reagent. On oxidation with potassium permanganate, formed a compound 'Q' having same number of carbon atoms as 'P'. Q reacts with Na_2CO_3 (aq) to give carbon dioxide. 'Q' on reaction with ethanol in the presence of Sulphuric acid formed an ester having molecular formula $C_4H_8O_2$ (R). Identify P, Q, R and write their IUPAC names. [Q.N.23, 2068]
8. Convert the following: 2.5×2=5
(i) Ethanal into Methanal. [Q.N.23(i), 2065]
9. What action takes place when :
i. Methanal is warmed with Tollen's reagent ? [Q.N.22(i), 2063]
ii. Propanone is warmed with iodine and aqueous sodium hydroxide ? [Q.N.22(iii), 2063]
10. What happens when ?
(a) propanone reacts with PCl_5 ? [Q.N. 22(ii), 2064]
(b) ethanal if allowed to react with hydroxylamine ? [Q.N. 22(iii), 2064]
(c) Methanal reacts with ammonia. [Q.N. 23(b), 2062]
(d) Acetone reacts with hydroxyl amine. [Q.N. 23(d), 2062]
11. An organic compound ($C_5H_{10}O$) reacts with phenyl hydrazine to form phenyl hydrazone. The compound does not reduce Fehling's solution but gives Iodoform test. The compound on Clemmensen reduction gives n-pentane. Identify the organic compound giving necessary chemical equations. [Q.N. 21, 2058]
12. a) A carbonyl compound (X) gives addition product (Y) with methyl magnesium bromide. The compound (Y) on hydrolysis gives isopropyl alcohol. Identify X and Y.
b) Convert acetaldehyde to acetone. [Q.N. 21, 2057]
13. An alkene A on ozonolysis yields acetone and an aldehyde. The aldehyde is easily oxidised to an acid B. When B is treated with Br_2/P it yields a compound C which on hydrolysis gives a hydroxy acid D. This acid can also be obtained from acetone by the reaction with HCN followed by hydrolysis. Identify the compounds A, B, C, D. [Q.N.21,2054]

Long Questions

(All questions are of equal value, 10 marks each.)

1. An alkene (A) undergoes ozonolysis to give two carbonyl compounds (B) and (C). The compound (B) on reduction with $Zn-Hg/H^+$ gives propane. The compound (C) reacts with HCN and followed by Hydrolysis to produce 2-hydroxy propanoic acid as the major product. Write chemical reactions involved and give the IUPAC name of A, B and C. [Q.N. 31(b), 2071 Supp.]
2. Write any three methods of preparation of ethanal. How is ethanal converted into
i) 3-hydroxy butanal ii) Ethanoic acid [Q.N. 31(a), 2070 'C']
3. An alkene A undergoes ozonolysis to give two carbonyl compounds B and C. The compound B on reduction with $Zn-Hg/H^+$ gives propane. The compound C reacts with HCN and followed by hydrolysis to produce 2-hydroxy propanoic acid as the major product. Write chemical reactions involved and give the IUPAC name of A, B and C. [Q.N. 31(b), Set 'D' 2071]

4. Show your acquaintance with Cannizzaro reaction and Perkin Condensation. What happens when propanone is heated with 2,4-dinitrophenyl hydrazine. [Q.N. 31(a), 2070 'D']
5. Give examples of : 5+1+1+1+1+1
- (a) Aldol condensation [Q.N. 32 (a) (i), Supp. 2069]
- (b) DNPH test [Q.No. 32 (b) (i), Supp. 2069]
- (c) aldol condensation [Q.N. 32 (a), Set 'A' 2069]
- (d) DNPH test [Q.N. 32 (c), Set 'A' 2069]
6. Predict the major products of the following reactions:
- (i)
$$\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3 \xrightarrow{\text{NH}_2\text{OH}} \dots\dots\dots$$
 [Q.N. 29(b-iii), 2059]
7. Write the possible isomeric aldehydes and ketones that can be formed from $\text{C}_4\text{H}_8\text{O}$. Give their IUPAC names. Which one of these isomers give iodoform test and why? [Q.N. 29, 2060]
8. An organic compound A($\text{C}_4\text{H}_8\text{O}$) forms phenyl hydrazone with phenyl hydrazine and reduces Fehling's solution. It has negative iodoform test. Identify the organic compound A. [Q.N. 29(a), 2059]
9. Show your acquaintance with the following:
- a. Aldol condensation. [Q.N.30(b-III), 2056]
10. Give three general methods of preparation of aldehydes. Show your acquaintance with the following reactions (i) Aldol condensation (ii) Cannizzaro reaction [Q.N. 30, 2055]
11. Write short notes on :
- (a) Cannizzaro's reaction [Q.N. 28(b), 2053]

12.2 Aromatic Aldehydes and Ketones

Very Short Questions

(All questions are of equal value, 2 marks each.)

1. How does benzaldehyde reacts with: 1+1 [Q.N.12, 2072'D']
- i) Conc. NaOH
- ii) Acetic anhydride
2. What happens when: Benzaldehyde is heated with conc NaOH solution. [Q.N.12(ii), 2072'E']
3. What happens when benzaldehyde is heated with
- i. LiAlH_4 ii. Acetic anhydride in presence of sodium acetate. [Q.N. 12, 2070 'C']
4. Given an example of each of the following reaction:
- (i) Benzoin condensation [Q.N. 5(i), 2063]
5. Write an example of each of the following reaction :
- (i) Perkin's condensation [Q.N. 5(i), 2060]
6. Write an example of Perkin's condensation. [Q.N. 5, 2059]
7. Give an example (with formula) each from aromatic aldehydes which give Cannizzaro reaction. [Q.N. 5, 2058]

Short Questions

(All questions are of equal value, 5 marks each.)

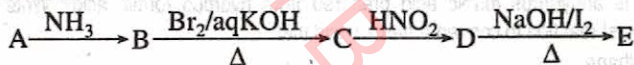
1. What action takes place when :
- i. Benzaldehyde is heated with ethanoic anhydride in presence of sodium ethanoate? [Q.N.22(ii), 2063]
2. What happens when ?
- (a) benzaldehyde is warmed with aqueous NaOH? [Q.N. 22(i), 2064]
- (b) Benzaldehyde is refluxed with alcoholic KCN. [Q.N. 23(a), 2062]

19. What is decarbonylation? Give one example. [Q.N. 8, 2060]
 20. Why is chloroacetic acid stronger than acetic acid? [Q.N. 7, 2059]
 21. Why is methanoic acid stronger than ethanoic acid? [Q.N. 7, 2058]
 22. Write the name of the following components according to the IUPAC rule.
 (a) $\text{CH}_3\text{-C}(\text{CH}_3)_2\text{-CH}_2\text{-COOH}$ [Q.N. 18(b), 2056]
 23. Name:
 (a) $\text{CH}_3\text{-CH}_2\text{-C}(\text{CH}_3)_2\text{-CH}_2\text{-COOH}$ according to IUPAC rule. [Q.N. 10(b), 2052]

Short Questions

(All questions are of equal value, 5 marks each.)

1. Suggest any three suitable chemical reactions for the preparation of ethanoic acid. How is ethanoic acid converted into methanoic acid. 3+2 [Q.N.28, 2072'D']
 2. Give the chemical reactions for the preparation of ethanoic acid from (i) sodium ethoxide (ii) ethanenitrile (iii) methyl magnesium iodide. Why is acetic acid weaker acid than chloroacetic acid? 3+2 [Q.N.28, 2072'C']
 3. An aliphatic compound (A) reacts with SOCl_2 to give (B). (B) on reduction with H_2 in presence of Pd/BaSO_4 to give (C). When HCN is added to (C), produces (D). On hydrolysis of (D) in acidic medium forms (E). Compound (C) gives iodoform test and produces silver mirror with Tollen's reagent. Identify (A), (B), (C), (D), (E) and write reactions involved. 5 [Q.N.29, 2072'C']
 4. Identify A, B, C, D and E in the following reaction sequence and write reactions involved.



The compound E produces ethyne when heated with silver powder.

- 5 [Q.N.27, 2070 'Supp']
 5. Describe the method of preparation of anhydrous formic acid in the laboratory. 5 [Q.N. 27, 2070 'C']
 6. Describe the laboratory preparation of anhydrous formic acid with a neat and labelled diagram. [Q.N. 28, Supp. 2069]
 7. Write any three important methods of preparation of ethanoic acid. How would you obtain anhydrous formic acid from its aqueous solution? [Q.N.23, 2068]
 8. How is anhydrous formic acid prepared in the laboratory? Suggest suitable chemical methods for the conversion of formic acid into ethanoic acid and viceversa. [Q.N. 28, 2067]
 9. Starting from Methyl magnesium bromide (CH_3MgBr) how would you prepare:
 (i) ethanoic acid [Q.N.21(iii), 2065]
 10. Convert the following Organic compounds :
 (i) Ethanoic acid to methanoic acid [Q.N. 22(ii), 2062]
 11. What happens when?
 (a) Methanoic acid is warmed with ammoniacal silver nitrate. [Q.N. 23(e), 2062]
 12. What products are obtained when CH_3COOH is allowed to react with
 (a) NaOH (b) NaOH/CaO
 (c) PCl_5 (d) P_2O_5 (e) LiAlH_4
 Also mention reaction condition where ever relevant. [Q.N. 22, 2061]
 13. Why is P_2O_5 not used for the preparation of anhydrous formic acid? Suggest a suitable method for the preparation of anhydrous formic acid. [Q.N. 23, 2059]

14. Convert the following:

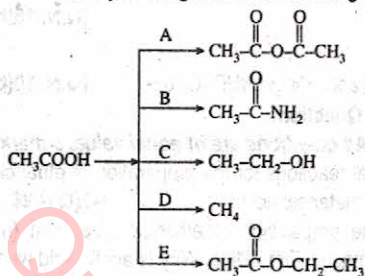
a. Ethane to ethanoic acid.

[Q.N. 26(a), 2056]

b. Ethylamine to methylamine

[Q.N. 26(b), 2056]

15. How would you bring about the following conversions ?



[Q.N. 26, 2055]

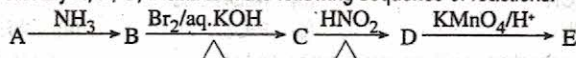
Long Questions

(All questions are of equal value, 10 marks each.)

- Write any three methods of preparation of ethanoic acid. How is ethanoic acid distinguished from methanoic acid? [3+2] [Q.N.31 (b), 2072'E']
- How will you prepare ethanoic acid from 5 [Q.N.31(a), Supp. 2071]
 - tribromoethane
 - ethanenitril
 - CH_3MgI . What happens when ethanoic acid is
 - heated with P_2O_5
 - treated with SOCl_2
- How is anhydrous formic acid prepared from hydrous formic acid? Write suitable chemical reaction to convert ethanoic acid into:
 - Methane
 - Methyl ethanoate
 - ethanoic anhydride [Q.N. 31(a), Set 'C' 2071]
- How will you prepare ethanoic acid from
 - tribromomethane
 - ethanenitrile
 - methyl magnesium iodide. What happens when ethanoic acid is:
 - heated with P_2O_5 .
 - treated with SOCl_2 . [Q.N. 31(a), Set 'D' 2071]
- How is ethanoic acid prepared from methyl magnesium iodide? What happens when ethanoic acid is,
 - Heated with P_2O_5
 - Heated with HI in presence of red phosphorous.
 - Passed over heated MnO .
 - Warmed with ethanol in presence of conc. H_2SO_4 .
- $$\text{A} \xrightarrow{\text{NH}_3} \text{B} \xrightarrow{\text{Br}_2/\text{aq. KOH}} \text{C} \xrightarrow{\text{HNO}_2} \text{D} \xrightarrow{\text{NaOH}/\text{I}_2} \text{E}$$

Compound E produces ethyne when heated with silver powder. 5×1=5 [Q.N. 31(b), 2070 'D']

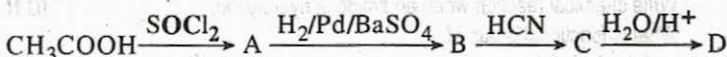
7. Identify A, B, C, D and E in the following sequence of reactions.



The compound (E) can be obtained by heating oxalic acid in presence of glycol.

[Q.N. 30(b), Set 'B' 2069]

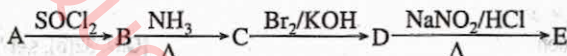
8. Identify each lettered in the following reaction sequence:



What major product would you obtain when B is treated with alkaline solution of hydrazine and ethylene glycol? [Q.N.28(b), 2068]

9. How is anhydrous formic acid prepared in the laboratory? Suggest suitable chemical methods for the conversion of formic acid into ethanoic acid and viceversa. [Q.N. 28, 2067]
10. Write any three methods of preparation of ethanoic acid. How would you convert ethanoic acid into (i) Ethanoic anhydride and (ii) Methyl ethanoate respectively. [Q.N. 29(a), 2066]
11. Describe the preparation of methanoic acid in the laboratory. How is anhydrous acid obtained from it? How does methanoic acid act upon : -
(i) Fehling's solution (ii) methanol/H⁺ (iii) Conc. H₂SO₄? [Q.N. 29, 2064]

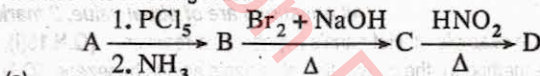
12. Consider a reaction:



The compound, E is a primary alcohol which has positive iodoform test. Identify A, B, C, D and E. [Q.N.29(b), 2063]

13. Describe the preparation of anhydrous formic acid in laboratory. How is it converted to acetic acid? [Q.N. 28, 2057]

14. Consider the following reaction



(a)

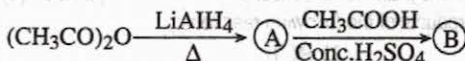
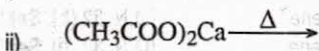
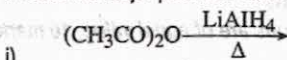
The compound, A is a carboxylic acid. Calcium salt of A on heating gives acetone. Identify A, B, C and D. [Q.N. 29(a), 2057]

13.2 Derivatives of Carboxylic Acid:

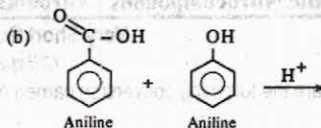
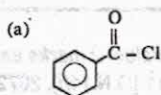
Very Short Questions

(All questions are of equal value, 2 marks each.)

1. Identify (A) and (B) in the following sequence of reaction and given their IUPAC name. [Q.N.13, 2072'C']
2. Predict the major products of the following reaction: 1+1 [Q.N.13, 2072'D']



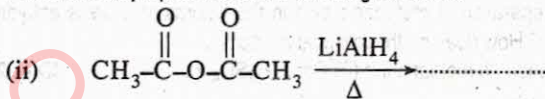
3. What happens when:
i. Zinc is exposed to moist air.
ii. White vitriol is strongly heated. [Q.N.20, 2072'E']
4. Convert ethanoyl chloride to methanol. [Q.N.4, 2063]
5. Complete the following equations: [Q.N. 5, 2061]



6. What happens when benzamide is heated with bromine and aq. KOH? [Q.N. 8, 2059]
 7. Write chemical reaction when an amide is hydrolyzed. [Q.N. 7, 2057]
 8. What is functional group of:
 a. Ester b. Amide [Q.N. 11, 2052]

Short Questions*(All questions are of equal value, 5 marks each.)**The short answer questions have not been asked from this lesson yet.***Long Questions***(All questions are of equal value, 10 marks each.)*

1. Predict the major products of the following reactions:



[Q.N. 29(b-v), 2059]

2. Given example of:

(a) Esterification

[Q.N. 32(b), set 'A' 2069]

(b) Esterification

[Q.No. 32(b), (ii), Supp. 2069]

(c) Friedelcraft's alkylation

[Q.No. 32 (b) (iii), Supp. 2069]

13.3 Aromatic Carboxylic Acids:**Very Short Questions***(All questions are of equal value, 2 marks each.)*

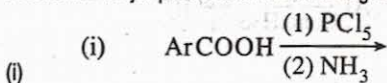
1. Define and give an example of: Hofmann's hypobromite reaction. [Q.N.15(i), 2072'E']
 2. Mention suitable method for the conversion of benzoic acid to benzene. [Q.N.6, 2068]
 3. How is benzoic acid prepared from benzene. [Q.N. 6, 2067]
 4. How is benzoic acid prepared from benzene? [Q.N. 7, 2066]

Short Questions*(All questions are of equal value, 5 marks each.)*

1. What happens when?
 (a) benzoic acid is nitrated? [Q.N. 22(iv), 2064]
 2. How could you synthesise benzoic acid from aniline? [Q.N. 22(b), 2059]
 3. Write the chemical equation, with conditions for the following reaction.
 (a) Benzoic acid is nitrated [Q.N. 23(b), 2057]

Long Questions*(All questions are of equal value, 10 marks each.)*

1. Perform the following conversion:
 (a) Benzoic acid to p-aminoazobenzene [Q.N. 32 (b), Set 'C' 2071]
 (b) Benzoic acid to p-aminoazobenzene [Q.N. 30 (b), Set 'D' 2071]
 2. Predict the major products of the following reactions:



[Q.N. 29(b-ii), 2059]

Unit 14: Nitrocompounds**14.1 Aliphatic Nitrocompounds (Nitroalkane)****Very Short Questions***(All questions are of equal value, 2 marks each.)*

1. How are the following conversion carried out? 1+1 [Q.N.14(i), 2072'C']

- i) Nitroethane into N-ethyl hydroxylamine.
 2. How does nitroalkane react with:
 i) Zn/NH_4Cl ii) Sn/HCl [Q.N. 14, Set 'C' 2071]

Short Questions*(All questions are of equal value, 5 marks each.)**The short answer questions have not been asked from this lesson yet.***Long Questions***(All questions are of equal value, 10 marks each.)**The long answer questions have not been asked from this lesson yet.***14.2 Aromatic Nitrocompounds****Very Short Questions***(All questions are of equal value, 2 marks each.)*

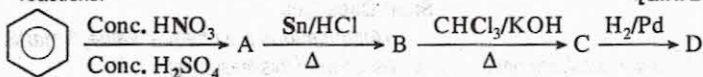
- How are the following conversion carried out? 1+1 [Q.N.14(ii), 2072'C']
 i) Nitrobenzene into azobenzene.
- Convert nitrobenzene into : 1+1 [Q.N.14, 2072'D']
 i) P-aminophenol
 ii) Hydrazobenzene
- Electrophilic substitution reaction in nitrobenzen occurs at meta position. Give reason. 2 [Q.N.14, Supp. 2071]
- Electrophilic substitution reaction in nitroarene occurs at meta position. Give reason. [Q.N. 14, Set 'D' 2071]
- Convert nitrobenzene in p-aminoazobenzene. [Q.N.15, 2070 'Supp']
- Why is $-NO_2$ group a metadirecting towards the electrophilic aromatic substitution? [Q.N. 14, 2070 'D']
- Why does nitrobenzene undergo electrophilic substitution reaction in meta position? [Q.N. 14, Supp. 2069]
- What products would you expect when Nitro benzene is treated with:
 i) $Zn/NaOH$ ii) Electrolytic reduction. [Q.N. 15, Set 'B' 2069]
- Why does nitrobenzene undergo electrophilic substitution reaction in meta position? [Q.N. 14, Set 'A' 2069]
- Explain why is $-NO_2$ group a meta directing group towards electrophilic aromatic substitution? [Q.N. 8, 2062]
- Account for the fact that $-NO_2$ group is a meta directing group towards electrophilic aromatic substitution. [Q.N. 8, 2058]
- Why is $-NO_2$ a metadirecting group towards electrophilic aromatic substitution? [Q.N. 8, 2057]
- Why is $-NO_2$ group meta directing in electrophilic aromatic substitution reaction? [Q.N. 17, 2055]
- Explain with any one example of electrophilic substitution in aromatic compounds. [Q.N. 17, 2054]

Short Questions*(All questions are of equal value, 5 marks each.)*

- What happens when nitrobenzene is reduced in acidic, neutral, alkaline and electrolytic conditions? [Q.N. 25, 2070 'D']
- Write the resonating structures of nitrobenzene and explain why does it give meta substituted product during electrophilic substitution? How is nitrobenzene converted to p-hydroxy azo benzene? [Q.N.21, 2063]
- Write the chemical equation, with conditions for the following reaction.

a) Nitrobenzene is reduced in neutral medium. [Q.N. 23(d), 2057]

4. Write the structures of organic compound A, B, C and D in the following sequence of reactions. [Q.N. 25, 2056]

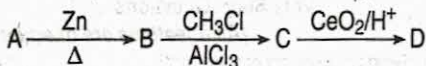


5. How is nitro-benzene prepared in laboratory? [Q.N. 27, 2056]

Long Questions

(All questions are of equal value, 10 marks each.)

1. How is dry and pure nitrobenzene prepared in the laboratory. Identify A, B, C and D in the following reaction sequence:



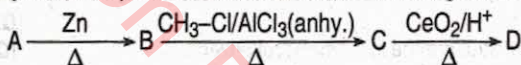
Compound D when react with zinc amalgam in presence of acid to give toluene.

6+4[Q.N.31, 2072'C']

2. (a) Give a chemical reaction for the preparation of nitrobenzene from benzene, starting from nitrobenzene how will you prepare 1+4+4+1 [Q.N.30, Supp. 2071]

- (i) Azobenzene (ii) oxyazobenzene
(iii) hydrazobenzene (iv) TNT

- (b) Identify the major products A, B, C and D in the following reaction sequences.



Compound D gives methylebenzene when heated with alc KOH and hydrazine.

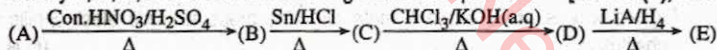
3. How is pure nitrobenzene prepared in the laboratory? Perform the following conversion:

(a) nitrobenzene to p-hydroxyazobenzene [Q.N.32 (a), Set 'C' 2071]

4. How is pure nitrobenzene prepared in the laboratory? Perform the following conversions.

(a) nitrobenzene to p-hydroxyazobenzene [Q.N. 30 (a), Set 'D' 2071]

5. Identify A, B, C, D and E in the following reaction sequences. [Q.N. 30(b), 2070 'C']



Compound A can be obtained by heating phenol in presence of Zn-dust.

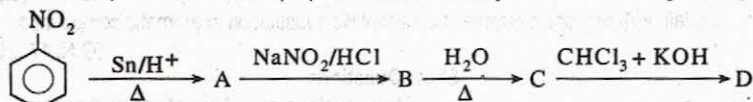
6. How is nitrobenzene prepared in the laboratory in pure and dry state?

[Q.N. 30 (a), 2070 'D']

7. Write short notes on Laboratory preparation of nitrobenzene [Q.N. 33 (d), Supp. 2069]

8. How is nitrobenzene prepared in the laboratory? [Q.N. 31(a), Set 'B' 2069]

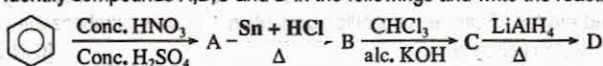
9. How is pure nitro-benzene prepared in the laboratory? [Q.N. 30, 2067]



What happens when C is treated with aqueous bromine?

10. How is dry and pure nitrobenzene prepared on laboratory? [Q.N. 28(a), 2066]

11. Identify compounds A, B, C and D in the followings and write the reactions involved:



[Q.N. 28(b), 2066]