OPEN STUDENT FOUNDATION
STD: 12th Chemistry
Practice Sheet Day -6

Chapters: 6 | Date : 24/02/24

Section A

● **Choose correct answer from the given options. [Each carries 1 Mark]** **[10]**

1. By which reaction Freon-12 is prepared from CCl_4 ?

(A) Wurtz Reaction (B) Fitting Reaction (C) Swarts Reaction (D) Finkelstein Reaction

2. Which has the fastest SN_2 reaction rate ?

(A) $C_6H_5CH(CH_3)Br$ (B) $C_6H_5CH(C_6H_5)Br$ (C) $C_6H_5C(CH_3)(C_6H_5)Br$ (D) $C_6H_5CH_2Br$

3. Polarimeter is used to determine _____ of compounds.

(A) D and L Configuration (B) *d* and *l* Configuration

(C) R and S Configuration (D) Both D and L aswell as *d* & *l* Configuration

4. 50% of the reagent is used for dehydrohalo genation of 6.45 gm CH_3CH_2Cl what will be the weight of the main product obtained ?

[At. mass of H, C and Cl are 1, 12 and 35.5 gm/mol^{-1} respectively]

(A) 0.7 gm (B) 1.4 gm (C) 2.8 gm (D) 5.6 gm

5. Which of the following statement is incorrect for bimolecular nucleophylic substiturion reaction (SN^2) ?

(A) It is a second order reaction

(B) In SN^2 reaction the substrate does not undergo heterocylic fission

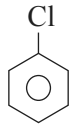
(C) The rate of SN^2 reaction does not depends on concentrations of both substrate and nucleophilic reagent.

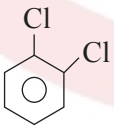
(D) SN^2 reaction occurs in single step without proming inter mediate.

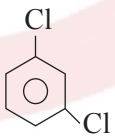
6. What is 3-Bromopropene's common name ?

(A) Allyl bromide (B) Vinyl bromide (C) Tert-Butyl bromide (D) Propylidene bromide

7. Which substance has highest melting point ?

(A) 

(B) 

(C) 

(D) 

8. Indicate decreasing order of reactivity of HX for reaction $R - OH + HX \rightarrow R - X + H_2O$.

(A) HI > HBr > HCl > HF (B) HBr > HCl > HI > HF

(C) HCl > HBr > HI > HF (D) HF > HBr > HCl > HI

9. $X \xrightarrow{PCl_5} C_2H_5Cl$; $Y \xrightarrow{PCl_3} CH_3COCl$ identify X and Y.

(A) C_2H_5I and C_2H_5CHO (B) C_2H_5OH and CH_3CO_2H

(C) $(C_2H_5)_2O$ and CH_3CO_2H (D) C_2H_5OH and C_2H_5CHO

10. Identify (Z) in the following reaction series,

$C_2H_5I \xrightarrow[KOH]{\text{Alcoholic}} (X) \xrightarrow{Br_2} (Y) \xrightarrow{KCN} (Z)$:

(A) $CH_3 - CH_2 - CN$ (B) $CH_2(CN) - CH_2(CN)$ (C) $CH_2(Br) - CH_2(CN)$ (D) $CH(Br) = CH(CN)$

Section B

● **Write the answer of the following questions. [Each carries 2 Marks]** **[10]**

1. What are Vinylic halides and Aryl halides Explain with examples.
2. Write short note on triiodomethane (Iodoform)
3. Give Fittig, Wurtz – Fittig and Grignard reaction of haloarene.
4.)Explain zaitsev or Saytzeff rule with example.
5. What is racemic mixture ?

Section C

● **Write the answer of the following questions. [Each carries 3 Marks]** **[12]**

6. Explain the preparation of haloalkanes from hydrocarbon.
7. Explain molecular asymmetry, chirality and enantiomers.
8. What is neucleophilic substitution reactions. Write down different products obtain from alkyl halides.
9. Explain unimolecular Nucleophilic substitution (S_N1) reaction with mechanism.

Section D

● **Write the answer of the following questions. [Each carries 4 Marks]** **[12]**

10. Write the structure of the major organic product in each of the following reactions :

(i) $CH_3 - CH_2 - CH_2 - Cl + NaI \xrightarrow[\text{heat}]{\text{acetone}}$ (ii) $(CH_3)_3CBr + KOH \xrightarrow[\text{heat}]{\text{ethanol}}$

(iii) $CH_3CH(Br)CH_2CH_3 + NaOH \xrightarrow{\text{water}}$ (iv) $CH_3CH_2Br + KCN \xrightarrow{\text{aq. ethanol}}$

(v) $C_6H_5ONa + C_2H_5Cl \longrightarrow$ (vi) $CH_3CH_2CH_2OH + SOCl_2 \longrightarrow$

(vii) $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{peroxide}}$ (viii) $CH_3CH = C(CH_3)_2 + HBr \longrightarrow$

11. Primary alkyl halide C_4H_9Br (a) reacted with alcoholic KOH to give compound (b). Compound (b) is reacted with HBr to give (c) which is an isomer of (a). When (a) is reacted with sodium metal it gives compound (d), C_8H_{18} which is different from the compound formed when n-butyl bromide is reacted with sodium. Give the structural formula of (a) and write the equations for all the reactions.
12. Explain Halogenation, Nitration, Sulphonation and Friedel crafts reaction of chlorobenzene.[4-marks]

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➠ Ans : (C)

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➠ Ans : (D)

3. Polarimeter is used to determine _____ of compounds.

(A) D and L Configuration (B) *d* and *l* Configuration

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➠ Ans : (B)

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[At. mass of H, C and Cl are 1, 12 and 35.5 gm/mol^{-1} respectively]

(A) 0.7 gm (B) 1.4 gm (C) 2.8 gm (D) 5.6 gm

Ans. (B)

➪ $CH_3CH_2Cl + KOH \xrightarrow[\Delta]{\text{Ethanol}} CH_2 = CH_2 + KCl + H_2O$

1 mol 1 mol

64.5 gm 28 gm

64.5 gm $\rightarrow$ 28 gm

6.45 gm $\rightarrow$ (?)

$= \frac{6.45 \times 28}{64.5} = 2.8$ gm

But reagent is 50% so product will be 1.4 gm.

5. Which of the following statement is incorrect for bimolecular nucleophylic substiturion reaction (SN^2) ?

(A) It is a second order reaction

(B) In SN^2 reaction the substrate does not undergo heterocylic fission

(C) The rate of SN^2 reaction does not depends on concentrations of both substrate and nucleophilic reagent.

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➠ Ans : (C)

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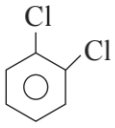
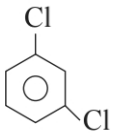
(A) Allyl bromide (B) Vinyl bromide (C) Tert-Butyl bromide (D) Propylidene bromide

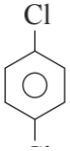
➠ Ans : (A)

7. Which substance has highest melting point ?

(A) 

(B) 

(C) 

(D) 

Cl

➠ Ans : (D)

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(A) HI > HBr > HCl > HF (B) HBr > HCl > HI > HF

(C) HCl > HBr > HI > HF (D) HF > HBr > HCl > HI

➠ Ans : (A)

9. $X \xrightarrow{PCl_5} C_2H_5Cl$; $Y \xrightarrow{PCl_3} CH_3COCl$ identify X and Y.

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➠ Ans : (B)

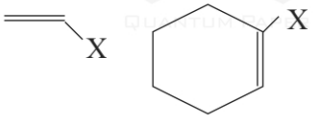
Section B

● **Write the answer of the following questions. [Each carries 2 Marks]** **[10]**

1. What are Vinylic halides and Aryl halides Explain with examples.

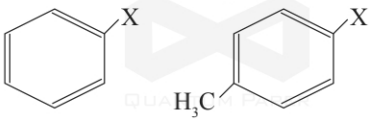
➪ (a) Vinylic halides

➠ These are the compounds in which the halogen atom is bonded to a sp^2-hybridised carbon atom of a carbon-carbon double bond (C = C).



➪ (b) Aryl halides

➠ These are the compounds in which the halogen atom is directly bonded to the sp^2-hybridised carbon atom of an aromatic ring.



2. Write short note on triiodomethane (Iodoform)

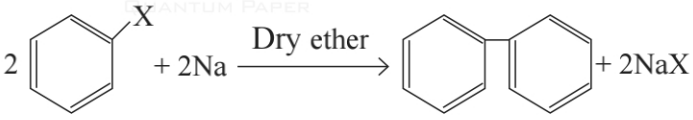
➪ It was used earlier as an antiseptic but the antiseptic properties are due to the liberation of free iodine and not due to iodoform itself.

➪ Due to its objectionable smell, it has been replaced by other formulations containing iodine.

3. Give Fittig, Wurtz – Fittig and Grignard reaction of haloarene.

➪ (1) Fittig reaction :

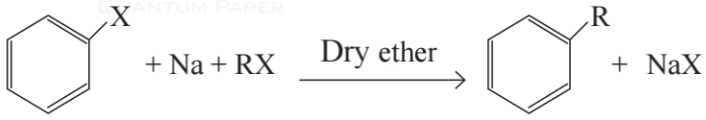
➪ Aryl halides also give analogous compounds when treated with sodium in dry ether, in which two aryl groups are joined together. It is called Fittig reaction.



Diphenyl

(2) Wurtz-Fittig reaction :

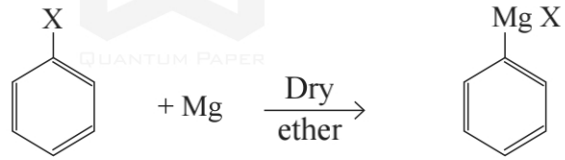
➪ A mixture of an alkyl halide and aryl halide gives an alkylarene when treated with sodium in dry ether and is called Wurtz-Fittig reaction.



Halogrene Alkylbenzene

(3) Grignard reaction :

➪ Aryl nalide compounds react with Mg Metal in presence of Dry ether & gives Aryl Magnesium halide.



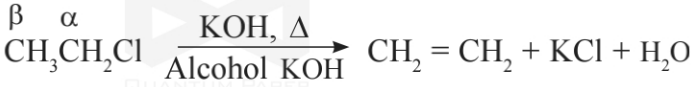
Aryl halide Aryl magnesium halide

4.)Explain zaitsev or Saytzeff rule with example.

➪ When a haloalkane with β-hydrogen atom is heated with alcoholic solution of potassium hydroxide, there is elimination of hydrogen atom from βcarbon and a halogen atom from the α-carbon atom.

B = Base ; X=Leaving group

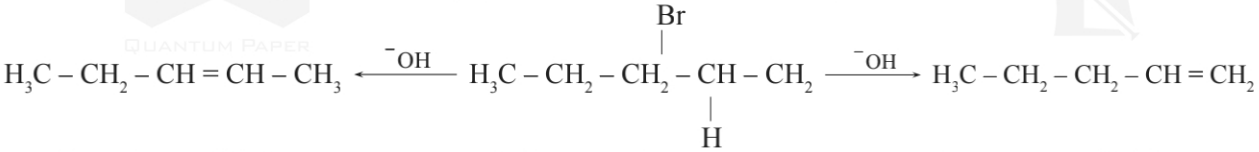
➪ As a result, an alkene is formed as a product. Since β-hydrogen atom is involved in elimination, it is often called β-elimination.



➪ If there is possibility of formation of more than one alkene due to the availability of more than one β-hydrogen atoms, usually one alkene is formed as the major product.

➪ These form part of a pattern first observed by Russian chemist, Alexander Zaitsev (also pronounced as Saytzeff).

➪ A rule which can be summarised as "in dehydrohalogenation reactions, the preferred product is that alkene which has the greater number of alkyl groups attached to the doubly bonded carbon atoms."



Pent-2-ene (81%) 2-Bromopentane Pent-1-ene (19%)

➪ Thus, 2-bromopentane gives pent-2-ene as the major product.

5. What is racemic mixture ?

➪ A mixture containing two enantiomers in equal proportions will have zero optical rotation, as the rotation due to one isomer will be cancelled by the rotation due to the other isomer. Such a mixture is known as racemic mixture or racemic modification.

➪ A racemic mixture is represented by prefixing dl or (±) before the name, for example (±) butan-2-ol. The process of conversion of enantiomer into a racemic mixture is known as racemisation.

Section C

● **Write the answer of the following questions. [Each carries 3 Marks]** **[12]**

6. Explain the preparation of haloalkanes from hydrocarbon.

➪ (I) From alkanes by free radical halogenation :

➠ Free radical chlorination or bromination of alkanes gives a complex mixture of isomeric mono- and polyhaloalkanes, which is difficult to separate as pure compounds. Consequently, the yield of any single compound is low.

e.g.

(i) $CH_3 - CH_3 \xrightarrow[\text{Or heat}]{Cl_2/\text{UV Light}} CH_3 - CH_2 - Cl$

(ii) $\underset{\text{n-butane}}{CH_3CH_2CH_2CH_3} \xrightarrow[\text{Or heat}]{Cl_2/\text{UV Light}} \underset{\text{1-chloro butane (Minor)}}{CH_3CH_2CH_2CH_2Cl} + \underset{\text{2-chloro butane (Major)}}{CH_3CH_2CHClCH_3}$

➪ (II) From alkenes :

(i) Addition of hydrogen halides :

➠ An alkene is converted to corresponding alkyl halide by reaction with hydrogen chloride, hydrogen bromide or hydrogen iodide.

$$>C=C< + HX \rightarrow >\underset{H}{C}-\underset{X}{C}<$$

➠ Propene yields two products, however only one predominates as per Markovnikov's rule.

$$\underset{\text{Propene}}{CH_3CH=CH_2} + H\text{–}I \rightarrow \underset{\substack{\text{Minor}\\\text{1-Iodo Propane}}}{CH_3CH_2CH_2I} + \underset{\substack{\text{Major}\\\text{2-Iodo Propane}}}{CH_3CHICH_3}$$

➪ (ii)Addition of halogens:

➠ In the laboratory, addition of bromine in CCl_4 to an alkene resulting in discharge of reddish brown colour of bromine constitutes an important method for the detection of double bond in a molecule.

➠ The addition results in the synthesis of vic-dibromides, which are colourless.

$$\begin{matrix}H\\H\end{matrix}\!\!>C=C<\!\!\begin{matrix}H\\H\end{matrix} + Br_2 \xrightarrow{CCl_4} \underset{\textit{vic}\text{-Dibromide}}{BrCH_2 - CH_2Br}$$

7. Explain molecular asymmetry, chirality and enantiomers.

➪ The observation of Louis Pasteur (1848) that crystals of certain compounds exist in the form of mirror images laid the foundation of modern stereochemistry.

➪ He demonstrated that aqueous solutions of both types of crystals showed optical rotation, equal in magnitude (for solution of equal concentration) but opposite in direction.

➪ He believed that this difference in optical activity was associated with the three dimensional arrangements of atoms in the molecules (configurations) of two types of crystals.

➪ Dutch scientist, J. Van't Hoff and French scientist, C. Le Bel in the same year (1874), independently argued that the spatial arrangement of four groups (valencies) around a central carbon is tetrahedral and if all the substituents attached to that carbon are different, the mirror image of the molecule is not superimposed (overlapped) on the molecule; such a carbon is called asymmetric carbon or stereocentre.

➪ The resulting molecule would lack symmetry and is referred to as asymmetric molecule.

➪ Chirality :

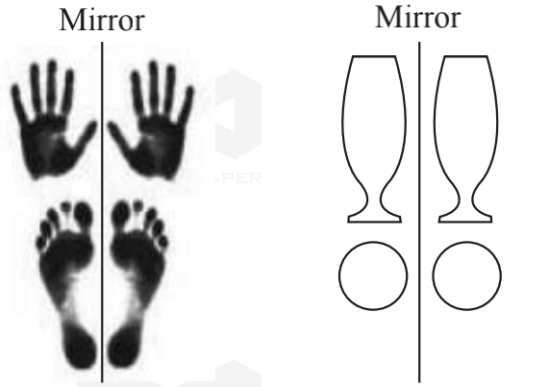
➪ The symmetry and asymmetry are also observed in many day to day objects: a sphere, a cube, a cone, are

all identical to their mirror images and can be superimposed.

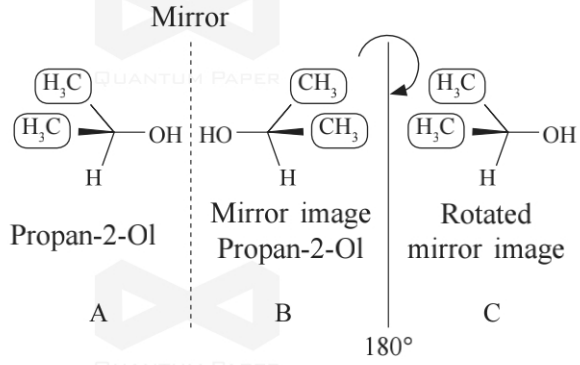
- However, many objects are non superimposable on their mirror images. For example, your left and right hand look similar but if you put your left hand on your right hand by moving them in the same plane, they do not coincide.
- The objects which are non- superimposable on their mirror image (like a pair of hands) are said to be chiral and this property is known as chirality.
- Chiral molecules are optically active,
- while the objects, which are, superimposable on their mirror images are called achiral. These molecules are optically inactive.

CHIRALITY

An object that can not be superimposed on its mirror image is called chiral



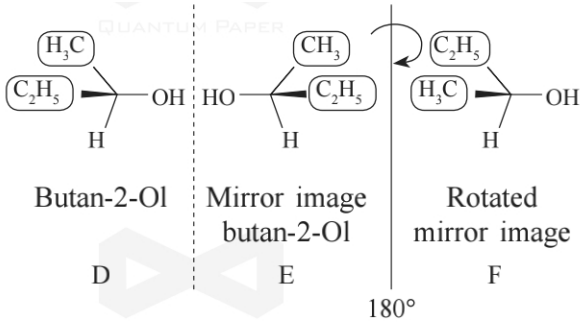
- The above test of molecular chirality can be applied to organic molecules by constructing models and its mirror images or by drawing three dimensional structures and attempting to superimpose them in our minds.
- Let us consider two simple molecules propan-2-Ol and butan-2-Ol and their mirror images.



B is imrror image of A; B is rotated by 180° and C is obtained; C is superimposable on A.

- As you can see very clearly, propan-2-Ol (A) does not contain an asymmetric carbon, as all the four groups attached to the tetrahedral carbon are not different.
- We rotate the mirror image (B) of the molecule by 180° (structure C) and try to overlap the structure (C) with the structure (A), these structures completely overlap. Thus propan-2-ol is an achiral molecule.

Mirror



E is mirror image of D; E is rotated by 180° to get F and F is non superimposable on its mirror image D

- Butan-2-ol has four different groups attached to the tetrahedral carbon and as expected is chiral.
- Some common examples of chiral molecules such as 2-chlorobutane, 2, 3-dihyroxypropanal, (OHC–CHOH–CH2OH), bromochloro-iodomethane (BrClCHI), 2-bromopropanoic acid (H3C–CHBr–COOH), etc.
- The stereoisomers related to each other as non- superimposable mirror images are called enantiomers . A and B and D and E are enantiomers.
- Enantiomers possess identical physical properties namely, melting point, boiling point, refractive index, etc.
- They only differ with respect to the rotation of plane polarised light. If one of the enantiomer is dextro rotatory, the other will be laevo rotatory.

8. What is neucleophilic substitution reactions. Write down different products obtain from alkyl halides.

- Nucleophiles are electron rich species. Therefore, they attack at that part of the substrate molecule which is electron deficient.
- The reaction in which a nucleophile replaces already existing nucleophile in a molecule is called nucleophilic substitution reaction.
- Haloalkanes are substrate in these reactions.

$$Nu^- + -\overset{\delta+}{C} - \overset{\delta-}{X} \longrightarrow \diagup\!\!C - Nu + X^-$$

nucleophile substrate product Halide ion

- In this type of reaction, a nucleophile reacts with haloalkane (the substrate) having a partial positive charge on the carbon atom bonded to halogen.
- A substitution reaction takes place and halogen atom, called leaving group departs as halide ion. Since the substitution reaction is initiated by a nucleophile, it is called nucleophilic substitution reaction.
- It is one of the most useful classes of organic reactions of alkyl halides in which halogen is bonded to sp3 hybridised carbon.

$R - X + Nu^- \rightarrow R - Nu + X^-$

Reagent	Nucleophile (Nu^-)	Substitution product R – Nu	Class of main product
NaOH (KOH)	HO^-	ROH	Alcohol
H_2O	H_2O	ROH	Alcohol
NaOR'	$R'O^-$	ROR'	Ether
NaI	I^-	R-I	Alkyl iodide
NH_3	NH_3	RNH_2	Primary amine
$R'NH_2$	$R'NH_2$	RNHR'	Sec. amine
R'R"NH	R'R"H	RNR'R"	Tert. amine
KCN	$\bar{C}\equiv N:$	RCN	Nitrile (cyanide
AgCN	Ag-CN	RNC (isocyanide)	Isonitrile
KNO_2	O=N–O	R–O–N=O	Alkyl nitrite
$AgNO_2$	Ag–Ö–N=O	$R-NO_2$	Nitroalkane
R'COOAg	$R'COO^-$	R'COOR	Ester
$LiAlH_4$	H	RH	Hydrocarbon
R'^-M^+	R'	RR'	Alkane

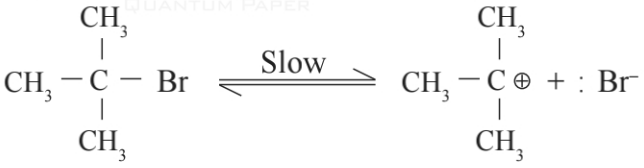
9. Explain unimolecular Nucleophilic substitution (S_N1) reaction with mechanism.

- S_N1 reactions are generally carried out in polar protic solvents (like water, alcohol, acetic acid etc.)
- The reaction between tert- butyl bromide and hydroxide ion yields tert-butyl alcohol and follows the first order kinetics,
- The rate of reaction depends upon the concentration of only one reactant, which is tert- butyl bromide.
- Rate = $K[(CH_3)_3\ C\ Br]$

$(CH_3)_3CBr + {}^-OH \longrightarrow (CH_3)_3\ COH + Br^-$

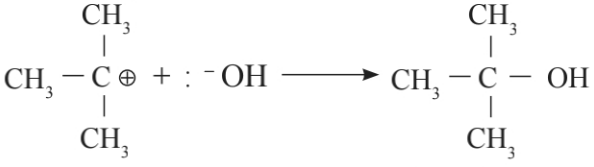
2-Bromo-2-methylpropane 2-methylpropane-2-01

- It occurs in two steps. In step I, the polarised C–Br bond undergoes slow cleavage to produce a carbocation and a bromide ion.
- Step 1 :



tert-butyl bromide

- The carbocation thus formed is then attacked by nucleophile in step II to complete the substitution reaction.
- Step 2 :



tert-butyl alconol

- Step I is the slowest and reversible. It involves the C–Br bond breaking for which the energy is obtained through solvation of halide ion with the proton of protic solvent.
- Since the rate of reaction depends upon the slowest step, the rate of reaction depends only on the concentration of alkyl halide and not on the concentration of hydroxide ion.

➪ Further, greater the stability of carbocation, greater will be its ease of formation from alkyl halide and faster will be the rate of reaction. In case of alkyl halides, 3° alkyl halides undergo SN^1 reaction very fast because of the high stability of 3° carbocations.

➪ Reactivity order for S_N1 reaction

➪ 3^0 halide > 2^0 – halide > 1^0 – halide > $CH_3 - X$

Section D

● **Write the answer of the following questions. [Each carries 4 Marks]** **[12]**

10. Write the structure of the major organic product in each of the following reactions :

(i) $CH_3 - CH_2 - CH_2 - Cl + NaI \xrightarrow[\text{heat}]{\text{acetone}}$ (ii) $(CH_3)_3CBr + KOH \xrightarrow[\text{heat}]{\text{ethanol}}$

(iii) $CH_3CH(Br)CH_2CH_3 + NaOH \xrightarrow{\text{water}}$ (iv) $CH_3CH_2Br + KCN \xrightarrow{\text{aq. ethanol}}$

(v) $C_6H_5ONa + C_2H_5Cl \longrightarrow$ (vi) $CH_3CH_2CH_2OH + SOCl_2 \longrightarrow$

(vii) $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{peroxide}}$ (viii) $CH_3CH = C(CH_3)_2 + HBr \longrightarrow$

➪ (i) $CH_3CH_2CH_2 - Cl + NaI \xrightarrow[\Delta]{\text{Acetone}} CH_3CH_2CH_2I + NuCl$

1-Chloropropan — 1-Iodopropane

➪ (ii) $(CH_3)_3CBr + KOH \xrightarrow[\Delta]{\text{Ethanol}} CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} = CH_2 + KBr + H_2O$

2-Bromo-2-methylpropane — 2-Methylpropene

➪ (iii) $CH_3CH(Br)CH_2CH_3 + NaOH \xrightarrow{\text{Water}} CH_3 - \underset{\displaystyle OH}{\overset{\displaystyle |}{CH}} - CH_2 - CH_3 + NaBr$

2-Bromobutane — Butan-2-Ol

➪ (iv) $CH_3CH_2Br + KCN \xrightarrow{\text{Ethanol}} CH_3 - CH_2 - CN + KBr$

Bromoethane — Propan Nitrile

➪ (v) $C_6H_5ONa + C_2H_5Cl \longrightarrow C_6H_5OC_2H_5 + NaCl$

Sodium phenoxide — Chloroethane — Ethoxybenzene

➪ (vi) $CH_3CH_2CH_2OH + SOCl_2 \longrightarrow CH_3CH_2CH_2Cl + SO_2 + HCl$

Propan-1-Ol — Chloropropane

➪ (vii) $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{Peroxide}} CH_3CH_2CH_2CH_2Br$

But-1-ene — 1-Bromobutane

➪ (viii) $CH_3CH = C(CH_3)_2 + HBr \longrightarrow CH_3 - CH_2 - \underset{\displaystyle Br}{\overset{\displaystyle |}{C}}(CH_3)_2$

2-methyl but-2-ene — 2-bromo-2-methyl butane

11. Primary alkyl halide C_4H_9Br (a) reacted with alcoholic KOH to give compound (b). Compound (b) is reacted with HBr to give (c) which is an isomer of (a). When (a) is reacted with sodium metal it gives compound (d), C_8H_{18} which is different from the compound formed when n-butyl bromide is reacted with sodium. Give the structural formula of (a) and write the equations for all the reactions.

➪ There are two primary alkyl halides having the formula, C_4H_9Br. They are *n* - bulyl bromide and isobutyl bromide.

$CH_3 - CH_2 - CH_2 - CH_2 - Br$ — n - Butyl bromide

$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2 - Br$ — lsobutyl bromide

➪ Therefore, compound (a) is either n-butyl bromide or isobutyl bromide.

➪ Now, compound (a) reacts with Na metal to give compound (b) of molecular formula, C_8H_{18} which is different from the compound formed when n-butyl bromide reacts with Na metal. Hence, compound (a) must be isobutyl bromide.

$$2CH_3CH_2CH_2CH_2Br \xrightarrow[\text{(Wurtz reaction)}]{2Na/\text{dry ether}} CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3 + 2NaBr$$

n-Butly bromide — *n*-Octane

$$2CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-Br \xrightarrow[\text{(Wurtz reaction)}]{2Na/\text{dry ether}} CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3 + 2NaBr$$

Isobutyl bromide (a) — 2,5-Dimethylhexane (d)

➪ Thus, compound (d) is 2, 5-dimethylhexane.

➪ It is given that compound (a) reacts with alcoholic KOH to give compound (b). Hence, compound (b) is 2-Methylpropane.

$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-Br \xrightarrow[\text{(Dehydrohalogenation)}]{KOH(acl)/\Delta} CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH_2 + H\,Br$$

Isobutyl bromide (a) — 2-Methylpropene (b)

➪ Also, compound (b) reacts with HBr to give compound (c) which is an isomer of (a).

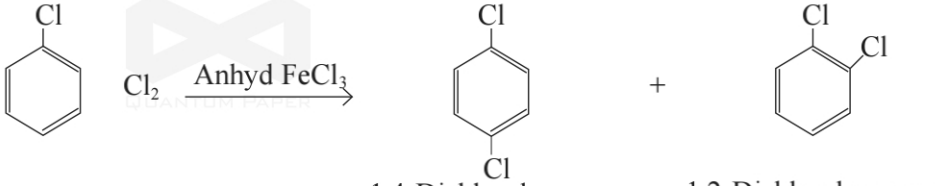
➪ Hence, compound (c) is 2-bromo-2-methylpropane.

$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}=CH_2 \xrightarrow[\text{(Markovnikov addition)}]{HBr} CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle Br}{\overset{|}{C}}}}-CH_3$$

2-Methylpropene (b) — 2-Bromo-2-Methylpropene (c) (as isomer of (a))

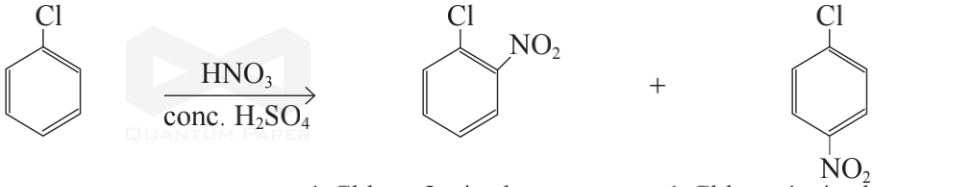
12. Explain Halogenation, Nitration, Sulphonation and Friedel crafts reaction of chlorobenzene. [4-marks]

➪ (i) Halogenation



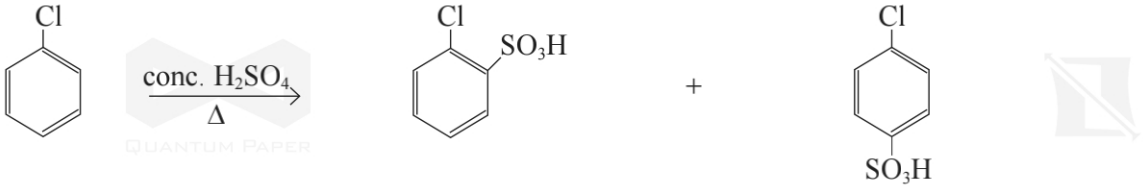
1,4-Dichlorobenzene (Major) + 1,2-Dichlorobenzene (Minor)

(ii) Nitration



1-Chloro-2-nitrobenzene (Minor) + 1-Chloro-4-nitrobenzene (Major)

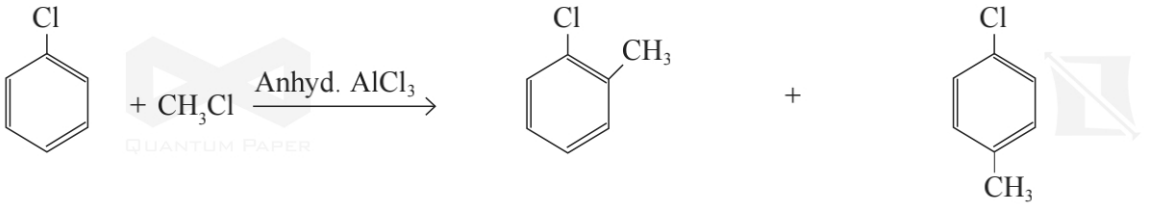
(iii) Sulphonation



2-Chlorobenzenesulphonic acid (Minor)

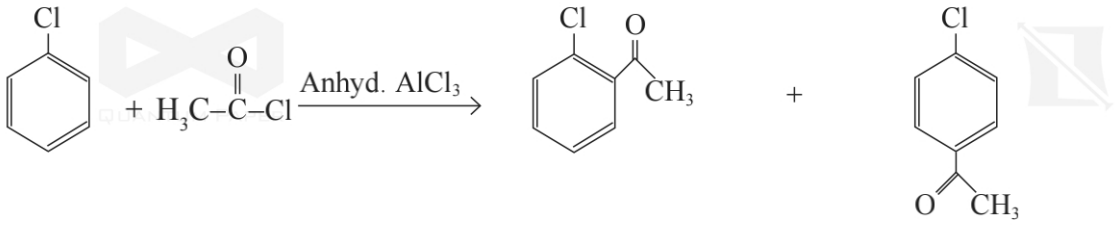
4-Chlorobenzenesulphonic acid (Major)

(iv) Friedel-Crafts reaction



1-Chloro-2-methylbenzene (Minor)

1-Chloro-4-methylbenzene (Major)



2-Chloroacetophenone (Minor)

4-Chloroacetophenone (Major)