

# ORGANIC CHEMISTRY

Unit X	Haloalkanes and Haloarenes	9	28
Unit XI	Alcohols, Phenols and Ethers	9	
Unit XII	Aldehydes, Ketones and Carboxylic Acids	10	
Unit XIII	Amines	7	
Unit XIV	Biomolecules	8	

## ORGANIC CHEMISTRY

1. IMPORTANT NAME REACTIONS
2. CHEMICAL DISTINGUISH TEST BETWEEN PAIR OF ORGANIC COMPOUNDS
3. REACTION MECHANISM
4. IMPORTANT CONVERSIONS
5. REASONING BASED QUESTIONS
6. CASE BASED / PARAGRAPH BASED QUESTIONS

## IMPORTANT NAME REACTIONS

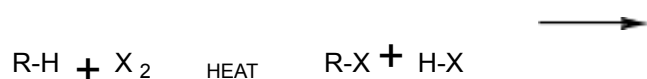
1. ALDOL REACTION AND CROSS-ALDOL REACTION
2. CARBYLAMINE REACTION
3. CANNIZZARO REACTION
4. CLEMMENSEN REDUCTION
5. ETARD REACTION
6. FINKELESTEIN REACTION
7. HELL-VOLHARD ZELINSKY REACTION
8. HOFFMANN DEGRADATION REACTION
9. REIMER-TIEMANN REACTION
10. ROSENMUND REDUCTION REACTION

### HALOALKANES AND HALOARENES (UNIT - 9)

The placement of hydrogen atom(s) in a hydrocarbon, aliphatic or aromatic, by halogen atom(s) results in the formation of alkylhalide



(haloalkane) and arylhalide (haloarene), respectively



## (A) IMPORTANT NAME REACTIONS

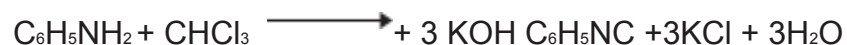
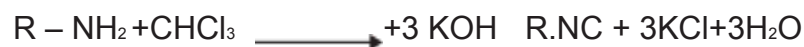
### i) Finkelstein Reaction



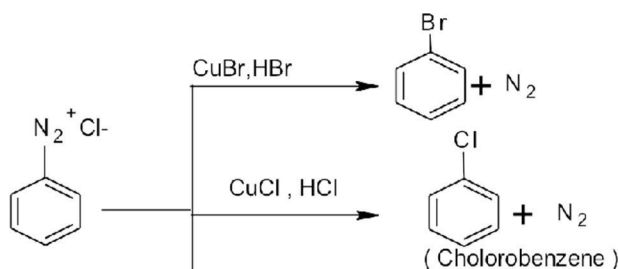
### ii) Swarts Reaction



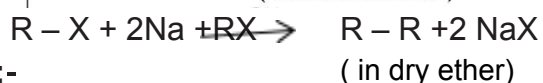
### 1. Carbylamines reaction



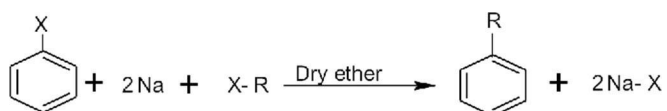
### 2. Sandmeyer's reaction



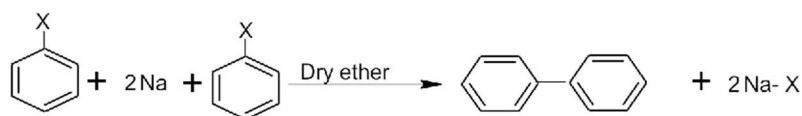
### 3. Wurtz Reaction



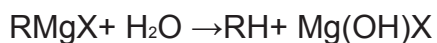
### 4. Wurtz Fittig reaction:-



### 5. Fittig reaction



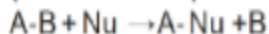
### 6. Grignard reagent:



## (B) IMPORTANT MECHANISM

i) Nucleophilic Substitution ii) Elimination reaction iii) Electrophilic substitution

i) **Nucleophilic Substitution** :- it involves the replacement of an atom or group of atoms by a nucleophile (electron rich species)



It is of two types:-

a) Unimolecular nucleophilic substitution reaction ( $S_N1$ )

b) Bimolecular nucleophilic substitution reaction ( $S_N2$ )

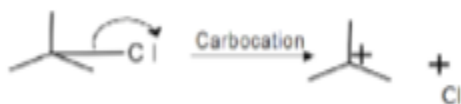
**a) Unimolecular substitution reaction ( $S_N1$ )**

(i) it involves two steps

(ii) in this retention/Racemization of configuration take place.

(iii) unimolecular and all are first order.

**Mechanism (step 1)** formation of carbocation.



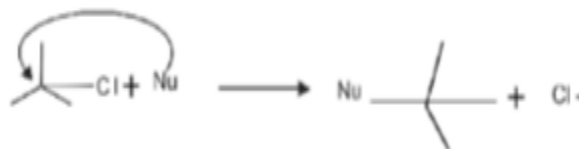
**Step 2** Attack of nucleophile on carbocation

( front/rear end)



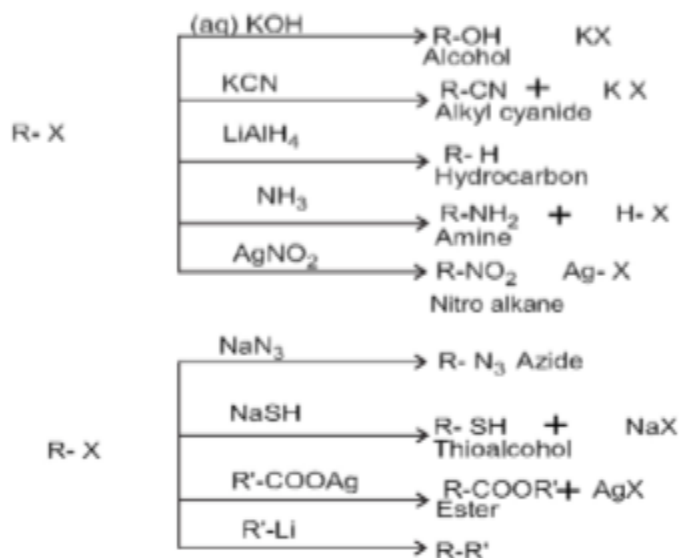
**Order of reactivity:**  $3^\circ > 2^\circ > 1^\circ$  ( Because  $3^\circ$  carbocation is more stable)

(b) **Bimolecular Nucleophilic Substitution  $S_N2$**  (i) it involves one step. (ii) in this inversion of configuration takes place. (iii) bimolecular mechanism: in this nucleophile attacks from the backside where halogen atom is attached. It facilitates the departure of leaving halide group.



**Order of reactivity:**  $1^\circ > 2^\circ > 3^\circ$  (Because of less steric hindrance in  $1^\circ$  alkyl halide)

## Nucleophilic substitution reaction of alkyl halides

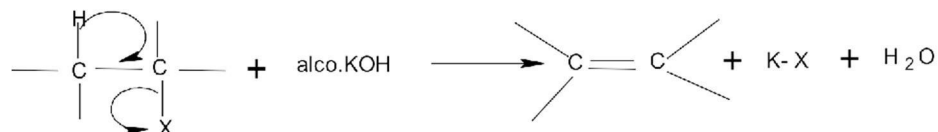


i)

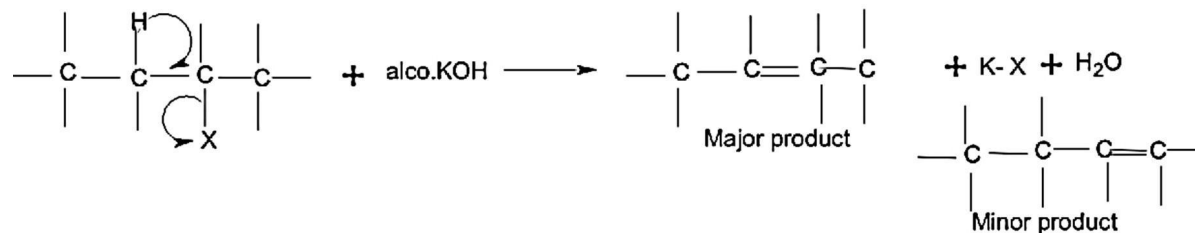


KX

i) **Elimination reaction** : Haloalkanes having hydrogen atom, when heated with alcoholic KOH, there is elimination of hydrogen atom from  $\beta$ -carbon and a halogen atom from the  $\alpha$ -carbon atom & alkene is formed. **Saytzeff rule** "in dehydrohalogenation reactions, the preferred product is that alkene which has the

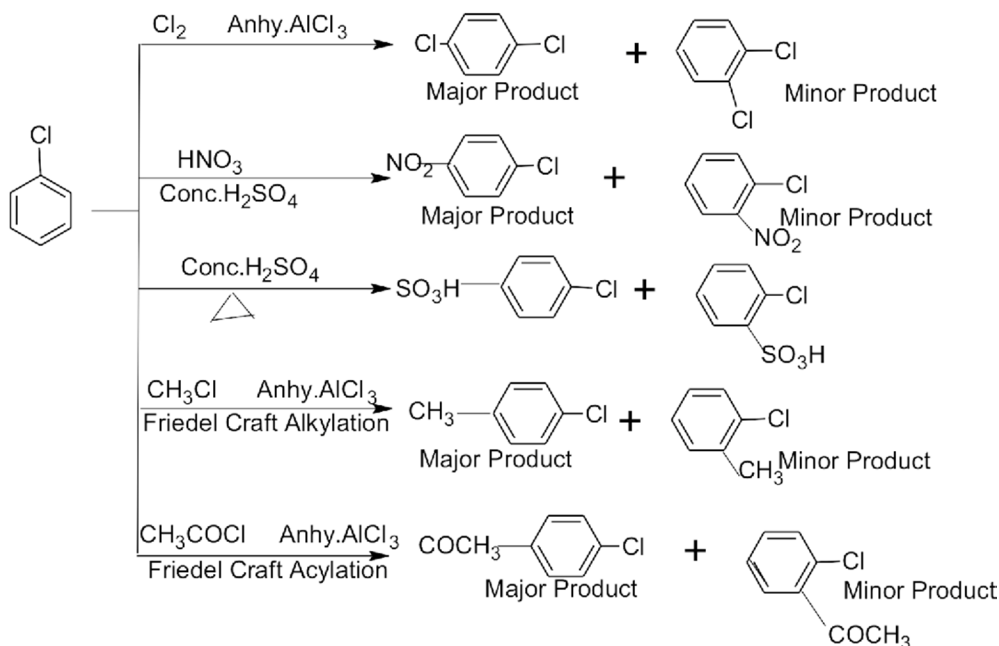
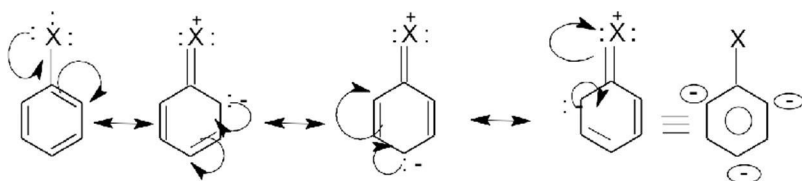


greater number of alkyl groups attached to the doubly bonded carbon atoms."



ii) **Electrophilic substitution**:-  
respect to the halogen atom.

substitution occurs at *ortho*- and *para*- positions with



**Q.1 What are ambident nucleophiles?** (1 Mark)

Ans. Nucleophiles which can attack through two different sites are called ambident nucleophiles. Example:-Cyanide ion:  $\text{CN}^-$  &  $\text{C}=\text{N}^-$

**Q.2 Which is a better nucleophile, a bromide ion or iodide ion?** (1 Mark)

Ans. Iodide ion because it has lower electronegativity and larger size.

**Q.3 Arrange the compounds of each set in order of reactivity towards  $\text{S}_{\text{N}}2$  displacement: 2-Bromo-2-methylbutane, 1-Bromopentane, 2-Bromopentane.** (1 Mark)

Ans. The reactivity in  $\text{S}_{\text{N}}2$  reactions depends upon steric hindrance; more the steric hindrance, slower the reaction. The order of reactivity in  $\text{S}_{\text{N}}2$  reactions follows the order:  $1^\circ > 2^\circ > 3^\circ$ . 1-Bromopentane  $>$  2-Bromopentane  $>$  2-Bromo-2-methylbutane.

**Q.4 Arrange the following in increasing order of boiling point.**

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ ,  $(\text{CH}_3)_3\text{CBr}$ ,  $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$ . (1 Mark)

Ans. The boiling point increases as the branching decreases, so the increasing order of boiling point is:  $(\text{CH}_3)_3\text{CBr} < (\text{CH}_3)_2\text{CHCH}_2\text{Br} < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$

**Q.5 Define optical activity?** (1 Mark)

Ans. The compounds which rotate the plane of polarized light when it is passed through their solutions are called optically active compounds and this property is known as optical activity.

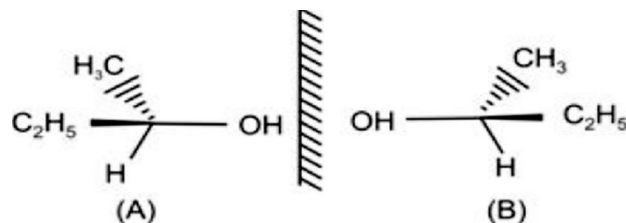
**Q.6 What is racemic mixture or racemic modification?** (1 Mark)

Ans. 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.

**Q.7 What are enantiomers?** (1 Mark)

Ans. The stereo isomers related to each other as non-superimposable mirror images are called enantiomers.



## ASSERTION -REASON TYPE

**A statement of assertion is followed by a statement of reason.**

**Mark the correct choice from the options given below:**

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

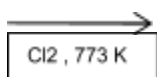
1. Assertion :  $S_N2$  reactions do not proceed with retention of configuration.

Reason :  $S_N2$  reactions proceed in a single step. ( Ans - b)

2. Assertion : Chloroform is generally stored in dark coloured bottles filled to the brim.

Reason : Chloroform reacts with glass in the presence of sun light. ( Ans - c)

3. Assertion :  $\text{CH}_3\text{-CH}=\text{CH}_2 \xrightarrow{\text{Cl}_2, 773 \text{ K}} \text{Cl-CH}_2\text{-CH}=\text{CH}_2 + \text{HCl}$



Reason : At high temperature,  $\text{Cl}_2$  dissociates into chlorine free radicals which bring about allylic substitution. ( Ans - a)

4. Assertion : Nucleophilic substitution reaction in an optically active alkyl halide gives a mixture of enantiomers.

Reason : Reaction occurs by  $S_N1$  mechanism. ( Ans - a)

5. Assertion : Primary allylic halides show higher reactivity in  $S_N1$  reactions than other primary alkyl halides.

Reason : Intermediate carbocation is stabilised by resonance. ( Ans - a)

One - word answer

1. Name the poisonous compound obtained when chloroform is exposed to air, in presence of sunlight. ( Ans - Phosgene)

2. Name the compound formed when Grignard's reagent is exposed to moisture. ( Ans - Alkane)

**Q.8 Haloalkanes react with aq. KOH to form alcohols but react with alc. KOH to form alkenes. Why?**

(2 Marks)

**Ans.** KOH is a strong base, so it completely ionizes in aqueous solution.  $\text{OH}^-$  ions are strong nucleophile, so

it replaces the halogen atoms and forms alcohols. In contrast, an alcoholic solution of KOH contains alkoxide ( $\text{R-O}^-$ )

ions which being a much stronger base than ( $\text{OH}^-$ ) ions preferentially eliminates a molecule of HCl from an alkyl chloride to form an alkene.

**Ans.** Haloalkanes are more polar than haloarenes. As a result the carbon atom carrying the halogen in haloalkanes is more electron-deficient than that in haloarenes. So, haloalkanes undergo nucleophilic substitution more readily than haloarenes.

In contrast, haloarenes contain a benzene ring. Since the typical reactions of benzene are electrophilic substitutions, therefore, haloarenes undergo electrophilic substitution while haloalkanes which do not contain a benzene ring do not undergo electrophilic substitution.

**Q. 10 Explain why?**

(a) **Alkylhalides, though polar, are immiscible in water.**

(b) **Grignard reagents should be prepared under anhydrous conditions?** (3Marks)

**Ans.** (a) Alkyl halides are polar in nature but it is insoluble in water because alkyl halide molecules are held together by dipole-dipole attraction and water molecules are held together by H-bonds. More energy is required to overcome these attractive forces between the haloalkanes. But less energy is released when haloalkanes and water molecules come together, so haloalkanes are not soluble in water.

(b) Grignard reagents are very reactive, so they react with moisture and form alkane.  $R-Mg-X + H-OH \rightarrow R-H + Mg(OH)X$

Therefore, it must be prepared and stored under anhydrous conditions..

**Q.9 Haloalkanes undergo nucleophilic substitution whereas haloarenes undergo electrophilic substitution. Why?**

(3Marks)

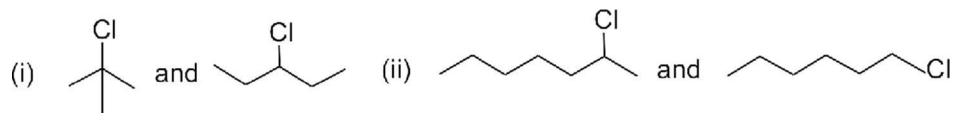
### Assignment

Q1 In the following pairs of halogen compounds, which would undergo  $S_N2$  reaction faster?



Q2 Although chlorine is an electron withdrawing group, yet it is *ortho*-, *para*- directing in electrophilic aromatic substitution reactions. Why?

Q3 In the following pairs of halogen compounds, which compound undergoes faster  $S_N1$  reaction?



Q4 Why is sulphuric acid not used during the reaction of alcohols with KI?

Q5 *p*-Dichlorobenzene has higher m.p. and solubility than those of *o*- and *m*-isomers. Discuss.

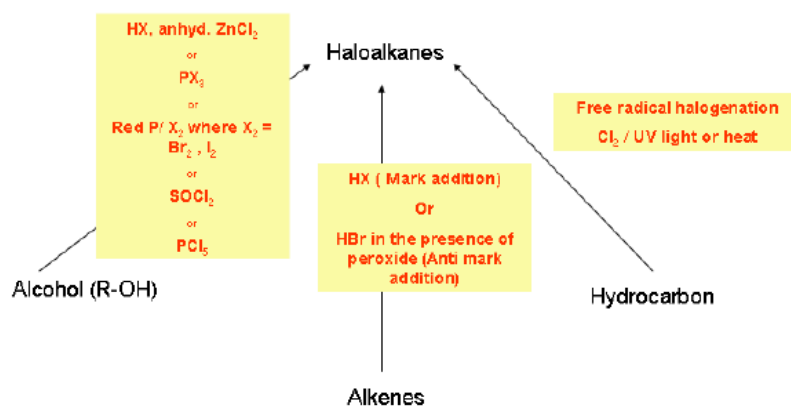
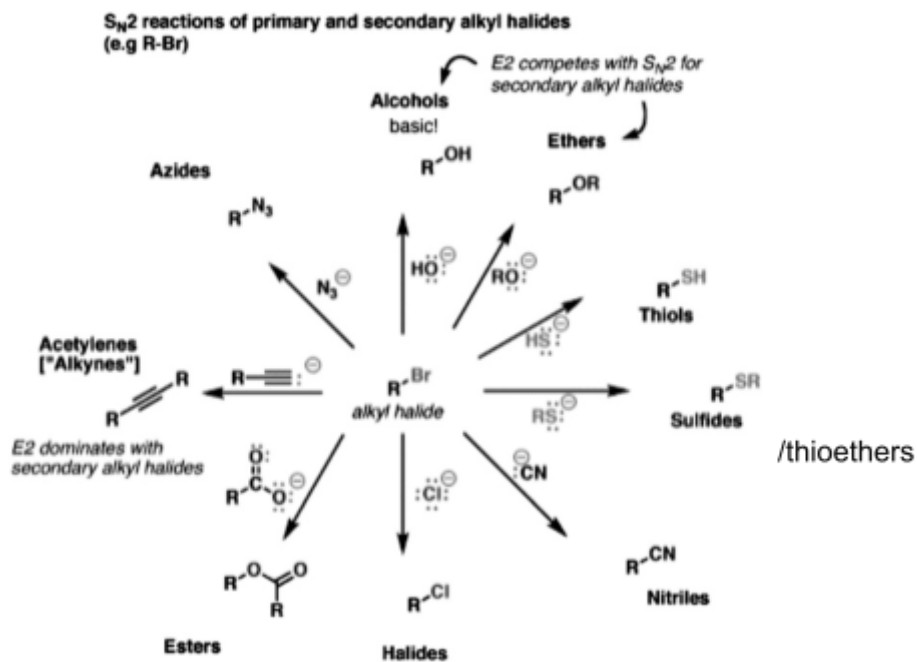
Q6 Hydrocarbon  $C_5H_{10}$  does not react with chlorine in dark but gives a single monochloro compound  $C_5H_9Cl$  in bright sunlight. Identify the hydrocarbon.

Q7. Chloroform is stored in dark coloured & sealed bottle. Why?

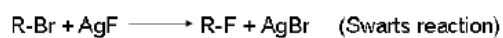
Q8 Arylhalides cannot be prepared by the action of sodium halide in the presence of  $H_2SO_4$ . Why?



## MIND MAP FOR CONVERSION



Halogen exchange method:



**MULTIPLE CHOICE QUESTION (MCQs)**

1). Identify the following compounds as primary halide:

- (i) 1-Bromobut-2-ene
- (ii) 4-Bromopent-2-ene
- (iii) 2-Bromo-2-methylpropane

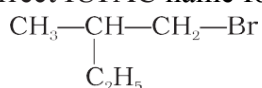
Ans : (i) 1-Bromobut-2-ene ( $1^\circ$  alkyl halide)

2). Which of the following compounds are gem-dihalides ?

- (a) Ethylidene chloride
- (b) Ethylene dichloride
- (c) Methyl chloride
- (d) Benzyl chloride

Ans : Option (a) is correct . In gem-dihalides both the halogens are attached to the same carbon atom.

3). Which is the correct IUPAC name for



- i) 1-Bromo-2-ethylpropane
- ii) 1-Bromo-2-ethyl-2-methylethane
- iii) 1-Bromo-2-methylbutane
- iv) 2-Methyl-1-bromobutane

Ans. iii) 1-Bromo-2-methylbutane

4). What should be the correct IUPAC name for diethylbromomethane? i) 1-Bromo-1,1-diethylmethane

ii) 3-Bromopentane

iii) 1-Bromo-1-ethylpropane

iv) 1-Bromopentane Ans. ii). 3-Bromopentane

5). Which of the following is /are secondary bromide?

- (i)  $\text{CH}_3\text{CH}_2\text{Br}$
- (ii)  $(\text{CH}_3)_3\text{CCH}_2\text{Br}$
- (iii)  $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{CH}_3$
- (iv)  $(\text{CH}_3)_2\text{CBrCH}_2\text{CH}_3$

Ans. (iii)  $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{CH}_3$

6.) Pure chloroform is obtained by treating

- (i) Ethanol with bleaching powder
- (ii) Acetone with bleaching powder
- (iii) Chloral with Sodium hydroxide
- (iv)  $\text{CCl}_4$  with moist Iron

Ans : (iii) Chloral with Sodium hydroxide

7.) 1,1-Dichloropropane on hydrolysis gives

- a) Propanone
- b) Propanal
- c) Ethanal
- d) 1,1-Propanediol

Ans : b)

Propanal

8.). Among the following , the molecule with the highest dipole moment is :

- a)  $\text{CH}_3\text{Cl}$
- b)  $\text{CH}_2\text{Cl}_2$

c)  $\text{CHCl}_3$ d)  $\text{CCl}_4$ Ans : a)  $\text{CH}_3\text{Cl}$ **SHORT ANSWERED QUESTIONS ( 1-MARK)**1. Write the IUPAC name of  $(\text{CH}_3)_3\text{CCH}_2\text{Cl}$ 2. Which of the following under goes  $\text{S}_{\text{N}}1$  faster: 2-chlorobutane or 1-chlorobutane

3. Arrange each set of compounds in order of increasing boiling points.

(i) Bromomethane, (ii) Bromoform, (iii) Chloromethane, (iv)

Dibromomethane. 4. Write the product formed when toluene is

chlorinated in presence of sunlight. 5. Write the product formed when

n-butyl chloride is treated with alcoholic KOH ?

6. Which is a better nucleophile, a bromide ion or an iodide ion ?

7. Which has higher dipole moment, Chlorobenzene or Cyclohexyl chloride?

8. Draw the structure of DDT.

9. Give formula of Benzyl chloride

10. How many centres of chirality are present in 3-Bromopent-1-ene.

**ANSWERS**

1. 1-chloro-2,2-dimethylpropane

2. 2-chlorobutane.

3. (iii) &lt; (i) &lt; (iv) &lt; (ii)

4. Chloromethylbenzene

5. But-2-ene

6. Iodide ion


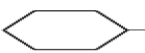
7. Cyclohexyl chloride

8. Correct structure (Dichloro diphenyl trichloroethane)

9.  $\text{C}_6\text{H}_5\text{-CH}_2\text{-Cl}$ 

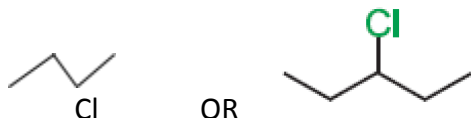
10. one

**Last 10 years CBSE Board questions from the chapter for practice****2020(SET I)**

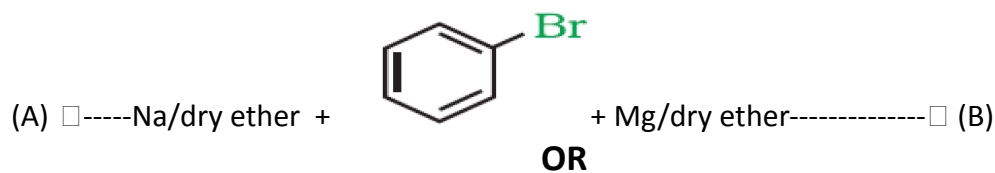
**Q1** Out of  and - $\text{CH}_2\text{-Cl}$ , which one is more reactive towards  $\text{S}_{\text{N}}1$  reactions ?

**Q2(i)** Write the structure of major alkene formed by  $\beta$ (beta)-elimination of 2,2,3-trimethyl-3-bromopentane with sodium ethoxide in ethanol.

(ii) Which one of the compounds in the following pairs is chiral.



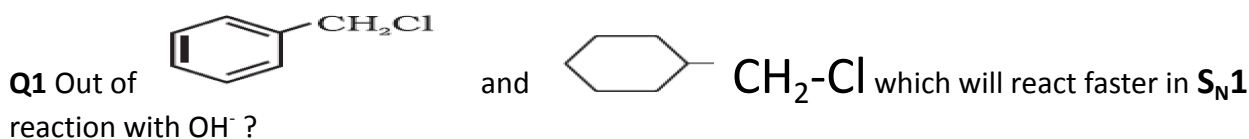
(iii) Identify (A) and (B) in the following.



How can you convert the followings?

- (i) But-1-ene to 1-iodobutane
- (ii) Benzene to acetophenone
- (iii) Ethanol to propanenitrile

2020 SET -II



2020 SET III

Q1 Out of  $CH_3-CH_2-CH_2-Cl$  and  $CH_2=CH-CH_2-Cl$  which one is more reactive towards  $S_N1$  reaction?

2019

Q1. Out of chlorobenzene and cyclohexyl chloride which one is more reactivity towards nucleophilic substitution reaction and why?

Q2 Among all the isomers of molecular formula  $C_4H_9Br$ , identify

- (a), the one isomer which is optically active.
- (b) the one isomer which is highly reactive towards  $S_N2$ .
- (c) the two isomers which give some product on dehydro-halogenation with alcoholic KOH.

2018

Q1. Out of chlorobenzene & Benzyl-chloride, which one gets easily hydrolyzed by aqueous NaOH & why? (IN SET 2) -1M



Write the IUPAC name of following compound  $CH_3-C(CH_3)(C_2H_5)-CH(CH_3)-OH$  (IN SET 1)

Q2.b) Write the structure of the product when chlorobenzene is treated with methylchloride in the presence of Na metal & dry ether? -1M

c) Write the structure of the alkane formed by dehydrohalogenation of 1-Bromo-1-methylcyclohexane with alcoholic KOH? -1M

2017

Q1. IUPAC name of  $CH_3-C(CH_3)=C(Br)-CH_2-OH$

Q2. Out of  &  which is an example of allylic halide? -1M

Q3. The following compounds are given to you –

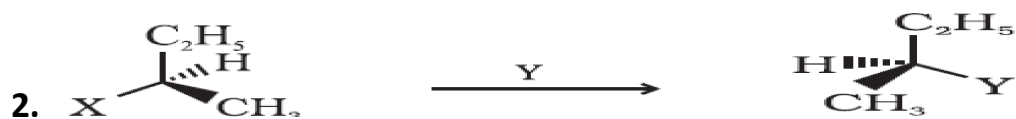
2-Bromopentane, 2-Bromo-2methylbutane, 1-Bromopentane

- a) Which compound is most reactive towards  $S_N2$  reaction.
- b) Write the compound which is optically active
- c) Write the compound which is most reactive towards  $\beta$  elimination reaction.

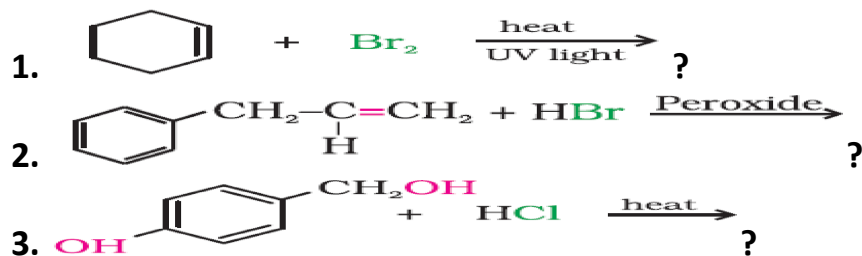
2016 ALL INDIA

Q1 Which of the following reactions is  $S_N2$  and why?



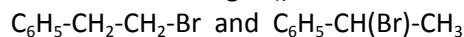


Q2 Draw the structure of major mono halo product in each of the following reaction;

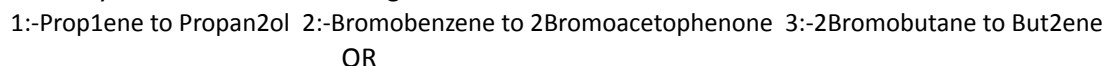


2015

Q1 Which would undergo  $S_N2$  reaction faster in the following pair?



Q2 How do you convert the following



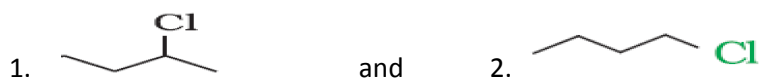
What happens when --1:-ethyl chloride is treated with NaI in the presence of acetone

2:-Chloro benzene is treated with NaI in the presence dry ether

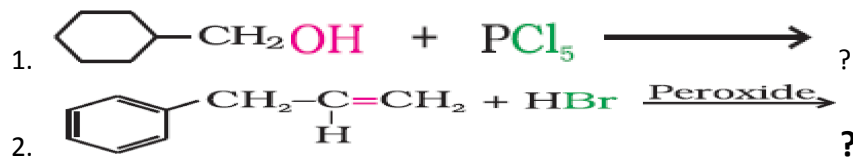
3:-methyl chloride is treated with  $KNO_2$

2014

Q1 Identify the chiral molecule in the following pair:--



Q2 Draw the structure of major monohalo products in each of the following reactions 1:-



Q3 Which halogen compound in each of the following pairs will react faster in  $S_N2$  reactions



2013

Q1 Give reasons for the followings :-

1- ethyl iodide undergoes  $S_N2$  reactions faster than ethyl bromide

2- (+)-2-Butanol is optically inactive

3- C-X bond in halo benzene is smaller than C-X bond in  $CH_3-X$

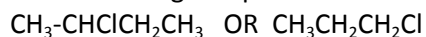
2012

Q1 What happens when bromine attacks  $CH_2=CH-CH_2-CH_2-C\equiv CH$

Q2 Answer the Following questions

1:-What is meant by chirality of compound? Give an example.

2:-Which one of the following compounds is more easily hydrolyzed by KOH and why?



Q3 Which one undergoes  $S_N2$  substitution reaction faster and why?



**2011**

**Q1** Rearrange the compounds of each of the following sets in order of reactivity towards  $S_N2$  displacement:-

1 2-Bromo-2-Methyl Butane, 1-Bromo pentane, 2-Bromo pentane

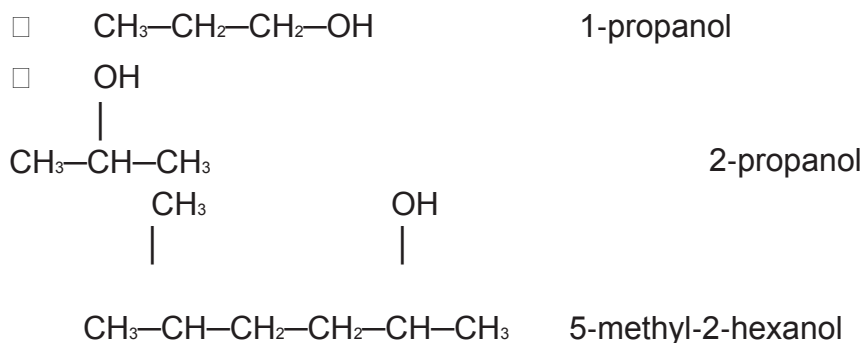
2 :-1-Bromo- 3-Methyl butane, 2-Bromo-2-Methyl- butane, 2-Bromo 3-methyl butane

3:- 1-Bromo butane, 1-Bromo 2,2dimethyl Propane, 1-Bromo 2-methyl butane

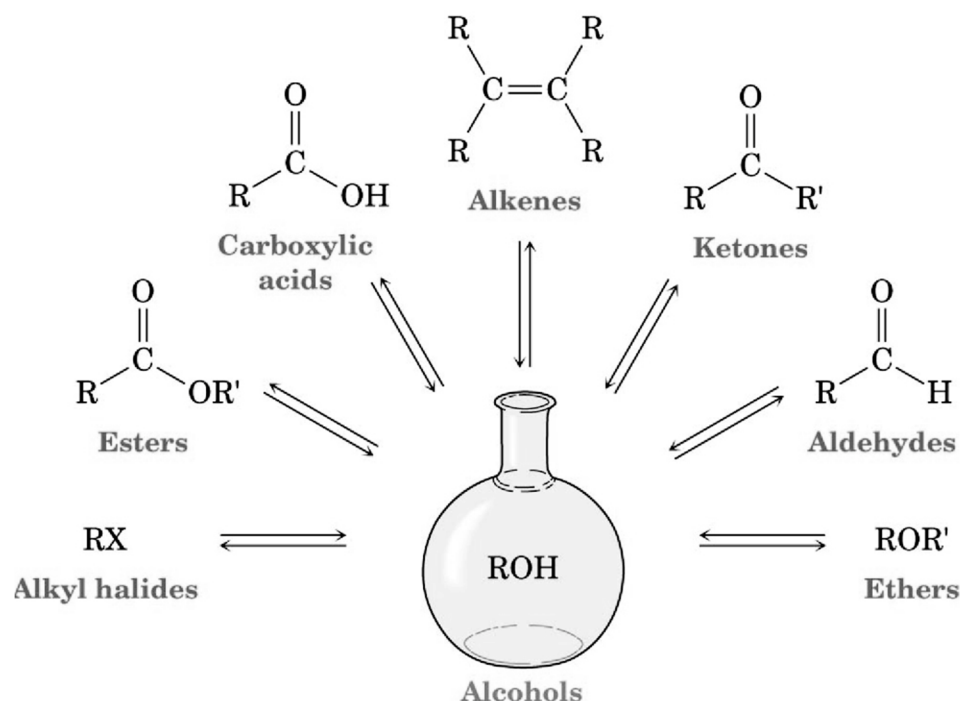
## ALCOHOLS, PHENOLS AND ETHERS (Unit- 10)

### Definition:

An alcohol is any organic compound in which a hydroxyl functional group (-OH) is bound to a carbon atom, usually connected to other carbon or hydrogen atoms.



### MIND MAP OF PROPERTIES OF ALCOHOL

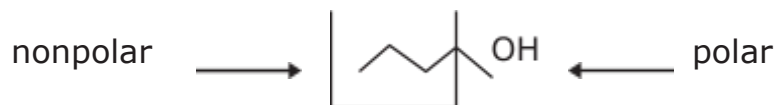


### Physical Properties

1. Alcohols are polar molecules (because of O-H and C-O).
2. Hydrogen bonding occurs between alcohol molecules relatively weak bond (represented by dots) O has a partially negative charge  $\delta^-$  & H has a partially positive charge.
3. They are weak acids (alkyl alcohols weaker than Phenol):

Although alkyl alcohols have an -OH group, they do not ionize in water, whereas phenols ionize like acids (donating a proton to water).

#### 4. Solubility in water (Molecular weight ↑: solubility ↓)



As the chain of the R group increases the hydrocarbon (**non-polar**) character of the compound also increases. Consequently, the **solubility** and **boiling point** of an alcohol are affected by the

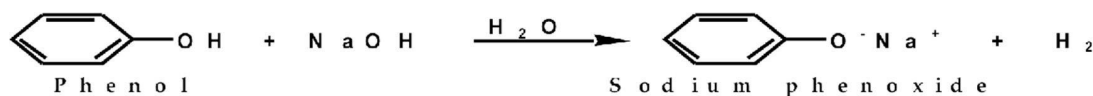
- 1) Length of the carbon chain and
- 2) The shape of the molecule.

The **short** chain alcohols are **soluble** in water, whereas the **longer** chain alcohols are **insoluble** in water.

In general a molecule which is **more compact** (i.e., more branched) will be **more soluble** in water and will have a **lower boiling point** than the straight chain isomer. (for isomeric alcohol)

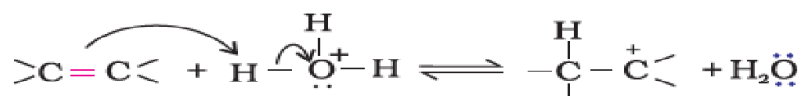
#### Chemical Properties of Alcohols

##### 1. Acidity of Alcohols / Phenols



##### 2. Acid-Catalysed Dehydration:

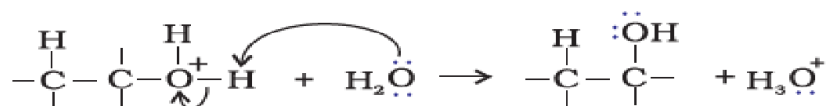
**Step 1: Protonation of alkene to form carbocation by electrophilic attack of  $\text{H}_3\text{O}^+$ .**



**Step 2: Nucleophilic attack of water on carbocation.**



**Step 3: Deprotonation to form an alcohol.**



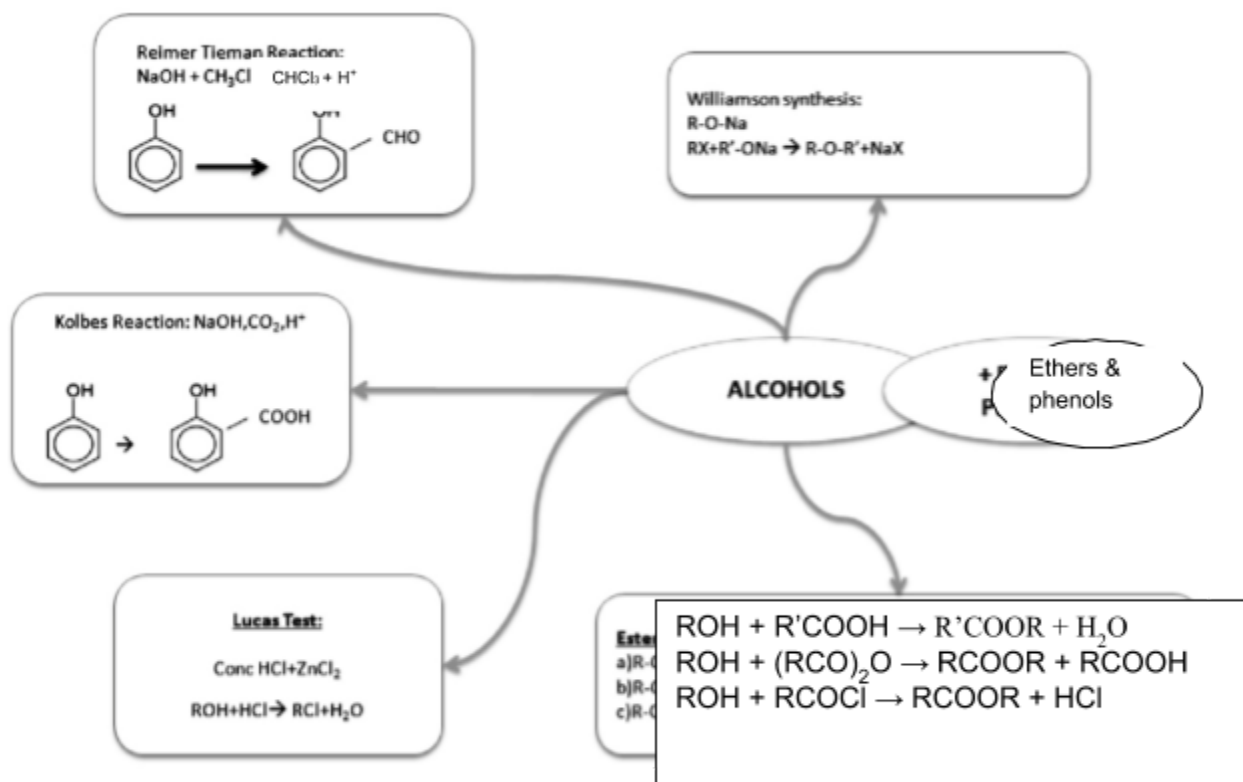
3. **Oxidation of Alcohols: (1°), (2°) & (3°)** Using potassium dichromate & sulphuric Acid as catalysts In the oxidation [O] of a primary alcohol (1°), aldehyde is produced

Primary alcohol  $\rightarrow$  aldehyde  $\rightarrow$  carboxylic acid

On oxidation of 2° alcohols a ketone is formed. Secondary alcohol  $\rightarrow$  ketone  
Tertiary alcohols do not oxidize.

Tertiary alcohol  $\rightarrow$  No reaction





## CONCEPTUAL QUESTIONS

**Q1) Preparation of ethers by acid dehydration of secondary or 3° alcohols is not a suitable method?**

Ans. The formation of ethers by dehydration of alcohol is a bimolecular reaction ( $\text{S}_{\text{N}}2$ ) group is hindered. As a result elimination dominates substitution as 3° carbocation is more stable. Hence in place of ethers, alkenes are formed.

**Q2) Phenols do not give protonation reactions readily. Why?**

Ans. The lone pair on oxygen of O-H in phenol is being shared with benzene ring through resonance. Thus, lone pair is not fully present on oxygen and hence phenols do not undergo protonation reactions.

## REASONING QUESTIONS

**Q1. Explain why propanol has higher boiling point than that of the hydrocarbon, butane?**

Ans. The molecules of butane are held together by weak van der Waal's forces of attraction while those of propanol are held together by stronger intermolecular hydrogen bonding.

**Q2. Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.**

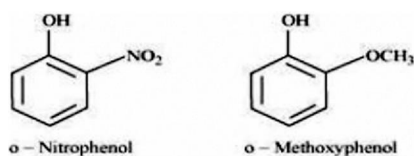
Ans. Alcohols can form hydrogen bonds with water and break the hydrogen bonds already existing between water molecules. Therefore they are soluble in water, whereas hydrocarbons cannot form hydrogen bonds with water and hence are insoluble in water.

**Q3 While separating a mixture of ortho and para nitro phenols by steam distillation, name the isomer which will be steam volatile. Give reason.**

Ans. O-nitrophenol is steam volatile due to intramolecular hydrogen bonding and hence can be separated by steam distillation from p-nitrophenol which is not steam volatile because of inter-molecular hydrogen bonding.

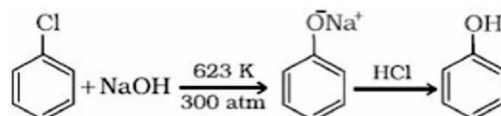
**Q4. Explain why is ortho-nitrophenol more acidic than ortho-methoxyphenol?**

Ans. The nitro-group is an electron-withdrawing group. Therefore decreases the electron density of the ring as well as oxygen. As a result, it is easier to lose a proton. Also, the o-nitrophenoxide ion formed after the loss of proton is stabilized by resonance. Hence, o-nitrophenol is stronger acid. On the other hand, methoxy group is an electron-releasing group. Thus, it increases the electron density of the oxygen atom and hence, the proton cannot be given out easily. Therefore, o-nitrophenol is more acidic than o-methoxyphenol.



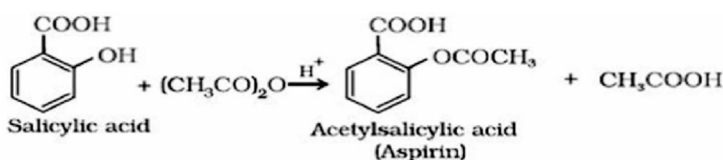
**Q5. Write chemical reaction for the preparation of phenol from chlorobenzene.**

Ans. Chlorobenzene is fused with NaOH at 623K and 320 atmospheric pressure. Phenol is obtained by acidification of sodium phenoxide so produced.



**Q6. How is aspirin (Acetylsalicylic acid) prepared from salicylic acid?**

Ans. Acetylation of salicylic acid produces aspirin.



**Q7. Which out of propan-1-ol and propan-2-ol is stronger acid?**

Ans. Propan-1-ol is stronger acid than propan-2-ol. The acidic strength of alcohols is in the order  $1^\circ > 2^\circ > 3^\circ$ .

**Q8. Give IUPAC name of  $\text{CH}_3\text{OCH}_2\text{OCH}_3$**

Ans. Dimethoxymethane

**Q9. Diethylether does not react with sodium. Explain.**

Ans. Diethyl ether does not contain any active hydrogen.

## ASSERTION - REASONING QUESTIONS

**A statement of assertion is followed by a statement of reason.**

**Mark the correct choice from the options given below :**

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.  
 (b) Both assertion and reason are true but reason is not the correct explanation of assertion.  
 (c) Assertion is true but reason is false.  
 (d) Both assertion and reason are false.

1. Assertion : Methyl alcohol is a weaker acid than water.

Reason : Among the aliphatic monohydric alcohols, methyl alcohol is the strongest acid. (Ans - b)

2. Assertion : o - Nitrophenol and p - Nitrophenol are separated by steam distillation.

Reason : o-Nitrophenol has intramolecular H - bonding while molecules of p-nitrophenol are linked by intermolecular H - bonding. ( Ans - a)

3. Assertion : Phenols do not react with phosphorus halides while alcohols do not react.

Reason : In phenols C-O bond has partial double bond character due to resonance while it is not so in alcohols. ( Ans - a)

4. Assertion : Phenol is acidic in nature.

Reason : Phenate ion is less resonance stabilised than phenol. ( Ans - a)

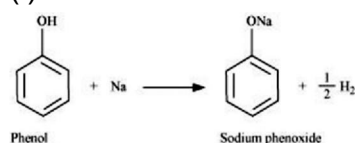
### One - word answer

1. Name a compound which can be used as an anesthetic in surgery ? ( Ans - Ethrane)  
 2. In Williamson synthesis , which type of halide should not be used ? ( Ans - Tertiary alkylhalide)

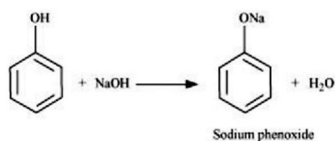
## 2 MARKS QUESTIONS

**Q1. Givetwo reactionsthat show theacidicnatureof phenol.Compareacidityof phenolwith thatofethanol.** Ans. The acidic nature of phenol can be represented by the following two reactions:

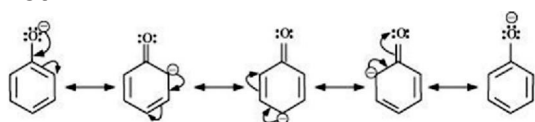
(i) Phenol reacts with sodium to give sodiumphenoxide, liberating H<sub>2</sub>.



(ii) Phenol reacts with sodium hydroxide to give sodium phenoxide and water.



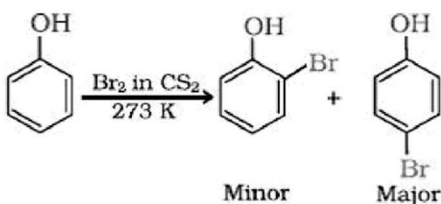
The acidity of phenol is more than that of ethanol. This is because after losing a proton, the phenoxide ion undergoes resonance and gets stabilized whereas ethoxide ion does not.



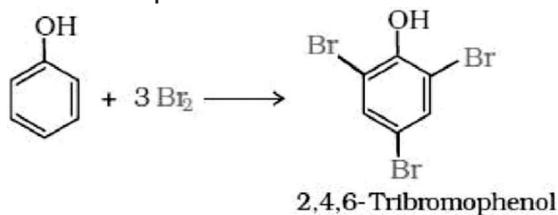
**Q2. How does phenol react with Br<sub>2</sub> in CS<sub>2</sub> and brominewater?**

Ans. (i) When thereaction is carried out in solvents of low polarity such as CHCl<sub>3</sub> or CS<sub>2</sub> and at low

temperature, monobromophenols are formed .



ii. When phenol is treated with bromine water, 2,4,6-tribromophenol is formed as white precipitate.



**Q4. How do you account for the fact that unlike phenol, 2, 4-dinitrophenol and 2, 4, 6-trinitrophenol are soluble in aqueous solution of sodium carbonate?**

Ans. 2, 4-Dinitrophenol and 2, 4, 6-trinitrophenol are stronger acids than carbonic acid (H<sub>2</sub>CO<sub>3</sub>) due to the presence of electron-withdrawing –NO<sub>2</sub> group. Hence, they react with Na<sub>2</sub>CO<sub>3</sub> to form their corresponding salts and dissolve in aq. Na<sub>2</sub>CO<sub>3</sub> solution.

**Q5. Account for the following**

- Boiling point of the C<sub>2</sub>H<sub>5</sub>OH is more than that of C<sub>2</sub>H<sub>5</sub>Cl
- The solubility of alcohols in water decreases with

increase in molecular mass. Ans. a. Because of hydrogen bonding.

- With increase in molecular mass the non-polar alkyl group becomes more predominant.

**Q6. Answer the following**

- What is the order of reactivity of 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup> alcohols with sodium metal?
- How will you account for the solubility of lower alcohols in water?

Ans, a. 1<sup>o</sup> > 2<sup>o</sup> > 3<sup>o</sup>

b. Here -OH group is predominant and the alcohol molecules can form hydrogen bonds with water molecules.

**Q7. Give reasons:**

i) Nitration of phenol gives ortho- and para-products only.

ii) Why do alcohols have higher boiling points than the haloalkanes of the same molecular mass?

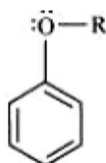
Ans. (1) -OH group increases the electron density more at ortho and para positions through its electron-releasing resonance effect.

(2) Alcohols are capable of forming intermolecular H-bonds, while alkyl halides do not.

**Q8. Explain the fact that in aryl alkyl ethers**

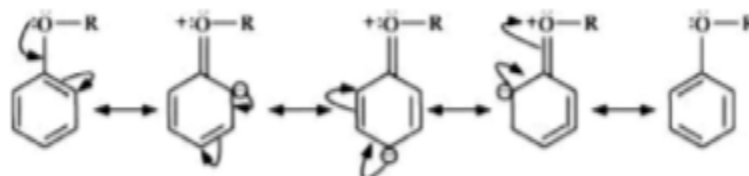
(i) The alkoxy group activates the benzene ring toward electrophilic substitution and

(ii) It directs the incoming substituents to ortho and para positions in benzene ring.



Aryl alkyl ether

(Ans. (i) In arylalkylethers, due to the +R effect of the alkoxy group, the electron density in the benzene ring increases as shown in the following resonance structure.

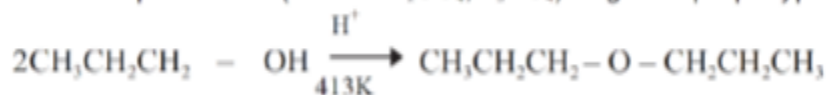


Thus, benzene is activated towards electrophilic substitution by the alkoxy group.

(ii) It can also be observed from the resonance structures that the electron density increases more at the ortho and para positions than at the meta position. As a result, the incoming substituents are directed to the ortho and para positions in the benzene.

**Q9. How is 1-propoxypropane synthesized from propan-1-ol? Write mechanism of this reaction.**

Ans. 1-propoxypropane can be synthesized from propan-1-ol by dehydration. Propan-1-ol undergoes dehydration in the presence of protic acids (such as  $\text{H}_2\text{SO}_4$ ,  $\text{H}_3\text{PO}_4$ ) to give 1-propoxypropane.

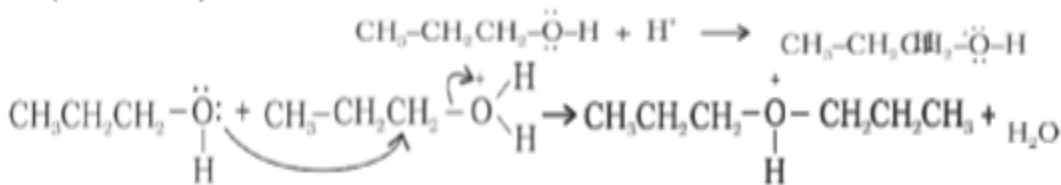


Propane-1-ol

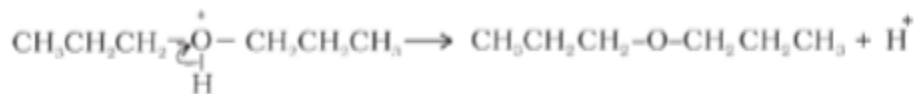
1- Propoxypropane

The mechanism of this reaction involves the following three steps: Step 1: Protonation

Step 2: Nucleophilic attack



Step 3: Deprotonation



**MULTIPLE CHOICE QUESTIONS (MCQs)**

Q.1 What is the IUPAC name of Vinyl alcohol ?

- (a) Ethanol
- (b) Methanol
- (c) Ethenol
- (d) Methe

not ANS: (c)

Q.2. Which of the following is more acidic than alcohol ?

- (a) Phenol
- (b) Cyclohexanol
- (c) Benzyl alcohol
- (d) Ethen

not ANS: ( a)

Q.3. Which one of the following compound is obtained by dehydrogenation of secondary alcohols?

- a) Ketone
- b) Aldehyde
- c) Carboxylic acid
- d) Am

not ANS:

(a)

Q.4. The reaction of carboxylic acid and alcohol catalysed by conc. $H_2SO_4$  is called ?

- a) Dehydration
- b) Saponification
- c) Esterification
- d) Neutralisation

not ANS: (c)

Q.5. Which of the following alcohol is most soluble in water

- a) Propanol
- b) Hexanol
- c) Pentanol
- d) Butanol

not ANS:(

a)

Q.6. On heating aqueous solution of benzene diazonium chloride , which of the following is formed

- (a) benzene
- (b) chloro benzene
- (c) phenol
- (d) aniline

not ANS:

ANS:( c)

Q.7. Catalytic dehydrogenation of a primary alcohol gives a

- (a) Ketone
- (b) Aldehyde
- (c) Sec . alcohol
- (d) Ester

ter

ANS:( b)

Q.8 Ethyl alcohol obtained by fermentation of starch is called wash and what is its purity?

- (a) 15%
- (b) 99%
- (c) 99.9%
- (d) 95%

ANS:( a)

Q.9 Which chemical is used to distinguish between phenol and benzyl alcohol. a).  $\text{NaHCO}_3$

- b).  $\text{FeCl}_3$
- c). Iodoform test
- d). none of the

above ANS:( b)

Q.10 Which is most acidic a). Phenol

- b). 4-nitrophenol
- c). Cresol
- d). 2-nitrophenol

ANS:( d)

#### SHORT ANSWERED QUESTIONS [1-MARK]

1. Write the IUPAC names of  $\text{CH}_2 = (\text{CH})\text{CH}_2\text{OH}$
2. Which of the following has higher pKa value : Nitrophenol OR phenol
3. Arrange the following compounds in order of increasing boiling points.  
(i) Bromoethane, (ii) Ethanol (iii) Methoxymethane
4. Write the structure of 2-Ethoxy-3-methyl pentane
5. Write the product formed when Ethoxy benzene reacts with HI
6. Which is more acidic : ortho-nitrophenol or ortho-methoxyphenol?
7. Name the chemical test used to distinguish between Phenol and Ethanoic acid?
8. Write the name of the product of reaction of Bromine in  $\text{CS}_2$  with phenol
9. What is the condition of the compound to undergo Iodoform test?
10. Write the structure of cumene. ANSWERS

1. Prop-2-en-1-ol

2. Phenol

3. (i) &lt; (iii) &lt; (ii)

4.

CH<sub>3</sub> 5 Phenol + Iodoethane

6. ortho-nitrophenol (Due to electron withdrawing group)

7. FeCl<sub>3</sub> test or sodium bicarbonate test

8. o-bromophenol and p-bromophenol

9. presence of terminal methyl group with alcoholic / carbonyl group

10. CH<sub>3</sub>-CH[C<sub>6</sub>H<sub>5</sub>]-CH<sub>3</sub> [Isopropylbenzene]

### LAST 10 YEARS CBSE QUESTIONS FROM THE CHAPTER FOR PRACTICE

#### 2020 SET 1

For question 1 choose any one option from following four options.

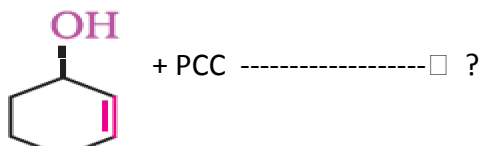
- (A) Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explanation of the Assertion (A).  
 (B) Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explanation of the Assertion (A).  
 (C) Assertion (A) is correct, but Reason (R) is wrong statement.  
 (D) Assertion (A) is wrong, but Reason (R) is correct statement.

Q1 **Assertion (A):** (CH<sub>3</sub>)<sub>3</sub>C-O-CH<sub>3</sub> gives (CH<sub>3</sub>)<sub>3</sub>C-I and CH<sub>3</sub>-OH on treatment with HI.

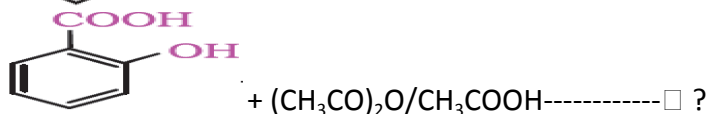
**Reason (R) :** The reaction occurs by S<sub>N</sub>1 mechanism.

Q2 Write the product(s) of the following reactions;

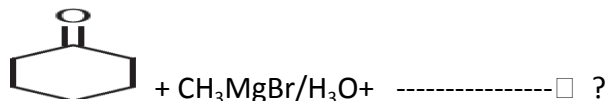
(i)



(ii)

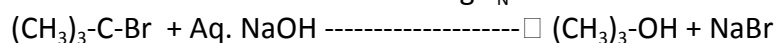


(iii)



**OR**

(a) Write the mechanism of the following S<sub>N</sub>1 reaction.





(b) Write the equation for the preparation of 2-methyl-2-methoxypropane by Williamson synthesis.

**2019**

Q1 (a) Give equations of the following reactions

(i) Phenol is treated with conc.  $\text{HNO}_3$ .

(ii) Propene is treated with  $\text{B}_2\text{H}_6$  followed by  $\text{H}_2\text{O}_2/\text{OH}^-$ .

(iii) Sodium t-butoxide is treated with  $\text{CH}_3\text{Cl}$ .

(b) How will you distinguish between butan-1-ol and butan-4-ol?

(c) Arrange the following in increasing order of acidity?

**Phenol, ethanol, water**

**OR**

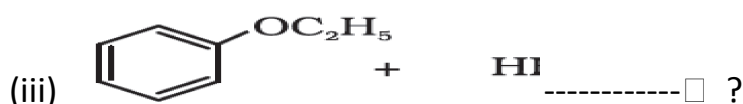
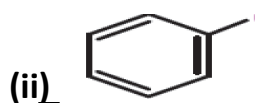
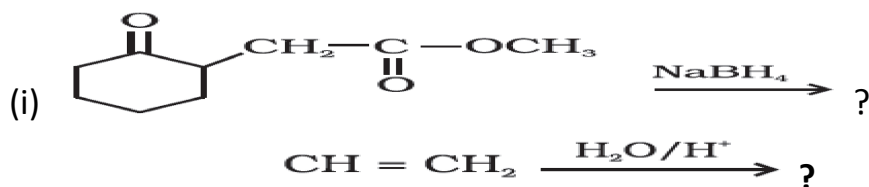
(a) How can you obtain Phenol from (i) Cumene (ii) Benzene sulphonic acid (iii) Benzene diazonium chloride?

(b) Write the structure of the major product obtained from dinitration of 3-methylphenol

(c) Write the reaction involved in Kolbe's reaction.

**2018**

1. Write the structure of the main products in the following reaction:



**2017**

1.(a) Arrange the following compound in increasing order of their acidic strength :  
p-cresol, p-nitrophenol & phenol

(b) Write the mechanism (using curved arrow notation) of the following reaction:



**OR**

Write the structure of the products when Butan-2-ol reacts with the following:

(i)  $\text{CrO}_3$

(ii)  $\text{SOCl}_2$

**2016**

Q1. Write the chemical equations involved in

1. Kolbe's reaction

2. Friedal craft Acetylation of Anisole

OR

Q. How do you convert

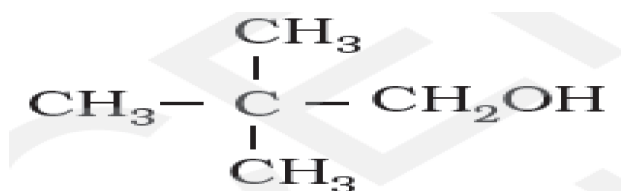
1. Phenol to Toluene
2. Formaldehyde to Ethanol

Q2. Give reasons for the following :

1. Protonation of phenols is difficult whereas ethanol easily undergoes protonation.
2. Boiling point of ethanol is higher than that of  $\text{CH}_3\text{-O-CH}_3$
3. Anisole on reaction with HI gives phenol and  $\text{CH}_3\text{-I}$  as main products and not Iodobenzene and  $\text{CH}_3\text{-OH}$ .

**2015**

Q1. IUPAC name of



Q2 Give reasons for the following :

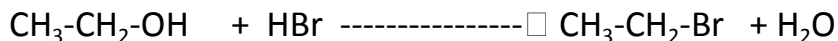
1. p – nitrophenol is acidic than p – methyl phenol.
2. Bond length of C-O in phenol is shorter than that in methanol.
3.  $(\text{CH}_3)_3\text{C-Br}$  on reaction with sodium methoxide ( $\text{Na}^+ \text{O}^-\text{CH}_3$ ) gives alkene as the main product and not an ether.

**2014**

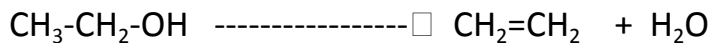
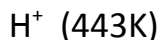
Q1. Write the equations involved in the following reactions:

1. Reimer – Tieman reaction
2. Williamson Synthesis

Q2. Write the mechanism of the following reaction.

**2013**

Q1. Explain the mechanism of the following reaction:



Q2. Write the equations involved in the following reactions:

1. Reimer – Tiemann reaction
2. Williamson's ether synthesis

**2012**

Q1. Explain the mechanism of acid catalysed hydration of an alkene to form corresponding alcohol.

Q2. Explain the following behaviours

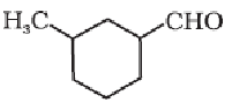
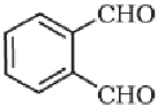
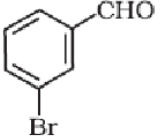
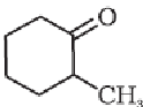
1. Alcohols are more soluble in water than the hydrocarbons of the comparable molecular masses.
2. Ortho nitrophenol is more acidic than ortho methoxy phenol.

**2011**

Q1. How would you obtain the following:-

1. Benzoquinone from phenol
2. 2 methyl propan2ol from methyl Magnesium bromide
3. Propan2ol from propene
4. Ethanol to ethene

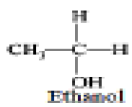
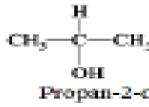
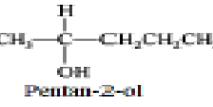
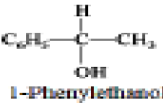

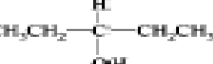

## Aldehydes ,Ketones and Carboxylic Acids(UNIT-11)

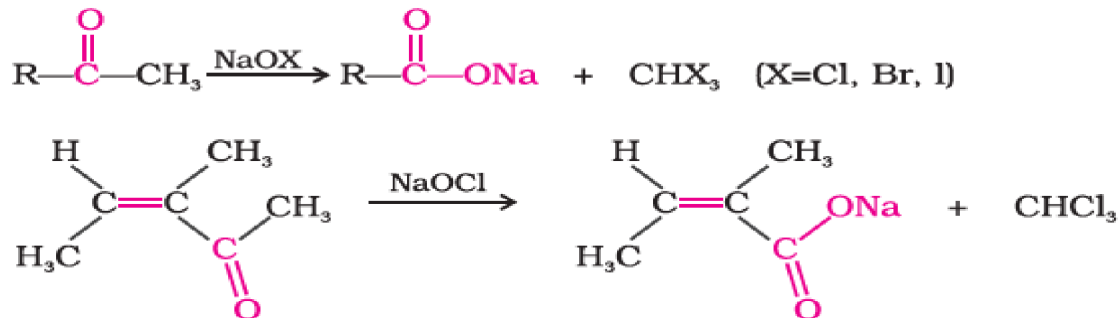
Structure	Common name	IUPAC name
<b>Aldehydes</b>		
HCHO	Formaldehyde	Methanal
CH <sub>3</sub> CHO	Acetaldehyde	Ethanal
(CH <sub>3</sub> ) <sub>2</sub> CHCHO	Isobutyraldehyde	2-Methylpropanal
	$\gamma$ -Methylcyclohexanecarbaldehyde	3-Methylcyclohexanecarbaldehyde
CH <sub>3</sub> CH(OCH <sub>3</sub> )CHO	$\alpha$ -Methoxypropionaldehyde	2-Methoxypropanal
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CHO	Valeraldehyde	Pentanal
CH <sub>2</sub> =CHCHO	Acrolein	Prop-2-enal
	Phthalaldehyde	Benzene-1,2-dicarbaldehyde
	<i>m</i> -Bromobenzaldehyde	3-Bromobenzenecarbaldehyde or 3-Bromobenzaldehyde
<b>Ketones</b>		
CH <sub>3</sub> COCH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>	Methyl <i>n</i> -propyl ketone	Pentan-2-one
(CH <sub>3</sub> ) <sub>2</sub> CHCOCH(CH <sub>3</sub> ) <sub>2</sub>	Diisopropyl ketone	2,4-Dimethylpentan-3-one
	$\alpha$ -Methylcyclohexanone	2-Methylcyclohexanone
(CH <sub>3</sub> ) <sub>2</sub> C=CHCOCH <sub>3</sub>	Mesityl oxide	4-Methylpent-3-en-2-one

### CHEMICAL DISTINGUISH TEST BETWEEN PAIR OF ORGANIC COMPOUNDS

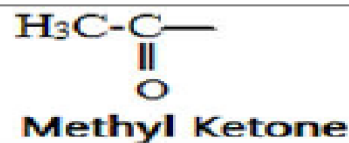
#### 1. Iodoform Test (NaOH + I<sub>2</sub> HEAT)

ALCOHOLS CONTAINING METHYL CARBINOL GROUP REACT WITH NaOH + I<sub>2</sub> AND HEAT (SODIUM HYPOIODITE, NaOI) GIVES YELLOW PPT. OF IODOFORM (CHI<sub>3</sub>).

<b>Positive Iodoform Test</b>				
<b>Negative Iodoform Test</b>	Any other primary alcohol			



Similarly, compounds like Ethanal, Propanone, Pentan-2-one, etc. organic compound containing methyl ketonic group, when is heated with  $\text{I}_2$  & aqueous solution of  $\text{Na}_2\text{CO}_3$  or  $\text{NaOH}$  forms yellow ppt. of iodoform ( $\text{CHI}_3$ ) which involves the oxidation, iodination & cleavage of C-C bond.



- Form aldehyde cannot be prepared by Rosenmund's reaction since formyl chloride is unstable at room temperature.
- Benzaldehyde is less reactive than aliphatic aldehydes towards nucleophilic addition reaction.
- In reaction of toluene with  $\text{CrO}_3$ , acetic anhydride is used to protect benzaldehyde as benzylidenediacetate to avoid further oxidation to benzoic acid.
- Aromatic ketones are less reactive, they do not react with  $\text{NaHSO}_3$ .
- In reaction of aldehydes and ketones with ammonia derivatives, the medium should be slightly acidic ( $\text{pH}=4.5$ ). In too highly acidic medium, ammonia derivatives being acidic form salts and not act as nucleophile
- Benzaldehyde although reduces Tollens' reagent, it does not reduce Fehling's and Benedict's solution.
- Ketones do not give Tollens reagent and Fehling's solution test.
- Only  $\text{CH}_3\text{CHO}$  and all methylketones give Iodoform test.
- A stronger acid has higher  $\text{pK}_b$  but lower  $\text{pK}_a$ .
- Benzoic acid is a stronger acid than acetic acid.
- $-\text{CHO}$  and  $-\text{COOH}$  group, attached to benzene ring, are deactivating and m-directing.
- Methanoic acid decolorises the pink colour of acidified  $\text{KMnO}_4$  solution but acetic acid does not.
- A 40% aqueous solution of formaldehyde is known as formalin and is used to preserve biological specimens, and to prepare bakelite.

 Benzaldehyde is used in perfumery and in dye industries.

### VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)

Q 1. Arrange the following compounds in an increasing order of their reactivity towards nucleophilic addition reaction.

$\text{CH}_3\text{CHO}$ ,  $\text{CH}_3\text{CH}_2\text{CHO}$ ,  $\text{CH}_3\text{COCH}_3$ ,  $\text{CH}_3\text{COCH}_2\text{CH}_3$ .

Ans.  $\text{CH}_3\text{COCH}_2\text{CH}_3 < \text{CH}_3\text{COCH}_3 < \text{CH}_3\text{CH}_2\text{CHO} < \text{CH}_3\text{CHO}$

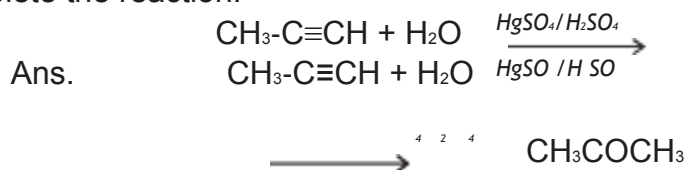
Q2. Name the reagent which is used to convert allyl alcohol to propanol. Ans.

PCC (Pyridinium Chlorochromate)

Q3. Name the aldehyde which does not give Fehling solution test. Ans. Benzaldehyde.

Q4. Write IUPAC name of the compound  $\text{CH}_2=\text{CHCOCH}_2\text{COOH}$ . Ans. 3-Oxopent-4-enoic acid

Q5. Complete the reaction:



## ASSERTION - REASON TYPE QUESTIONS

**A statement of assertion is followed by a statement of reason.**

**Mark the correct choice from the options given below.**

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.  
 (b) Both assertion and reason are true but reason is not the correct explanation of assertion.  
 (c) Assertion is true but reason is false.  
 (d) Both assertion and reason are false.
- Assertion : Carbonyl compounds take part in nucleophilic addition reactions.  
Reason : These reactions are initiated by nucleophilic attack at the electron deficient carbon atom. ( Ans - a)
  - Assertion : All aldehydes do not take part in aldol condensation.  
Reason : In the aldol condensation, carbanion is generated by the abstraction of  $\alpha$  - H atom by base. (Ans - b)
  - Assertion : Acetone is less reactive towards nucleophilic addition than acetaldehyde.  
Reason : The alkyl groups hinder the nucleophilic attack on carbonyl carbon atom. ( Ans - a)
  - Assertion : The  $\alpha$  - H atom in carbonyl compounds is less acidic.  
Reason : The anion formed after the loss of  $\alpha$  - H atom is not resonance stabilized. ( Ans - d)
  - Assertion : Aldehydes and ketones both react with Tollen's reagent to form silver mirror.  
Reason : Both aldehydes and ketones contain a carbonyl group. ( Ans - d)

### One - word answer

- Name the reagent used to distinguish between methanoic acid and ethanoic acid. ( Ans - Tollen's reagent)
- Name the product obtained by reaction of hydroxylamine with carbonyl compound?  
( Ans - Oxime)

### SHORT ANSWER TYPE QUESTIONS (2- MARKS)

Q1. Write chemical equation to illustrate following name reactions:-

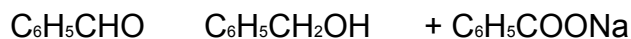
- (a) Cannizzaro's reaction  
 (b) Hell-Volhard-

Zelinsky reaction Ans. (a)

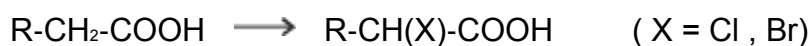
Cannizzaro's reaction



(OR)



- (b) Hell - Volhard Zelinsky



(i)  $\text{X}_2/\text{P(red)}$

(ii)  $\text{H}_2\text{O}$

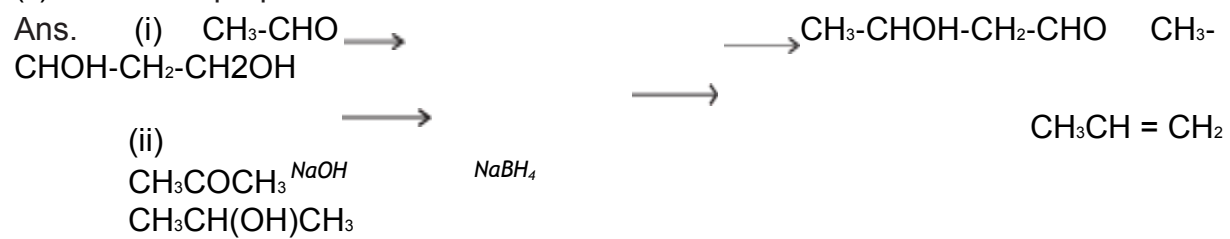
Q2. Give a chemical test to distinguish between the following pairs:-

- (i) Phenol and benzoic acid  
 (ii) Benzaldehyde and Acetophenone





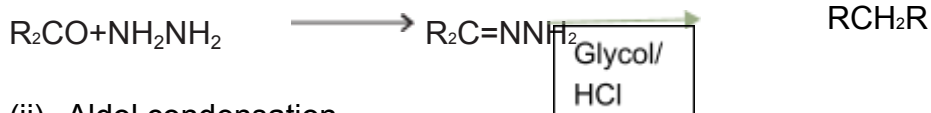
(ii) Acetone to propene



### SHORT ANSWER TYPE QUESTIONS (3-MARKS)

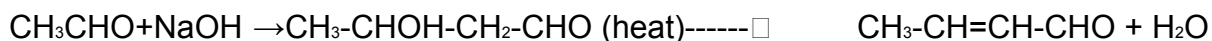
- Q1. Explain the following name reaction by giving one suitable example of each:- (i) Wolff-kishner reduction (ii) Aldol condensation (iii) Clemmensen's reduction

Ans. (i) Wolff-kishner reduction



(ii) Aldol condensation

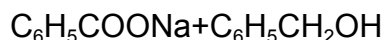
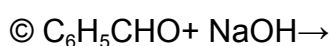
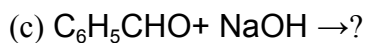
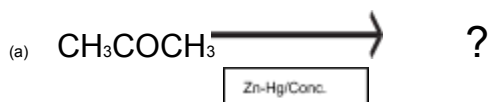
Carbonyl compounds with  $\alpha$ -hydrogen in basic medium undergo condensation to give Hydroxy aldehydes and ketones.



(iii) Clemmensen's reduction



Write the products in the following reactions:



3 . Explain : (i) Ethanal is more reactive than acetophenone towards nucleophilic addition reaction. (ii)  $(\text{CH}_3)_3\text{C-CHO}$  does not undergo aldol condensation.

(iii) Carboxylic acids are higher boiling liquids than alcohols.

Ans. (i) The presence of two alkyl groups in ketones hinder the approach of nucleophile to carbonyl carbon, and reduce the positive charge on carbonyl carbon more effectively in ketones than in aldehydes.

(i) Due to unavailability of  $\alpha$ -hydrogen in the given compound it does not undergo aldol condensation.

(ii) Due to extensive association of carboxylic acid molecules through intermolecular hydrogen bonding, (exist as dimer)

### LONG ANSWER TYPE QUESTIONS (5-MARKS)

Q1. (a) Although phenoxide ion has more number of resonating structures than carboxylate ion, carboxylic acid is a stronger acid than phenol. Give two reasons.

(b) How will you bring about the following conversions?

(i) Acetic acid to Acetaldehyde

(ii) Propylene to Acetone

(iii) Ethanal to but-2-enal

Ans. (a) (i) resonating structures of carboxylate ion are more stable than phenoxide ion.

(ii) Negative charge is dispersing on two electronegative oxygen in carboxylate ion whereas in phenoxide ion it is on one oxygen .

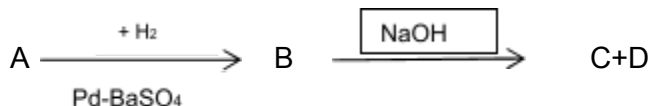
(b) Conversions:



(iii)  $\text{CH}_3\text{CHO} + \text{NaOH} \rightarrow \text{CH}_3\text{-CHOH-CH}_2\text{-CHO} \xrightarrow{\text{HEAT}}$   $\text{CH}_3\text{-CH=CH-CHO}$

Q2. (a)

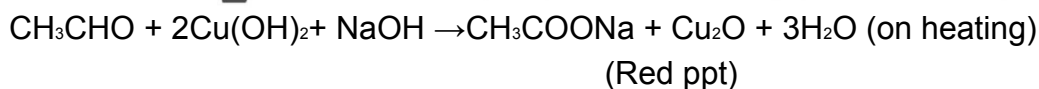
Write the structures of A, B, C and D in the following reactions:



Ans : A- Benzoyl chloride  
B- Benzaldehyde  
C - Benzylalcohol  
D - Sodium benzoate

(b) Distinguish between: (i) Acetone and Acetaldehyde (ii) Benzaldehyde and Benzophenone

Ans. (i)   $\text{CHO}$    $\text{-COONa}$    $\text{-CH}_2\text{OH}$    $\text{-CH(OH)CH}_3$  prous



- (iii) Benzaldehyde gives Tollens' test, while benzophenone does not.  $C_6H_5CHO + 2[Ag(NH_3)_2] \rightarrow C_6H_5COONH_4 + 2Ag + 3NH_3 + H_2O$

### ASSIGNMENT

- Arrange the following:
  - Benzoic acid
  - 4-Nitrobenzoic acid
  - 3,4-Dinitrobenzoic acid
  - 4-Methoxybenzoic acid (increasing acidic character)
  - $\text{CH}_3\text{CHO}$ ,  $\text{C}_6\text{H}_5\text{CHO}$ ,  $\text{HCHO}$  (reactivity towards nucleophilic addition reaction)
- Write the reaction mechanism for the reaction.  $\text{R-CHO} + \text{HCN} \rightarrow \text{R-CH(CN)-OH}$
- Draw the molecular structure of the compounds:-
  - 4-methylpent-3-en-2-one.
  - 3-Methylbutanal
  - Hexane-1,6-dioic acid
- How will you prepare benzyl alcohol from benzaldehyde without using a reducing agent? Identify the compounds A, B and C in the following reactions:



- How do you convert the following?  $\xrightarrow{\hspace{2cm}}$ 
  - Benzoic acid to benzaldehyde
  - Ethyne to ethanoic acid
- (a) Account for the following-
  - The boiling points of aldehydes and ketones are lower than their corresponding carboxylic acids.
  - The aldehydes and ketones undergo a number of addition reactions
  - In the reaction of ammonia derivatives with carbonyl compounds the pH should not be lesser than 4.5.
- (b) Give chemical test to distinguish between:
  - Acetaldehyde and benzaldehyde
  - Propanone and propanal
- Distinguish between the following:
  - Butanone and Butanal
    - Ethanal and ethanoic acid
  - Write a suitable example of each:
    - Rosenmund reaction
    - Etard reaction

### MCQs

- Addition of water to alkynes occurs in acidic medium and in the presence of  $\text{Hg}^{2+}$  ions as a catalyst. Which of the following products will be formed on addition of water to but-1-yne under these conditions.
  - $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CHO}$
  - $\text{CH}_3\text{-CH}_2\text{-CO-CH}_3$
  - $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-COOH} + \text{CO}_2$
  - $\text{CH}_3\text{-COOH} + \text{H-COOH}$
 Ans: (ii)
- Which of the following compounds is most reactive towards nucleophilic addition reactions?

- (i).  $\text{CH}_3\text{-COOH}$       ii).  $\text{CH}_3\text{-CO-CH}_3$   
 (iii)  $\text{C}_6\text{H}_5\text{-CHO}$     iv).  $\text{C}_6\text{H}_5\text{-CO-CH}_3$

Ans: (i)

3. The correct order of increasing acidic strength is\_\_\_\_\_.

- (i) Phenol < Ethanol < Chloroacetic acid < Acetic acid  
 (ii) Ethanol < Phenol < Chloroacetic acid < Acetic acid  
 (iii) Ethanol < Phenol < Acetic acid < Chloroacetic acid  
 (iv) Chloroacetic acid < Acetic acid < Phenol <

Ethanol Ans: (iii)

4. Compound can be prepared by the reaction of\_\_\_\_\_.

- (i) Phenol and benzoic acid in the presence of NaOH  
 (ii) Phenol and benzoyl chloride in the presence of pyridine  
 (iii) Phenol and benzoyl chloride in the presence of  $\text{ZnCl}_2$   
 (iv) Phenol and benzaldehyde in the presence of

palladium Ans: (ii)

5. The reagent which does not react with both, acetone and benzaldehyde.

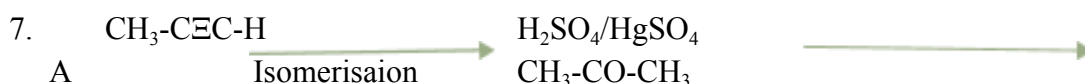
- (i) Sodium hydrogensulphite  
 (ii) Phenyl hydrazine  
 (iii) Fehling's solution  
 (iv) Grignard

reagent Ans: (iii)

6. Cannizaro's reaction is not given by\_\_\_\_\_.

- (i). Cyclohexanone  
 (ii).  $\text{C}_6\text{H}_5\text{-CHO}$   
 (iii) H CHO  
 (iv)  $\text{CH}_3\text{C}$

HO Ans: (iv)



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

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

tautomerism Ans: (iv)

8. Which is the most suitable reagent for the following conversion?



- (i) Tollen's reagent  
 (ii) Benzoyl peroxide  
 (iii)  $\text{I}_2$  and NaOH solution

(iv) Sn and NaOH

solution Ans: (iii)

9. Which of the following compounds will give butanone on oxidation with alkaline  $\text{KMnO}_4$  solution?

(i) Butan-1-ol

(ii) Butan-2-ol

(iii) Both of these

(iv) None of

these Ans: (ii)

10. In Clemmensen Reduction carbonyl compound is treated with\_\_\_\_\_.

(i) Zinc amalgam + HCl

(ii) Sodium amalgam + HCl

(iii) Zinc amalgam + nitric acid

(iv) Sodium amalgam +

$\text{HNO}_3$  Ans: (i)

### SHORT ANSWER QUESTIONS (1-MARK)

1. Why carboxylic acid have higher boiling point than alcohols as both have intermolecular hydrogen bonding?

Ans. Carboxylic acid forms a dimer due to double H-bonding. So it has higher boiling point than alcohols.

2. Arrange the following in increasing order of acidic character :  $\text{HCOOH}$ ,  $\text{CH}_2\text{ClCOOH}$ ,  $\text{CF}_3\text{COOH}$ ,  $\text{CCl}_3\text{COOH}$

Ans.  $\text{HCOOH} < \text{CH}_2\text{ClCOOH} < \text{CCl}_3\text{COOH} < \text{CF}_3\text{COOH}$

3. Why is the boiling point of an acid anhydride higher than the acid from which it is derived?

Ans. Acid anhydrides are bigger in size than corresponding acid. These have more surface area so have strong van der Waals Force of attractions. Hence they have higher boiling point.

4. Why do carboxylic acids not give the characteristic reactions of a carbonyl group? Ans. Due to resonance, It does not have free carbonyl.

5. Arrange the following compounds in increasing order of their boiling points.  $\text{CH}_3\text{CHO}$ ,  $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{OCH}_3$ ,  $\text{CH}_3\text{CH}_2\text{CH}_3$

Ans.  $\text{CH}_3\text{CH}_2\text{CH}_3 < \text{CH}_3\text{OCH}_3 < \text{CH}_3\text{CHO} < \text{CH}_3\text{CH}_2\text{OH}$

6. What happens when ethanoyl chloride is subjected to rosenmund reduction? Ans. Ethanoyl chloride is converted in to Ethanal. OR



7. Why does solubility decrease with increasing molecular mass in carboxylic acid?

Ans. Because with increase of molecular mass size of hydrophobic carbon chain length increases.

8. Why PCC cannot oxidize methanol to methanoic acid while  $\text{KMnO}_4$  can?

Ans. This is because PCC is a mild oxidizing agent and can oxidize methanol to methanal only. while  $\text{KMnO}_4$  is strong oxidizing agent which oxidizes it to methanoic acid.

9. Aromatic acids are solid while most of aliphatic acids are liquids. Why?

Ans. Aromatic acids have higher molecular weight and strong Van der Waals force of attraction as compared to aliphatic acids so they are solids.

10. The boiling points of aldehydes and ketones are lower than that of the corresponding acids. Why?

Ans. This is due to intermolecular hydrogen bonding in carboxylic acids.

## Last 10 years CBSE Board questions from the chapter for practice

### 2020 set 1

For question 1 choose one option from following four options.

- (E) Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explanation of the Assertion (A).  
 (F) Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explanation of the Assertion (A).  
 (G) Assertion (A) is correct, but Reason (R) is wrong statement.  
 (H) Assertion (A) is wrong, but Reason (R) is correct statement.

Q1 **Assertion (A)**: Benzoic acid does not undergoes Friedal Crafts reaction.

**Reason (R)** : The carboxyl group is activating and undergo electrophilic substitution reaction.

Ans.

C

Q2 (a) An organic compound (A) having molecular formula  $\text{C}_4\text{H}_8\text{O}$  gives orange red precipitate with 2,4 -DNP reagent. It does not reduce Tollens' reagent but gives yellow precipitate of iodoform on heating with  $\text{NaOH}$  and  $\text{I}_2$ . Compound (A) on reduction with  $\text{NaBH}_4$  gives compound (B) which undergoes dehydration reaction on heating with conc.  $\text{H}_2\text{SO}_4$  to form compound (C). Compound (C) on Ozonolysis gives two molecules of ethanal.

Identify (A), (B) and (C) and write their structures. Write the reactions of compound (A) with (i)  $\text{NaOH}/\text{I}_2$  and (ii)  $\text{NaBH}_4$

(b) Give reasons;

(i) Oxidation of propanal is easier than propanone.

(ii) alpha-hydrogen of aldehydes and ketones is acidic in nature.

**OR**

(a) Draw structures of the following derivatives :

(i) Cyanohydrin of cyclobutane

(ii) Hemiacetal of ethanal

(b) Write the major product(s) in the following :

(i)  $\text{CH}_3\text{-CH=CH-CH}_2\text{-CN}$   $\xrightarrow{\text{(i)DIBAL-H (ii) H}_3\text{O}^+}$   $\square$  ?

(ii)  $\text{CH}_3\text{-CH}_2\text{-OH}$   $\xrightarrow{\text{CrO}_3}$   $\square$  ?

(C) How can you distinguish between propanal and propanone ?

**2019**

Q1. Write structure of main compound A and B in each of the following reactions

(a)  $\text{C}_6\text{H}_5\text{-COOH}$   $\xrightarrow{\text{PCl}_5}$   $\square$  A  $\xrightarrow{\text{H}_2/\text{Pd-BaSO}_4}$   $\square$  B

(b)  $\text{CH}_3\text{-CN}$   $\xrightarrow{\text{(i)CH}_3\text{MgBr (ii)H}_3\text{O}^+}$   $\square$  A  $\xrightarrow{\text{Zn(Hg)/Con HCl}}$   $\square$  B



Q2 Give reasons

- (i) Benzoic acid is a stronger acid than acetic acid.
- (ii) Methanal is more reactive towards nucleophilic addition reaction than ethanal.
- (iii) Give a simple chemical test to distinguish between propanal and propanone.

**2018**

1. How will you convert the following:

- (i) Ethanol to Propanone
- (ii) Toluene to Benzoic acid.

**OR**

Account for the following:

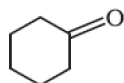
- (i) Aromatic Carboxylic Acids don't undergo Friedal Craft Reaction.
- (ii)  $pK_a$  value of 4-Nitrobenzoic acid is lower than that of Benzoic acid.

2. A, B, and C are three non-cyclic functional isomers of a carbonyl compound with molecular formula  $C_4H_8O$ . Isomers A and C give positive Tollen's Test whereas B don't give Tollen's Test, but gives positive Iodoform Test. Isomers A and B on reduction with  $Zn(Hg)/$  Conc. HCl give the same product D.

- (i) Write the structure of A, B, C and D.
- (ii) Out of A, B and C isomers which one is least reactive towards addition of HCN?

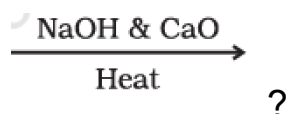
**2017**

Q1 Write the product(s) in the following reactions



1)  $+ HCN \rightarrow \square?$

2)  $C_6H_5-COONa$



3)  $CH_3-CH=CH-CN \xrightarrow{DIBAL-H/H_2O} \square?$

Q2 Give simple chemical test to distinguish between following pairs-

- 1) Butanal and Butane-2-one
- 2) Benzoic acid and phenol

**OR**

A) Write the reactions involved in the following

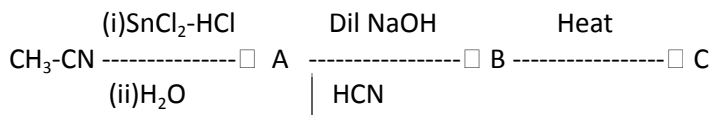
- 1) Etard reaction
- 2) Stephen reduction

B) How will you convert (not more than two steps)

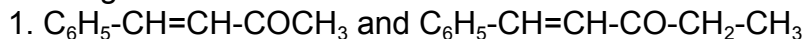
- 1) Benzoic acid to benzaldehyde
- 2) Acetophenone to benzoic acid
- 3) Ethanoic acid to 2-hydroxy ethanoic acid

**2016**

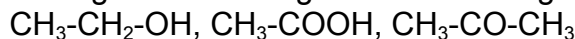
1. A. Write the structures of A, B, C and D in the following reactions :



B. Distinguish between



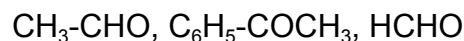
C. Arrange the following in the increasing order of their boiling points:



OR

1. Write the chemical reaction involved in Etard reaction:

2. Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction



3. Why pKa of  $\text{Cl-CH}_2\text{-COOH}$  is lower than the pKa of  $\text{CH}_3\text{-COOH}$ ?

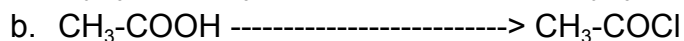
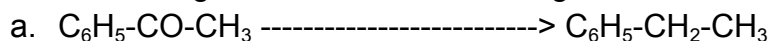
4. Write the product in the following reaction : (i)  $(\text{i-Bu})_2\text{AlH}$  (ii)  $\text{H}_2\text{O}$



5. A and B are two functional isomers of compound  $\text{C}_3\text{H}_6\text{O}$ . On heating with  $\text{NaOH}$  and  $\text{I}_2$ , isomer A forms yellow precipitate of iodoform whereas isomer B does not form any precipitate. Write the formula of A and B.

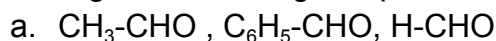
**2015( SET I)**

1. Write the reagents used in the following reactions:



OR

1. Arrange the following compounds in increasing order of their property as indicated:

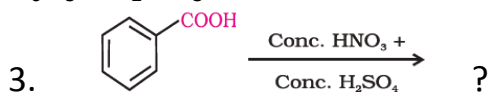
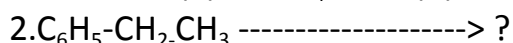
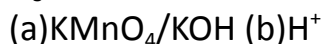
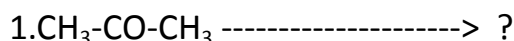
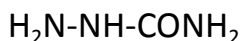


(reactivity towards Nucleophilic addition reaction)



(Acidic character)

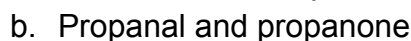
Q.2 Predict the products of the following reactions:

**2014 (SET I)**

1. Write the products formed when  $\text{CH}_3\text{CHO}$  reacts with the following reagents:



2. Give simple chemical tests to distinguish between the following pairs of compounds.

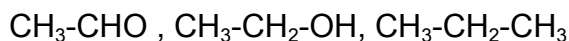


OR

- Account for the following
  - $\text{Cl-CH}_2\text{COOH}$  is a stronger acid than  $\text{CH}_3\text{COOH}$
  - Carboxylic acid do not give reactions of Carbonyl group.
- Write the chemical equations to illustrate the following reactions:
  - Rosenmund's reaction
  - Cannizzaro's reaction
  - Out of  $\text{CH}_3\text{-CH}_2\text{-CO-CH}_2\text{-CH}_3$  and  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CO-CH}_3$ , which gives the iodoform test?

### 2013 (SET III)

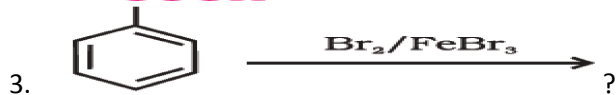
- Rearrange the following compounds in the increasing order of their boiling point.



- A) How will you convert the following:
  - Propanone to propan-2-ol
  - Ethanal to 2-hydroxypropanoic acid
  - Toluene to Benzoic acid
- B) Give simple chemical test to distinguish between
  - Pentan-2-one and Pentan-3-one
  - Ethanal and propanal

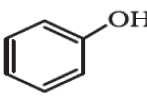
OR

(A) Write the products of the following reactions;



B) Which acid of each pair shown here would you expect to be stronger?

- a.  $\text{F-CH}_2\text{-COOH}$  or  $\text{Cl-CH}_2\text{-COOH}$

- b.  or  $\text{CH}_3\text{-COOH}$

(SET II)

- Ethanal is soluble in water. Why?

### 2012

- Write a suitable chemical equation to complete each of the following transformations :
  - Butan-1-ol to butanoic acid
  - 4-methylacetophenone to benzene-1,4-dicarboxylic acid
- An organic compound with molecular formula  $\text{C}_9\text{H}_{10}\text{O}$  forms 2,4-DNP derivatives, reduces Tollen's reagent and undergoes Cannizzaro's reaction, on vigorous oxidation it gives 1,2-benzene dicarboxylic acid. Identify the compound.

OR

- Give chemical tests to distinguish between-
  - Propanol and propanone.
  - Benzaldehyde and acetophenone
- Arrange the following compounds in an increasing order of their property as indicated :

- a) Acetaldehyde, Acetone, Methyl tertiary butyl ketone (reactivity towards HCN)  
 b) Benzoic acid, 3,4-Dinitrobenzoic acid and 4-methoxybenzoic acid (acid strength)  
 c)  $\text{CH}_3\text{-CH}_2\text{-CH(Br)COOH}$ ,  $\text{CH}_3\text{CH(Br)CH}_2\text{-COOH}$ ,  $(\text{CH}_3)_2\text{CHCOOH}$  (acid strength)

**2011**

1. Give equation for A) Cannizzaro reaction B) Clemmensen reaction
2. Obtain following
  - a. But2enal from Ethanal
  - b. Butanoic acid from Butanol
  - c. Benzoic acid from Ethylbenzene

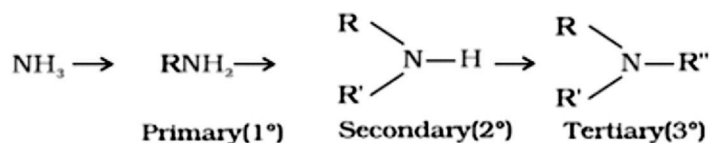
OR

1. A) Distinguish
  - a. Benzoic acid and Ethylbenzoate
  - b. Benzaldehyde and Acetophenone
2. Complete with giving missing reagents or products in following:



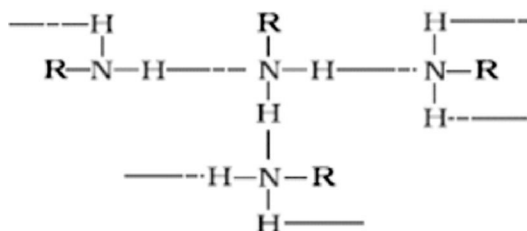
## AMINES (UNIT-12)

**Classification:** □ Amines are classified according to the number of carbon atoms bonded directly to the nitrogen atom. A primary ( $1^\circ$ ) amine has one alkyl (or aryl) group on the nitrogen atom, a secondary ( $2^\circ$ ) amine has two, and a tertiary ( $3^\circ$ ) amine has three.



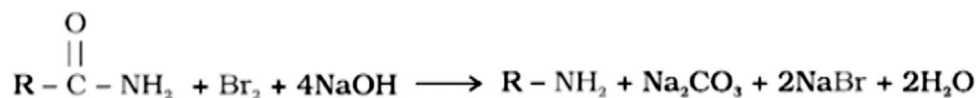
### Physical Properties of Amines

1. The lower aliphatic amines are gases with fishy smell. Primary amines with three or more carbon atoms are liquid and higher members are all solids.
2. Lower aliphatic amines are water soluble because they can form hydrogen bonds with water molecules, however the solubility decreases with increase in hydrophobic alkyl group.
3. Boiling points order: primary amine > secondary amine > tertiary amine

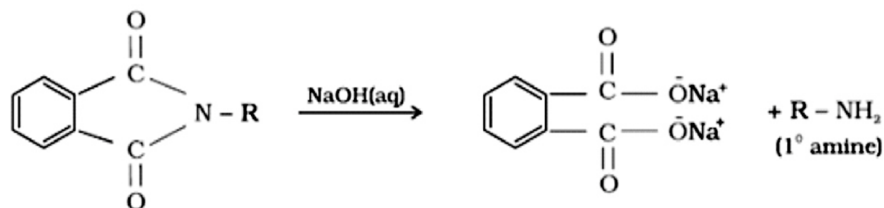
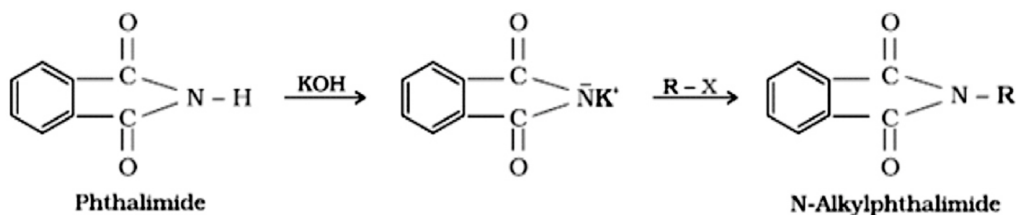


### Preparation

#### HOFFMANN BROMAMIDE REACTION:-



#### GABREIL PHTHALIMIDE SYNTHESIS: □



### Chemical Properties Basic Strength of Amines

Amines act as Lewis bases due to the presence of lone pair of electrons on the nitrogen atom. More the  $K_b$  (dissociation constant of base), higher is the basicity of amines. Lesser the  $pK_b$  higher is the basicity of amines. Aliphatic amines ( $R-NH_2$ ) are stronger bases than  $NH_3$  due to the electron releasing +I effect of the alkyl group. Among aliphatic methylamines, the order of basic strength in aqueous solution is as follows:

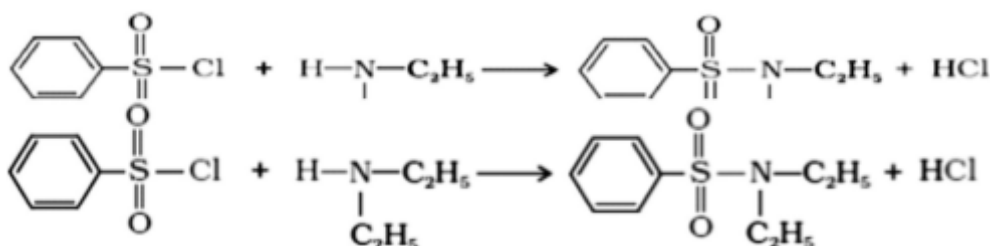
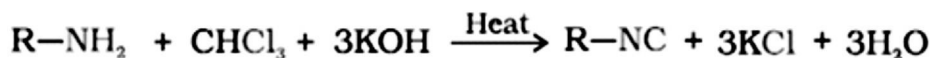


Aromatic amines are weaker bases than aliphatic amines and  $NH_3$ , due to the fact that the electron pair on the nitrogen atom is involved in resonance with the  $\pi$ -electron pairs of the ring.

#### BENZOYLATION:



#### CARBYLAMINE REACTION: HINSBERG'S TEST:



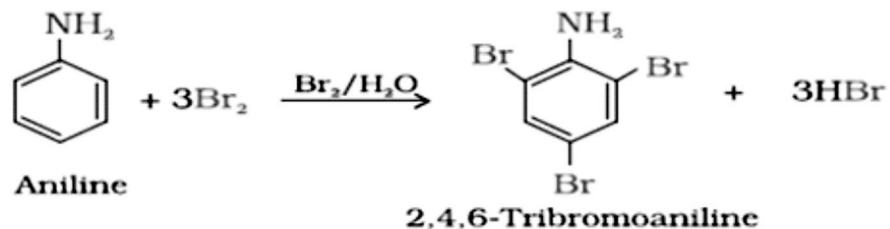
**N,N-Diethylbenzenesulphonamide (Insoluble in KOH)**

Tertiary amines do not react with benzene sulphonyl chloride. ELECTROPHILIC

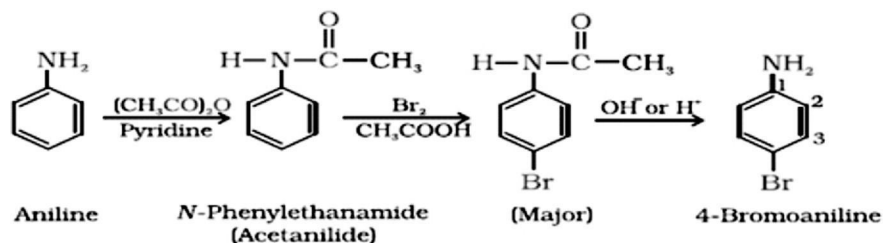
SUBSTITUTION REACTIONS:-

BROMINATION:-

To prepare monosubstituted derivative, activating effect of  $-NH_2$  group must be controlled by

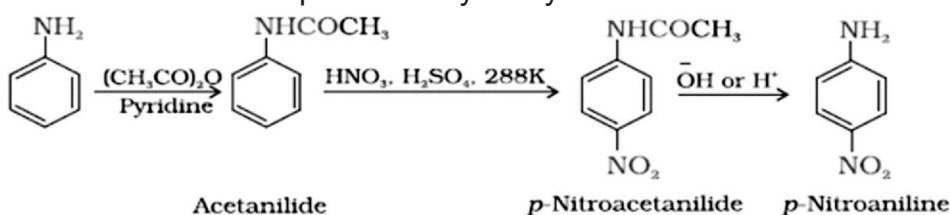


protecting-NH<sub>2</sub> by acetylation with acetic anhydride.

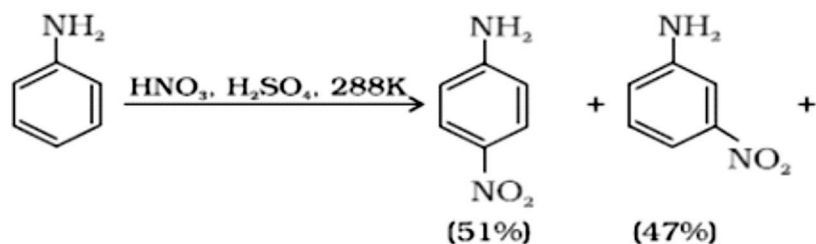


NITRATION:

Direct nitration of aniline is not possible as it is susceptible to oxidation, thus amino group is first protected by acetylation

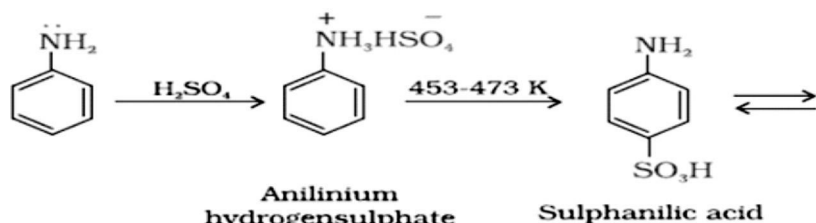


In strongly acidic medium, aniline is protonated to form anilinium ion which is meta directing so it gives meta product also



SULPHONATION:

Aniline does not undergo Friedel Craft reaction due to salt formation with aluminium chloride, the Lewis acid, which is used as a catalyst.



**Very Short Answer questions: (1 Mark)**

Q.1 What is Hinsberg's reagent? Ans. Benzene sulphonyl chloride

Q.2 Why is

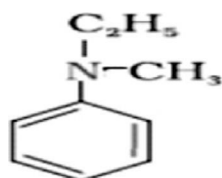
aniline acylated before its nitration? Ans.

To prevent it from oxidation

Q.3 Ethylamine is soluble in water but aniline is not, why?

Ans. Ethylamine forms intermolecular H-bond with water, but aniline does not form H-bond to a very large extent due to the presence of a large hydrophobic  $-C_6H_5$  group.

Q.4 Write the structure of



N-Ethyl-N-methylaniline. Ans.

Q.5 Write structures and IUPAC names of the amide which gives propanamine by Hoffmann bromamide reaction.

Ans.  $CH_3-CH_2-CH_2-C(=O)-NH_2$ , Butanamide

**ASSERTION - REASON TYPE**

**A statement of assertion is followed by a statement of reason.**

**Mark the correct choice from the options given below.**

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

1. Assertion : The diazotisation reaction must be carried in ice cold solution ( $0-4^{\circ}C$ ).

Reason : At higher temperature, benzenediazonium chloride reacts with water to give phenol.

( Ans - a )

2. Assertion : In strongly acidic solution aniline becomes less reactive towards electrophilic reagents.

Reason : Due to protonation of amino group the lone pair of electrons on nitrogen is not available for resonance. ( Ans - a )

3. Assertion : Gabriel phthalimide synthesis can be used to convert alkyl chlorides into primary amines.

Reason : With proper choice of reagent Gabriel synthesis can be used to prepare primary, secondary and tertiary amines. ( Ans - c )

4. Assertion : N-Ethylbenzenesulphonamide is soluble in alkali.

Reason : Hydrogen attached to nitrogen in sulphonamide is strongly acidic in nature. ( Ans - a )



5. Assertion : Benzenediazonium chloride can not be stored and is used immediately after its preparation.

Reason : It is very unstable and dissociates to give nitrogen. (Ans - a)

One - word answer

- Which one is more acidic : anilinium ion or p-fluoroanilinium ion ? (Ans - p-fluoroanilinium ion)
- Name the effect due to which nitrobenzene does not undergo Friedal Craft reaction.
- ( Ans - Deactivating)

### Short Answer questions: (2 Mark)

Q.6 Write IUPAC names of the following compounds and classify them into primary, secondary and tertiary amines.

(i)  $C_6H_5NHCH_3$

Ans. (i) N-Methyl aniline  $2^\circ$

(ii)  $(CH_3CH_2)_2NCH_3$

(ii) N-Ethyl-N-methylethanamine  $3^\circ$

Q.7 Give plausible explanation for each of the following:

- Why do primary amines have higher boiling point than tertiary amines?
- Why are aliphatic amines stronger bases than

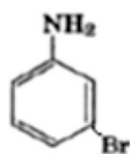
aromatic amines? Ans. (i) Due to strong intermolecular H-bonding in primary amines.

(ii) In aromatic amines lone pair is engaged with benzene in resonance.

Q.8 How can you convert an amide into an amine having one carbon less than the starting compound? Name the reaction.

Ans. By using Hoffmann bromamide reaction

Q.9 Write the structures of: (a) 3-Bromobenzenamine (b)



3-Chlorobutanamide Ans: (a) (b)  
 $CH_3CH(Cl)CH_2CONH_2$

Q.10 Arrange the following:

(i) In decreasing order of the  $pK_b$  values:

$C_2H_5NH_2$ ,  $C_6H_5NHCH_3$ ,  $(C_2H_5)_2NH$  and  $C_6H_5NH_2$

(ii) In increasing order of basic strength: Aniline, p-nitroaniline and p-toluidine

Ans: (i)  $C_6H_5NH_2$ ,  $C_6H_5NHCH_3$ ,  $C_2H_5NH_2$ ,  $(C_2H_5)_2NH$

(ii) p-Nitroaniline, aniline, p-toluidine

### Short Answer questions: (3 Marks)

Q.11 Give one chemical test to distinguish between the following pairs of compounds.

(i) Methylamine and dimethylamine

(ii) Ethylamine and aniline

(iii) Aniline and

benzylamine Ans: (i)

Carbylamine reaction

(ii) Azo dye Test

(iii) Azo dye Test

Q.12 Account for the following:

- Although amino group is o, p- directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of m-nitroaniline.
- Aniline does not undergo Friedel-Crafts reaction.
- Gabriel phthalimide synthesis is preferred for synthesizing primary amines.

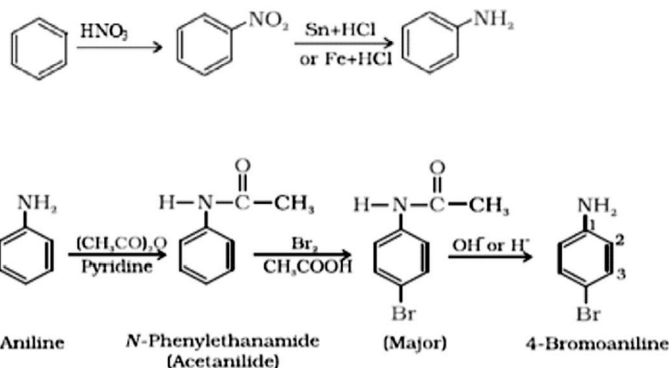
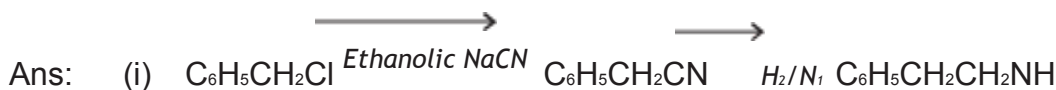
Ans. (i) Because nitration is carried out in an acidic medium. In an acidic medium, aniline is protonated to give anilinium ion which is meta-directing.

(ii) Friedel-Craft reaction is carried out in the presence of  $\text{AlCl}_3$ . But  $\text{AlCl}_3$  acts as a Lewis acid, while aniline acts as a Lewis base. Thus, aniline reacts with  $\text{AlCl}_3$  to form a salt.

(iii) Gabriel phthalimide synthesis results in the formation of primary amines only. Secondary and tertiary amines are not formed in this synthesis. Thus, a pure primary amine can be obtained. Therefore, Gabriel phthalimide synthesis is preferred for synthesizing primary amines.

Q.13 How will you convert:

- Benzyl chloride to 2-phenylethanamine
- Benzene to Aniline
- Aniline to p-bromoaniline



Q.14 An organic compound [A]  $\text{C}_3\text{H}_6\text{O}_2$  on reaction with ammonia followed by heating yield B. Compound B on reaction with  $\text{Br}_2$  and alc.  $\text{NaOH}$  gives compound C ( $\text{C}_2\text{H}_7\text{N}$ ). Compound C forms a foul smelling compound D on reaction with chloroform and  $\text{NaOH}$ . Identify A, B, C, D and write the equations of reactions involved.

[Hint: (A)  $\text{CH}_3\text{CH}_2\text{COOH}$  (B)  $\text{CH}_2\text{CH}_2\text{CONH}_2$  (C)  $\text{CH}_3\text{CH}_2\text{NH}_2$  (D)  $\text{CH}_3\text{CH}_2\text{NC}$ .]

## ASSIGNMENTS

1

### MARK QUESTIONS

- Arrange the following in decreasing order of their basic strength:  $\text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{C}_6\text{H}_5\text{NHCH}_3$ ,  $(\text{C}_2\text{H}_5)_2\text{NH}$  and  $\text{C}_6\text{H}_5\text{NH}_2$
- Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide. Why?

3. Diazonium salts of aromatic amines are more stable than those of aliphatic amines. Why?
4. Why aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis?
5. Write structures and IUPAC names of the amine produced by the Hoffmann degradation of benzamide.

2

**MARKS**  
**QUESTIONS**

Q1. Write short notes on the following:

- (i) Carbylamine reaction
- (ii) Hofmann's reaction

**MARK QUESTIONS**

Q1. How will you convert?

- i) Benzene into N, N-dimethylaniline
- ii) Aniline to phenol

Q2. An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with  $\text{Br}_2$  and KOH forms a compound 'C' of molecular formula  $\text{C}_6\text{H}_7\text{N}$ . Write the structures and IUPAC names of compounds A, B and C.

**MULTIPLE CHOICE QUESTIONS(MCQs)**

1. Which of the following is a 3° amine?

- (i) 1-methylcyclohexylamine
- (ii) Triethylamine
- (iii) tert-butylamine
- (iv) N-methylani

line Ans: (ii)

2. The correct IUPAC name for  $\text{CH}_2=\text{CHCH}_2\text{NHCH}_3$  is

- (i) Allylmethylamine
- (ii) 2-amino-4-pentene
- (iii) 4-aminopent-1-ene
- (iv) N-methylprop-2-en-1-a

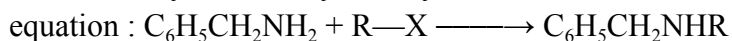
mine Ans:(iv)

3. Amongst the following, the strongest base in aqueous medium is \_\_\_\_\_.

- (i)  $\text{CH}_3\text{NH}_2$
- (ii)  $\text{NCCH}_2\text{NH}_2$
- (iii)  $(\text{CH}_3)_2\text{NH}$
- (iv)  $\text{C}_6\text{H}_5\text{NH}$

$\text{CH}_3$  Ans: (iii)

4. Benzylamine may be alkylated as shown in the following



Which of the following alkylhalides is best suited for this reaction through  $\text{S}_{\text{N}}1$  mechanism?

- (i)  $\text{CH}_3\text{Br}$
- (ii)  $\text{C}_6\text{H}_5\text{Br}$
- (iii)  $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$
- (iv)  $\text{C}_2\text{H}_5$

Br Ans: (iii)

5. Which of the following reagents would not be a good choice for reducing an aryl nitro compound to an amine?

- (i)  $\text{H}_2$  (excess)/Pt
- (ii)  $\text{LiAlH}_4$  in ether
- (iii) Fe and HCl
- (iv) Sn and

HCl Ans: (ii)

6. In order to prepare a  $1^\circ$  amine from an alkyl halide with simultaneous addition of one  $\text{CH}_2$  group in the carbon chain, the reagent used as source of nitrogen is\_\_\_\_\_.

- (i) Sodium amide,  $\text{NaNH}_2$
- (ii) Sodium azide,  $\text{NaN}_3$
- (iii) Potassium cyanide, KCN
- (iv) Potassium phthalimide,

$\text{C}_6\text{H}_4(\text{CO})_2\text{N}-\text{K}^+$  Ans: (iii)

7. The source of nitrogen in Gabriel synthesis of amines is\_\_\_\_\_.

- (i) Sodium azide,  $\text{NaN}_3$
- (ii) Sodium nitrite,  $\text{NaNO}_2$
- (iii) Potassium cyanide, KCN
- (iv) Potassium phthalimide,

$\text{C}_6\text{H}_4(\text{CO})_2\text{N}-\text{K}^+$  Ans: (iv)

8. The best reagent for converting 2-phenylpropanamide into 2-phenylpropanamine is\_\_\_\_\_.

- (i) excess  $\text{H}_2$
- (ii)  $\text{Br}_2$  in aqueous NaOH
- (iii) iodine in the presence of red phosphorus
- (iv)  $\text{LiAlH}_4$  in

ether Ans: (iv)

9. The best reagent for converting 2-phenylpropanamide into 1-phenylethanamine is\_.

- (i) excess  $\text{H}_2$ /Pt
- (ii) NaOH/ $\text{Br}_2$
- (iii)  $\text{NaBH}_4$ /methanol

(iv)  $\text{LiAlH}_4/\text{et}$

her Ans: (ii)

10. Hoffmann Bromamide Degradation reaction is shown by\_\_\_\_\_.

(i)  $\text{ArNH}_2$

(ii)  $\text{ArCONH}_2$

(iii)  $\text{ArNO}_2$

(iv)  $\text{ArCH}_2$

$\text{NH}_2$  Ans: (ii)

### SHORT ANSWERED QUESTIONS (1-MARK)

1. What is the hybridisation of N in  $(\text{CH}_3)_3\text{N}$  and shape of  $(\text{CH}_3)_3\text{N}$  ?

Ans. Hybridisation of N in  $(\text{CH}_3)_3\text{N}$  is  $\text{sp}^3$  and shape of  $(\text{CH}_3)_3\text{N}$  is trigonal pyramidal.

2. Which diazonium salt is stable at room temperature.

Ans. Benzene diazonium fluoro borate( $\text{C}_6\text{H}_5\text{N}_2\text{F}$ ).

3. Which diazonium salt is insoluble in water at room temperature?

Ans. Benzene diazonium fluoro borate ( $\text{C}_6\text{H}_5\text{N}_2\text{F}$ ).

4. Out of  $\text{CH}_3\text{NH}_2$  and  $\text{CH}_3\text{CH}_2\text{NH}_2$  which has higher boiling point and why ?

Ans.  $\text{CH}_3\text{CH}_2\text{NH}_2$  because bigger the alkyl group more is the surface area higher is the magnitude of van der Waals force.

5. Why are primary amines higher boiling than tertiary amines ?

Ans. Primary amines have two hydrogen atoms on the N atom and therefore form intermolecular hydrogen bonding. Tertiary amines do not have hydrogen atoms on the N atom and therefore, these do not form hydrogen bonds.

6. Write the structure and IUPAC name of t-butylamine.

Ans. 2-Methylpropan-2-amine

7. Which one is more basic  $\text{CH}_3\text{NH}_2$  or  $(\text{CH}_3)_3\text{N}$  in gaseous phase and why ?

Ans.  $(\text{CH}_3)_3\text{N}$  is more basic because greater number of alkyl groups increase the magnitude of +I effect so increase the basicity .

8. Which one is more basic  $\text{CH}_3\text{NH}_2$  or  $(\text{CH}_3)_3\text{N}$  in gaseous phase and why ?

Ans.  $(\text{CH}_3)_3\text{N}$  is more basic because greater number of alkyl groups

increase the magnitude of +I effect so increase the basicity .

9. Out of Butan-1-ol and butan-1-amine ,which will be more soluble in water and why?

Ans. Butan-1-ol are more polar than amines and forms stronger intermolecular hydrogen bonds with water molecules than amines.

10. Why ethylamine is soluble in water whereas aniline is not ?

Ans. Ethylamine when added to water forms intermolecular H-bonds with water. Hence, it is

soluble in water.

**Q1** Choose one option from following four options. 1M

- (I) Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explanation of the Assertion (A).
- (J) Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explanation of the Assertion (A).
- (K) Assertion (A) is correct, but Reason (R) is wrong statement.
- (L) Assertion (A) is wrong, but Reason (R) is correct statement.

**(A)ASSERTION:-** Lower aliphatic amines are soluble in water but higher amines are insoluble.

**(B) REASON:-** Amines can form hydrogen bonds with water molecules. However, solubility decreases with increase in molar mass of amines due to increase in size of the hydrophobic alkyl part

**(A)ASSERTION:-Amines can be considered as derivatives of ammonia**

**(B) REASON:-** Amines can be obtained by replacement of one, two or all the three hydrogen atoms of  $\text{NH}_3$  by alkyl and/or aryl groups.

**(A)ASSERTION:-** In amines the angle C–N–E, (where E is C or H) is less than  $109.5^\circ$ ;

**(B) REASON:-** Due to the presence of unshared pair of electrons on N atom.

**(A)ASSERTION:-** In ammonolysis of halide the primary amine is obtained as a major product by taking large excess of ammonia.

**(B) REASON:-** Ammonolysis of alkyl amine has the disadvantage of yielding a mixture of primary, secondary and tertiary amines and also a quaternary ammonium salt.

**(A)ASSERTION:-** Reduction of nitrobenzene in to aniline with iron scrap and hydrochloric acid is preferred.



**(B) REASON:-**  $\text{FeCl}_2$  formed gets hydrolysed to release hydrochloric acid during the reaction. Thus, only a small amount of hydrochloric acid is required to initiate the reaction.

**(A) ASSERTION:-** In Gabriel phthalimide synthesis the aromatic primary amines cannot be prepared. **(B) REASON:-** Aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.

Q2. Choose correct options

Steps of Chemical equations for the following conversions:

- (i)  $\text{CH}_3\text{-CH}_2\text{-Cl}$  into  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-NH}_2$
- 1) (a) ethanolic NaOH then (b) Reduction
  - 2) (a) aqueous KOH (b) Reduction
  - 3) (a) K-CN (b) Oxidation
  - 4) (a) K-CN (b) Reduction
- (ii)  $\text{C}_6\text{H}_5\text{-CH}_2\text{-Cl}$  into  $\text{C}_6\text{H}_5\text{-CH}_2\text{-CH}_2\text{-NH}_2$
- 1) (a) ethanolic NaOH then (b) Reduction
  - 2) (a) aqueous KOH (b) Reduction
  - 3) (a) Aqueous K-CN (b) Oxidation
  - 4) (a) ethanolic K-CN (b) Reduction

IUPAC name of the amide which gives propanamine by Hoffmann bromamide reaction.

Butanamide Pentanamide Propanamide Acetamide

(ii) the amine produced by the Hoffmann degradation of benzamide.

Aniline benzenamine  $\text{C}_6\text{H}_5\text{-NH}_2$  All above

Name of  $\text{CH}_2=\text{CH-CH}_2\text{-NH}_2$  is

- (a) Allylamine
  - (b) Prop-2-en-1-amine
  - (c) Prop-1-en-3-amine
  - (d) Vinyl amine
- (a) And (b) ans  
 (b) (a) and (c)  
 (c) Only (c)  
 (d) (b) and (d)

1. N-Methylmethanamine 3.27
2. N,N-Dimethylmethanamine 4.22
3. Ethanamine 3.29
4. N-Ethylethanamine 3.00
5. N,N-Diethylethanamine 3.25

Correct order of their increasing order of basic strength is

12345

54321

45132

23154ans

Q Illustrate following chemical reactions (02Marks each)

1. Carbyl amine reaction
2. Hoffmann's Bromamide reaction
3. Gabriel Phthalimide Synthesis
4. Hinsberg's test for Primary amine
5. Sulphonation of aniline
6. Acetylation of ethanamine

### **2020 SET 1**

Q1 Write an isomer of  $C_3H_9N$  which gives foul smell of isocyanide when treated with chloroform and ethanolic NaOH.

Q2 Arrange the following compounds as directed: (this Q. is common in all three sets)

- (i) In increasing order of solubility in water:  
 $(CH_3)_2NH$ ,  $CH_3NH_2$ ,  $C_6H_5NH_2$      $3 < 1 < 2$
- (ii) In decreasing order of basic strength in aqueous solution:  
 $(CH_3)_3N$ ,  $(CH_3)_2NH$ ,  $CH_3NH_2$      $1 < 3 < 2$
- (iii) In increasing order of boiling point:  
 $(C_2H_5)_2NH$ ,  $(C_2H_5)_3N$ ,  $C_2H_5NH_2$      $2 < 1 < 3$

### **2020 set 2**

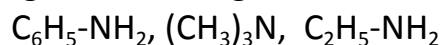
Q1 Out of  $CH_3NH_2$  and  $CH_3OH$ , which has higher boiling point?

### **2020 set 3**

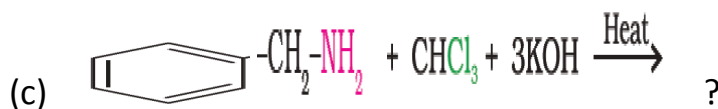
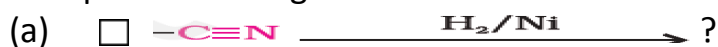
Write an isomer of  $C_3H_9N$  which does not react with Hinsberg reagent.

### **2019**

Q1 Arrange the following in decreasing order of basic character



Q2 Complete following reactions



OR

How do you convert

- N-phenylethanamide to p-Bromoaniline
- Benzene diazonium chloride to Nitro benzene.
- Benzoic acid to aniline.

2018

Q1 (a) Write the reactions involved in the followings.

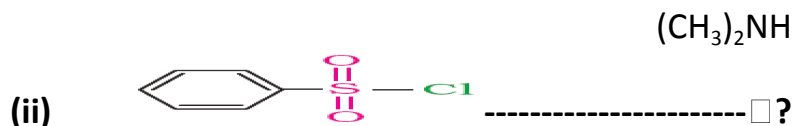
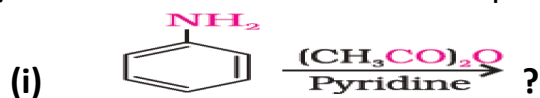
- Hoffmann Degradation Reaction
- Diazotisation
- Gabriel phthalimide synthesis

(b) Give reasons

- $(\text{CH}_3)_2\text{NH}$  is more basic than  $(\text{CH}_3)_3\text{N}$  in an aqueous solution.
- Aromatic diazonium salts are more stable than aliphatic diazonium salt.

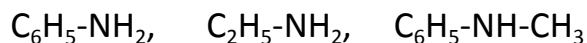
OR

(A) Write the structure of the main products of the following reactions.



(B) Give a simple chemical tests to distinguish between Aniline and N,N dimethyl aniline.

(C) Arrange the followings in the increasing order of their  $\text{pK}_b$  values.

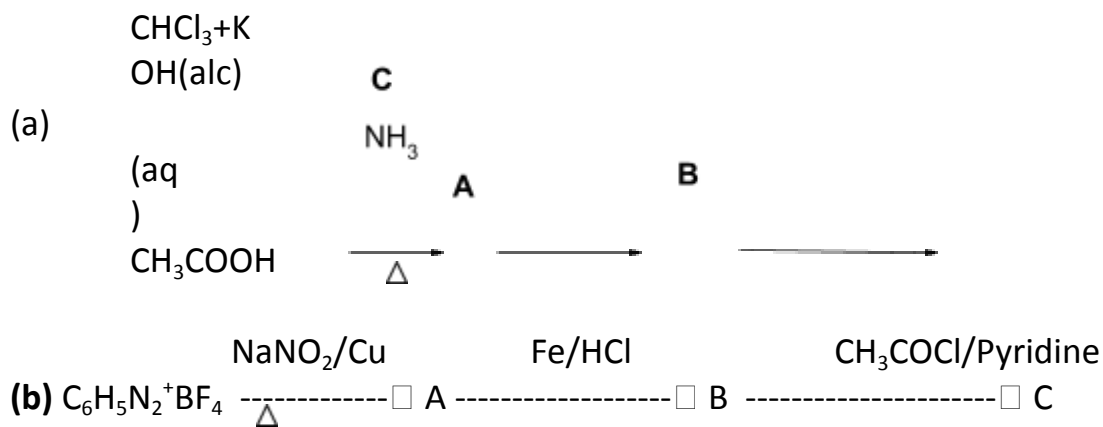


2017

1. Write the structure of compounds A, B, C in the following:

$\text{Br}_2/\text{KO}$

H

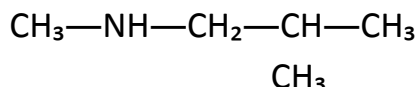


Q2 Give reasons for the followings

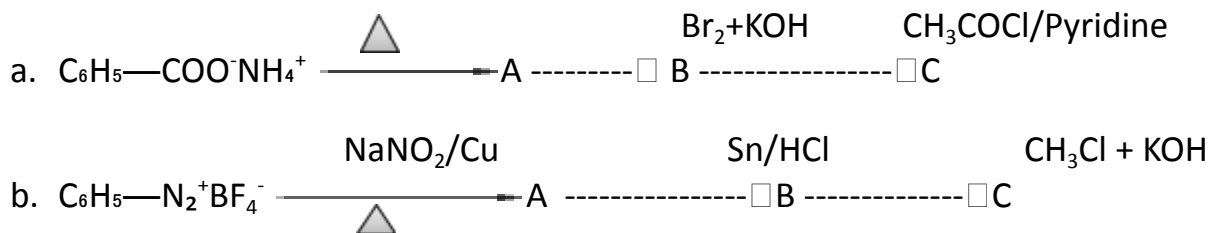
- Acetylation of aniline reduce its activation effect.
- $\text{CH}_3\text{NH}_2$  is more basic than  $\text{C}_6\text{H}_5\text{NH}_2$ .
- Although  $-\text{NH}_2$  is o/p directing group, yet aniline on nitration gives a significant amount of m-nitroaniline.

**2016**

1. Write IUPAC name of

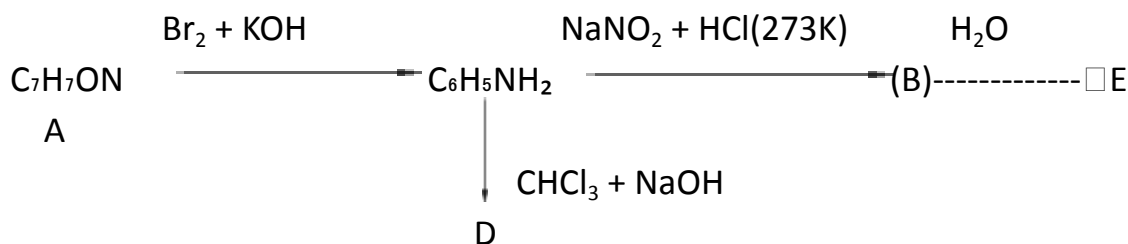


2. Write the structures of A,B AND C in following



**2015**

1. An aromatic compound A of molecular formula  $\text{C}_7\text{H}_7\text{ON}$  undergoes a series of reactions as shown below. Write the structure of A,B,C,D and E in the following reactions.



**OR**

a) Write the structures of the main products when aniline reacts with the following reagents

- $\text{Br}_2$  water
- HCl
- $(\text{CH}_3\text{CO})_2\text{O}$  / pyridine

b) arrange the following in the increasing order of their boiling point

- $\text{C}_2\text{H}_5-\text{NH}_2$ ,
- $\text{C}_2\text{H}_5-\text{OH}$ ,
- $(\text{CH}_3)_3\text{N}$

- c) give a sample chemical test to distinguish between the following pair of compounds  
 -  $(\text{CH}_3)_2\text{NH}$  and  $(\text{CH}_3)_3\text{N}$

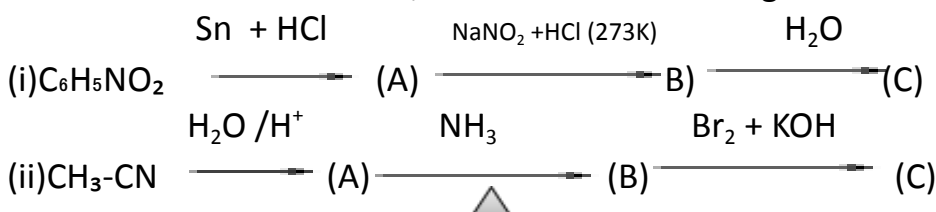
**2014**

1. Account for the following :

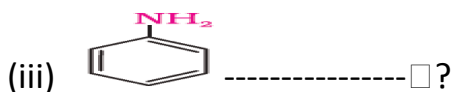
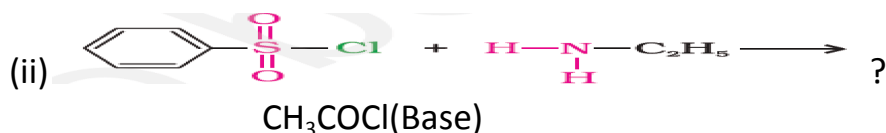
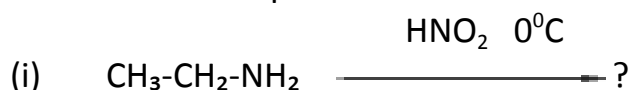
- (i) primary amines ( $\text{R-NH}_2$ ) have higher boiling points than tertiary amines  
 (ii) aniline does not undergo Friedel-Crafts reaction  
 (iii)  $(\text{CH}_3)_2\text{NH}$  is more basic than  $(\text{CH}_3)_3\text{N}$  in an aqueous solution.

**OR**

Give the structure of A, B and C in the following reactions

**2013**

Write the main products of the following reactions.

**2012**

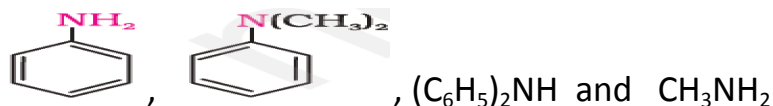
Q1 describe the following giving the relevant chemical equation in each case.

1. Carbylamine reaction    2. Hoffmann's bromamide reaction

1. complete the following reaction

**2011**

Q1 Rearrange the following in an increasing order of their basic strength



Q2 State reasons for the following

- (a)  $\text{pK}_b$  value for aniline is more than that for methyl amine.  
 (b) Ethylamine is soluble in water whereas aniline is not.  
 (c) Primary amines have higher boiling points than tertiary amines.

Q3 Give chemical test to distinguish ethylamine and aniline

## BIOMOLECULES (UNIT 13)

KEY POINTS	EXPLANATIONS
Reducing sugars	Aldehydic/ ketonic groups free so reduce Fehling's/ Tollen's solution and. e.g.- maltose and lactose
Non reducing sugars	Aldehydic/ ketonic groups are bonded so cannot reduce Fehling's solution and Tollen's reagent. E.g.- Sucrose
Anomers.	The two cyclic hemiacetal forms of glucose differ only in the configuration of the hydroxyl group at C1, called <i>anomeric carbon</i> Such isomers, i.e., $\alpha$ -form and $\beta$ -form, are called anomers.
Invert sugar	Sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fructose. Since the laevorotation of fructose ( $-92.4^\circ$ ) is more than dextrorotation of glucose ( $+ 52.5^\circ$ ), the mixture is laevorotatory. Thus, hydrolysis of sucrose brings about a change in the sign of rotation, from dextro(+) <i>to</i> laevo (-)andthe product is named asinvert sugar.
Glycosidic linkage	Linkage between two mono saccharide
Importance of Carbohydrates	Major portion of our food. / used as storage molecules as starch in plants and <b>glycogen</b> in animal. Cell wall of bacteria and plants is made up of cellulose.Wood and cloth are cellulose, provide raw materials for many important industries like textiles, paper, lacquers and breweries.
Essential amino acids	Whichcannot besynthesized inthebodyand must be obtained through diet, e.g.- Valine, Leucine

Non-essential aminoacids	Which can be synthesised in the body, eg-Glycine, Alanine
Zwitter ion.	In aqueous solution, amino acids exist as dipolar ion known as <i>zwitter ion</i> .
Peptide linkage	peptide linkage is an amide formed between $-COOH$ group and $-NH_2$ group of two successive amino acids in peptide chain.
1 <sup>0</sup> - str. Of proteins:	sequence of amino acids that is said to be the primary structure of protein
2 <sup>0</sup> - str. of proteins:	secondary structure of protein refers to the shape in which a long polypeptide chain can exist. They are found to exist in two types of structures viz. $\alpha$ -helix and $\beta$ -pleated sheet structure.
Tertiary structure of proteins:	further folding of the secondary structure. It gives rise to two major molecular shapes viz. fibrous and globular.
Fibrous proteins	Polypeptide chains run parallel, held together by hydrogen and disulphide bonds, fiber-like structure. Water insoluble. Eg- keratin (in hair, wool, silk) and myosin (present in muscles).
Globular proteins	chains of polypeptides coil around to give a spherical shape. water soluble. Eg- Insulin and albumins
Stab. forces 2° & 3°	Hydrogen bonds, disulphide linkages, van der Waals and electrostatic forces of attraction.
Denaturation of Proteins	When a protein is subjected to physical change like change in temperature or chemical change like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity. This is called <b>denaturation</b> of protein. (During denaturation 2° and 3° structures are destroyed but 1° structure remains intact.) eg- The coagulation of egg white on boiling, curdling of milk
DNA	pentose sugar (D-2-deoxyribose) + phosphoric acid + nitrogenous bases (A, G, C, T)

RNA	pentose sugar (ribose) + phosphoric acid + nitrogenous bases (A, G , C, U )
Nucleoside/tides	Nucleoside → sugar + base Nucleotides→ sugar+base +phosphate
Phosphodiester link	Linkage between two nucleotides in polynucleotides
FunctionsofNucleicAcids	DNA reserve genetic information, maintain the identity of different species is capable of self-duplication during cell division, synthesizes proteinin thecell.



**QUESTIONS**  
**VSA TYPE QUESTIONS (1 - MARK QUESTIONS)**

1. How many asymmetric carbon atoms are present in D (+) glucose?
2. Give the significance of (+)-sign in the name D- (+)-glucose.
3. Give the significance of prefix 'D' in the name D- (+)-glucose.
4. Why is sucrose called invert sugar?
5. Write the Zwitter ionic form of amino acetic acid. ( $\text{H}_2\text{NCH}_2\text{COOH}$ ).
6. How would you explain the amphoteric behaviour of amino acids?
7. Which nucleic acid is responsible for carrying out protein synthesis in the cell?
8. The two strands in DNA are not identical but complementary. Explain.
9. What type of linkage holds together the monomers of DNA and RNA?
10. Mention the number of hydrogen bonds between adenine and thymine.

**Answers**

1. 4
2. (+) sign indicates dextrorotatory nature of glucose.
3. 'D' Signifies that -OH group on C-5 is on the right hand side
4. When sucrose is hydrolyzed by water, the optical rotation of solution changes from positive to negative.
5. Amino acids are amphoteric due to the presence of both acidic and basic functional groups.
6. Amphoteric behavior.
7. RNA
8. complementary bases are prepared.
9. H-bonding is present between specific pairs of bases present in strands.
10. Phosphodiester linkage.

**(Q.) What is difference between reducing and non-reducing sugars or carbohydrates? (1 Mark)**

**(Ans)** All those carbohydrates which contain aldehydic and ketonic group in the hemiacetal or hemiketal form and reduce Tollen's reagent or Fehling's solution are called reducing carbohydrates while others which do not reduce these reagents are called non-reducing sugars.

**(Q.) Explain the term mutarotation? (1Mark)**

**(Ans)** Mutarotation is the change in the specific rotation of an optically active compound with time, to an equilibrium mixture.

**(Q.) Define glycosidic linkage? (1Mark)**

**(Ans)** The two monosaccharide units are joined together through an etheral or oxide linkage formed by the loss of a molecule of H<sub>2</sub>O. Such a linkage between two monosaccharide units through oxygen atoms is called glycosidic linkage.

**(Q.) Give a chemical equation for obtaining maltose? (1Mark)**

**(Ans)** Maltose is obtained by partial hydrolysis of starch by the enzyme diastase present in malt i.e., sprouted barley seeds.



**ASSERTION - REASON TYPE**

**A statement of assertion is followed by a statement of reason.**

**Mark the correct choice from the options given below:**

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.  
 (b) Both assertion and reason are true but reason is not the correct explanation of assertion.  
 (c) Assertion is true but reason is false.  
 (d) Both assertion and reason are false.

1. Assertion : D - glucose is dextrorotatory whereas L - glucose is laevorotatory.

Reason : D - compounds are always dextro and L - compounds are always laevo. ( Ans - b)

2. Assertion : Purine bases present in DNA are adenine and guanine.

Reason : The base thymine is present in RNA while base uracil is present in DNA. (Ans - c)

3. Assertion :  $\alpha$  - Amino acids are the building blocks of proteins.

Reason : Natural amino acids are mostly  $\alpha$  - amino acids. (Ans - b)

One - word answer

1. Name the linkage used to link different monosaccharide in a polysaccharide ? (Ans - Glycosidic)

2. Name a water soluble vitamin which is not excreted from our body? ( Ans - Vitamin - B12)

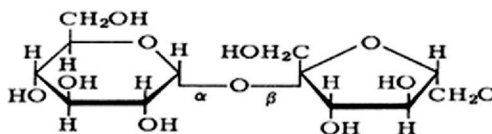
**(Q.) What do you understand by denaturation of proteins? (2Marks)**

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

**(Q.) Give the chemical structure of sucrose & explain why sucrose is non reducing sugar.**

**(2 Marks)**

**(Ans)**

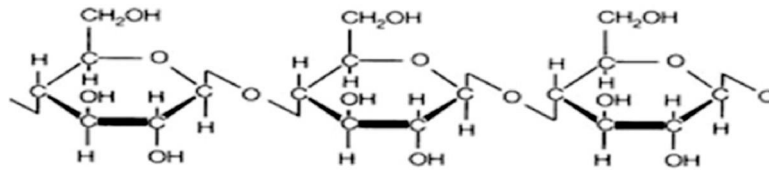


The two monosaccharide are held together by a glycosidic linkage between C1 of - glucose and C2 of

- fructose. Since the reducing groups of glucose and fructose are involved in glycosidic bond formation, sucrose is a non-reducing sugar.

(Q.) Write a short note on cellulose and give its chemical structure. (3Marks)

(Ans)



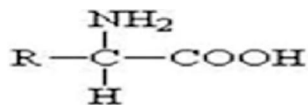
Cellulose occurs exclusively in plants and it is the most abundant organic substance in plant kingdom. It is a predominant constituent of cell wall of plant cells. Cellulose is a straight chain polysaccharide composed only of  $\alpha$ -D-glucose units which are joined by glycosidic linkage between C1 of one glucose unit and C4 of the next glucose unit

(Q.) Give a short note on Zwitter ion? (3Marks)

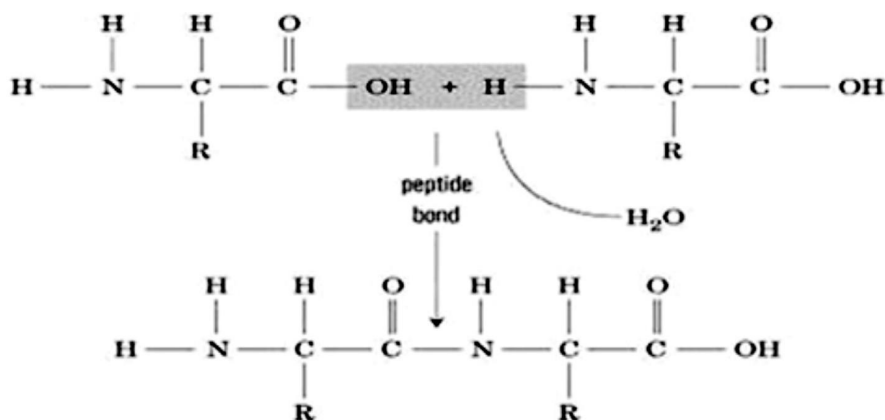
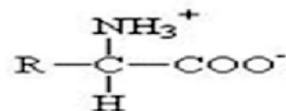
(Ans) Amino acids are usually colourless, crystalline solids. These are water soluble, high melting solids and behave like salts rather than simple amines or carboxylic acids. This behaviour is due to the presence of both acidic (carboxylic group) and basic (amino group) groups in the same molecule. In aqueous solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as zwitterion.

(Q.) How are peptides formed. Show the formation of peptide bond with diagram. (3 Marks)

(Ans) Peptides are amides formed by the condensation of amino group of one  $\text{NH}_2$ -amino group with the carboxyl group of another molecule of the same or different

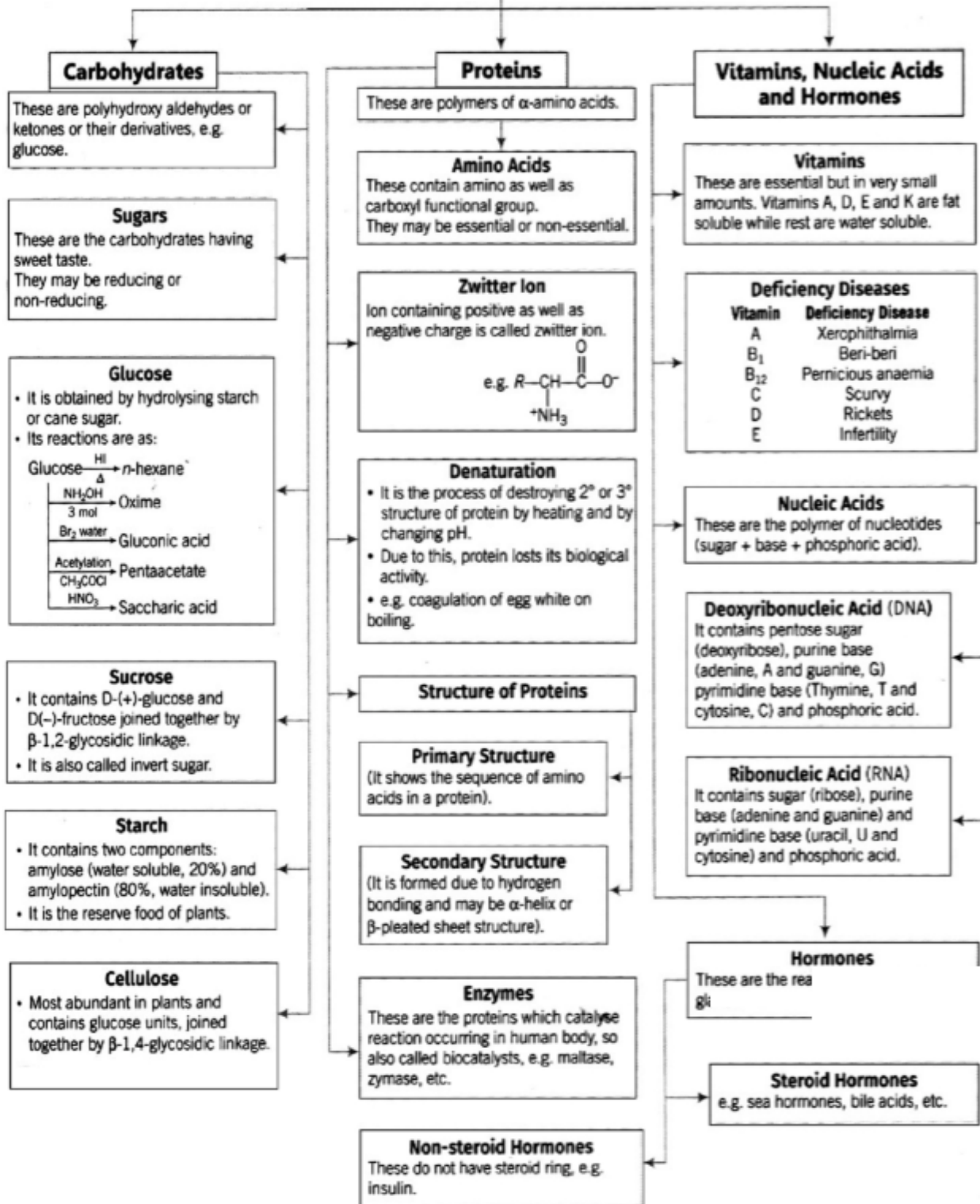


R is the functional group of the amino acid



# Biomolecules

These are the macromolecules essential for survival of life, e.g. carbohydrates, proteins, etc.



Chemicals released by endocrine glands

## **Concept of vitamins deleted this year**

**MCQ**

1. The function of enzymes in the living system is to–

- (a) Transport oxygen (b) Provide immunity (c) Catalyze biochemical reactions (d) Provide energy

Ans c

2. Which statement is incorrect about peptide bond?

- (a) N bond length in proteins is longer than usual bond length of C – N bond  
 (b) Spectroscopic analysis shows planar structure of – CO – NH – group  
 © C – N bond length in proteins is smaller than usual bond length of C – N bond  
 (d) None of the above

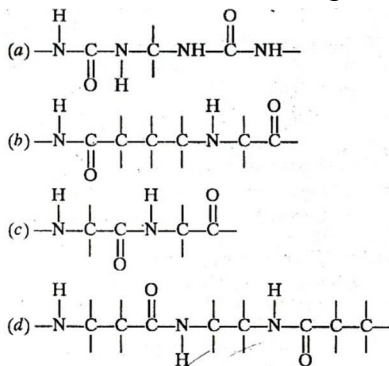
Ans a

3. The functional group which is found in amino acid is

- (a) – COOH (b) – NH<sub>2</sub> (c) – CH<sub>3</sub> (d) both (a) and (b)

Ans d

4. Which of the following structures represents the peptide chain?



Ans c

5. Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories –

- (a) A coenzyme (b) a hormone (c) an enzyme (d) An antibiotic

Ans b

6. Which base is present in RNA but not in DNA?

- (a) Uracil (b) Cytosine (c) Guanine (d) Thymine

Ans d

7. The nucleic acid base having two possible binding sites is –

- (a) Thymine (b) cytosine (c) Guanine (d) Adenine

Ans c

8. Which functional group participates in disulphide bond formation in proteins?

- (a) Thioether (b) Thiol (c) Thioester (d) Thiolactone

Ans b

9. In both DNA and RNA, heterocyclic base and phosphate ester linkages are at –

- $C_5'$  and  $C_2'$  respectively of the sugar molecule
- $C_2'$  and  $C_5'$  respectively of the sugar molecule
- $C_1'$  and  $C_5'$  respectively of the sugar molecule
- $C_5'$  and  $C_1'$  respectively of the sugar molecule

molecule Ans c

10. The human body does not produce –

- (a) Enzymes (b) DNA (c) Vitamins (d) Hormones

Ans c

11. The Pyrimidine bases present in DNA are –

- cytosine and adenine
- cytosine and guanine
- cytosine and thymine
- cytosine, thiamine and uracil

Ans d

### HOTS

**Q1.** How is globular protein different from fibrous protein?

**Ans–**

Globular Protein	Fibrous Protein
1. they form $\alpha$ -helix structure. 2. they are water soluble. 3. they involve H bonding.	1. they have $\beta$ -pleated structure. 2. they are water insoluble. 3. they have strong intermolecular forces of attraction.

**Q2.** (i) What products would be formed when a nucleotide from DNA containing thymine is hydrolyzed?

(ii) How will you distinguish  $1^\circ$  and  $2^\circ$  hydroxyl groups present in glucose?

**Ans.** (i) Complete hydrolysis of DNA yields a pentose sugar, phosphoric acid and thymine

(ii) On oxidation with nitric acid, glucose as well as gluconic acid both yield a dicarboxylic acid, saccharic acid. This indicates the presence of a primary alcoholic ( $-\text{OH}$ ) group in glucose.

**Q3.** Explain tertiary structure of Protein.

**Ans.** *Tertiary structure of proteins:* The tertiary structure of proteins represents overall folding of the polypeptide chains i.e., further folding of the secondary structure. It gives rise to two major molecular shapes viz. fibrous and globular. The main forces which stabilize the  $2^\circ$  and  $3^\circ$  structures of proteins are hydrogen bonds, disulphide linkages, van der Waals and electrostatic forces of attraction



2020set 1

Q1 Write the name of component of starch which is water soluble.

Q2 An alpha – helix is a structural feature of

- (a) Sucrose (b) Polypeptide (c) Nucleotide (d) Starch

Q3 Write the reactions showing the presence of following in the open structure of glucose:

- (i) A carbonyl group (ii) Straight chain with six carbon atoms.

**2020 set 2**

Q1 Write the name of linkage joining two monosaccharides.

Q2  $\alpha - D(+)$ glucose and  $\beta - D(+)$  glucose are

- (a) Geometrical isomers (b) Enantiomers (c) Anomers (d) Optical isomers

**2020 set 3**

Q1 What type of protein is present in keratin?

Q2 Which one is the complementary base of cystosine in one strand to that in other strand of DNA?

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

**2019**

Q1 What is the basic structural differences between Starch and Cellulose?

**OR**

Write the products obtained after hydrolysis of DNA.

Q2 (a) What are the products of hydrolysis of maltose?

(b) What type of bonding provides stability to alpha – helix structure of protein.

(c) Name the vitamin whose deficiency causes pernicious anaemia.

**OR**

Define following (i) Invert sugar (ii) Native protein (iii) Nucleotide

**2018**

Q1 Define the followings with an example of each.

- (a) Polysaccharides (b) Denaturated protein (c) Essential amino acids

**OR**

(a) Write the product when D-glucose reacts with conc.  $\text{HNO}_3$ .

(b) Amino acids shows amphoteric behavior. Why?

(c) Write one difference between alpha – Helix and beta- pleated structures of proteins.

**2017**

Q1 (a) Which polysaccharide component of carbohydrates is commonly present in bread?

(b) Write the two types of secondary structure of proteins.

(c) Give two examples of water soluble vitamins.

2016

Q1. 1. Write one reaction of D glucose which cannot be explained by its open chain structure.

2. What type of linkage is present in nucleic acids?

3. Give one example each for water soluble vitamins and fat soluble vitamins?

(1+1+1)

**2015 (set 1)**

1. Which one of the following is a disaccharide –

Starch, maltose, fructose, glucose

2. What is the difference between acidic and basic amino acids?

3. Write the name of the linkage joining nucleotides.

**2014(set 1)**

Q1 What are the products of hydrolysis of sucrose?

Q2 Define the following terms related to proteins-

(i) Peptide linkage (ii) primary structure

(iii) Denaturation

(set2)

Q1 What are the products of hydrolysis of maltose?

Q2 Define the following terms –

(i) Glycosidic linkage (ii) invert sugar

(iii) Oligosaccharides

(Set 3)

Q1 Write the products of hydrolysis of lactose?

Q2 Define the following terms

(i) Nucleotide (ii) anomers (iii) Essential amino acid

**2013 (set 3)**

Q1 What are the products of hydrolysis of lactose?

Q2 Value based question –

(i) Name the vitamins whose deficiency causes pernicious anemia.

(ii) Give an example of a water soluble vitamin.

(Set 2)

Q1 Write the name of linkage joining two amino acids.

**2012**

Q1 Write the structure of the product obtained when glucose is oxidized with nitric acid

Q2 What is essentially the difference between  $\alpha$  glucose and  $\beta$  glucose? What is meant by pyranose structure of glucose?

(set 3)

Q3 Write a reaction which shows that all the carbon atoms in glucose are linked in a straight chain.

Q4 Define the following as related to proteins.

(i) Peptide linkage (ii) primary structure (iii) Denaturation

**2011**

Q1 Explain what is meant by the following

(i) Peptide linkage

(ii) Pyranose structure of glucose

Q2 Write the main structural difference between DNA and RNA of the four – N.base, name those which are common to both DNA and RNA.

Q3 Write such reactions and facts about glucose which cannot be explained by its open chain structure.

**APPENDIX –A**

**Important formula (from unit 1 - 3)**

**UNIT- 1 SOLUTIONS**

**HENRY'SLAW**  $P = K_H X$   $K_H$  is Henry's law constant .

**RAOULT'SLAW:-**  $P = P^0 X_B$  ;  $P_{total} = P_A + P_B$

**5. RELATIVE LOWERING OF VAPOUR PRESSURE**

$$\frac{P^0 - P}{P^0} = X_B \quad X = \frac{n_B}{n_A + n_B}$$

For dilute solution,  $n_B \ll n_A$ , hence  $n_B$  is

neglected in the denominator.  $\frac{P^0 - P}{P^0} = \frac{n_B}{n_A}$

$$\frac{P^0 - P}{P^0} = \frac{W_B \cdot M_A}{M_B \cdot W_A}$$

**6. ELEVATION OF BOILING POINT**

$$\Delta T_b = k_b m$$

W  
h  
e  
r  
e  
,  
 $\Delta$   
T  
=

T

—

T

0

M

=

k

b

1

0

0

0

W

B

/

Δ

T

b

W

A

**7. DEPRESSION IN FREEZING POINT**

Δ

T<sub>f</sub>

=

K<sub>f</sub>

m

W

h

er

e

,

Δ

T

=

T<sup>0</sup>

—

T

f f f

M = k<sub>f</sub>

1000

W<sub>B</sub>/ΔT<sub>f</sub>

W<sub>A</sub>

**8. O**

**S  
M  
O  
T  
I  
C  
P  
R  
E  
S  
S  
U  
R  
E**

$$\Pi = CRT$$

$$\Pi = n/VRT$$

$$R = 0.0821 \text{ Latm mol}^{-1};$$

$i$  = normal molecular mass/ observed molecular mass

**VAN'T HOFF FACTOR (i)**

$i$  = observed colligative properties/ calculated value of colligative properties  $i < 1$  (for association)  $i > 1$  (for dissociation)

**MODIFIED FORMS OF COLLIGATIVE PROPERTIES**

$$5) \quad \frac{P_A^0 - P_A}{P_A^0} = i \quad \frac{n_B}{n_A}$$

$$6) \quad \Delta T_b = i K_b m$$

$$7) \quad \Delta T_f = i K_f m$$

$$8) \quad \Pi = i CRT$$

## UNIT 2 ELECTROCHEMISTRY

1.)  $p = R \ln$

2.)  $K = 1/p$

3.)  $K = 1/R \ln a$

4.)  $\Lambda_m = k100/c$

5.)  $E_{\text{cell}} = E^{\circ} - 2.303R.T/nF \log K$

6.) At 25°C  $E_{\text{cell}} = E^{\circ} - 0.0591/n \log K$  7.) At equilibrium

$$E^{\circ} = 0.0591/n \log K \quad 8.) \quad \Delta G = -nFE^{\circ}$$

## UNIT 3 CHEMICAL KINETICS

1. **1. Rate of reaction:** - For a reaction  $R \rightarrow P$ ,

Rate of reaction = change of conc. of R or P / T time interval

2. **Order of reaction:** □





2.

For the reaction  $aA + bB \rightarrow cC + dD$

$$= \frac{-\Delta[R]}{\Delta t} = \frac{\Delta[P]}{\Delta t}$$

3. Rate =  $K[A]^x[B]^y$

4. **Units of rate constants and graph between rate and conc. of reactant**

Order of reaction	zero	first	second	third
Unit of rate constt.	$\text{mol L}^{-1} \text{s}^{-1}$	$\text{s}^{-1}$	$\text{mol}^{-1} \text{L}^2 \text{s}^{-1}$	$\text{mol}^{-2} \text{L}^3 \text{s}^{-1}$
Relation b/w rate & conc of	$R \propto [A]^0$	$R \propto [A]^1$	$R \propto [A]^2$	$R \propto [A]^3$
Reactant				
Graph b/w rate & conc of Reactant	R	R	R	R
				
	[A]	[A]	[A]	[A]
	1	2	3	

### 5. Integrated rate equation for zero order and first order reaction

	for zero order reaction	for first order reaction
<b>Integrated rate equation</b>	$k = \frac{[R]_0 - [R]}{t}$	$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$
<b>Half life</b>	$t_{1/2} = [R]_0 / 2K$	$t_{1/2} = 0.693/K$
<b>Graph b/w half life &amp; conc of Reactant</b>		
<b>Graph b/w conc. of reactant &amp; time</b>		

6.  $t \propto [\text{conc}]^{1-n}$  where  $n = \text{order of reaction}$ .

### 7. Arrhenius equation

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left[ \frac{T_2 - T_1}{T_1 T_2} \right]$$

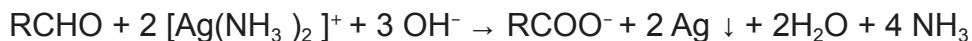
$$\log K = \log A - E_a / 2.303RT$$



## APPENDIX –C

### Distinguish By a Single Chemical Test

- All aldehydes (R-CHO) give **Tollens' Test** and produce silver mirror.



Tollens' Reagent

silver ppt

Note: HCOOH (methanoic acid) also gives this test, ketones (RCOR) do not give this test

- All aldehydes (R-CHO) and ketones (RCOR) give **2,4-DNP test**



- Aldehydes and ketones having **CH<sub>3</sub>CO-** (keto methyl) group give Iodoform Test. Alcohols having CH<sub>3</sub>CH-OH group also give **Iodoform Test**.



Yellow ppt

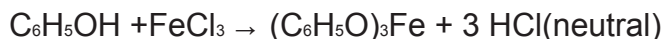
- The following compounds give Iodoform Test: ethanol (C<sub>2</sub>H<sub>5</sub>OH), propan-2-ol (CH<sub>3</sub>CH(OH)CH<sub>3</sub>), ethanal (CH<sub>3</sub>CHO), propanone (CH<sub>3</sub>COCH<sub>3</sub>), butanone (CH<sub>3</sub>COCH<sub>2</sub>CH<sub>3</sub>), pentan-2-one (CH<sub>3</sub>COCH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>), acetophenone (PhCOCH<sub>3</sub>)

- All carboxylic acids (R-COOH) give **Bicarbonate Test**



effervescence

- Phenol** gives **FeCl<sub>3</sub> Test**



(violet color)



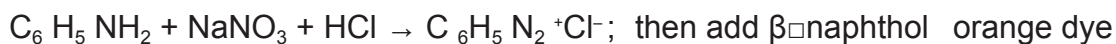


7. All primary amines (R/Ar -NH<sub>2</sub>) give **Carbyl Amine Test**



offensive smell

8. Aniline gives Azo Dye Test ( Only for aromatic amines)



9. All alcohols (ROH) give **Na-metal test**



bubbles

10. For esters(RCOOR) : Hydrolyses first. Then see the products( acid & alcohol) and give a test to identify them.

11. All alkenes (C=C) and alkynes (C≡C) decolorizes Br<sub>2</sub>- water from red to colourless

12. **Lucas Test to distinguish primary, secondary and tertiary alcohols**

Lucas reagent: ZnCl<sub>2</sub>/HCl

3° alcohol + Lucas reagent → immediate turbidity  
2° alcohol + Lucas reagent →

turbidity after sometime  
1° alcohol + Lucas reagent → no turbidity



CHEMISTRY

## APPENDIX –D

### ORGANIC CHEMISTRY CONCEPT BASED QUESTION & ANSWER

- 1 Bond enthalpy decreases as:  $\text{CH}_3\text{-F} > \text{CH}_3\text{-Cl} > \text{CH}_3\text{-Br} > \text{CH}_3\text{-I}$  Because C-X bond length increases from F to I due to greater size
- 2 Phenol can not be converted into chlorobenzene by using HCl  
Because C-O bond in phenol has partial double bond character and -OH group is attached to  $\text{sp}^2$  carbon
- 3 Thionyl chloride is preferred to convert ROH into RCl  
Because the side products are gases and the product can be obtained as pure
- 4  $3^\circ$  alcohol easily can be converted into alkyl halide Because  $3^\circ$  carbocations are stable
- 5 Benzene is converted into iodobenzene in presence of oxidizing agent like  $\text{HNO}_3$  or  $\text{HIO}_3$   
 $\text{C}_6\text{H}_6 + \xrightarrow[\text{reaction}]{\text{I}_2/\text{Fe}} \text{C}_6\text{H}_5\text{I} + \text{HI}$  Because  $\text{HNO}_3$  or  $\text{HIO}_3$  oxidises HI and prevent backward reaction
- 6 ROH is converted into RI by using KI in presence of  $\text{H}_3\text{PO}_4$  not  $\text{H}_2\text{SO}_4$   $\text{H}_2\text{SO}_4$  converts KI into HI and then into  $\text{I}_2$
- 7 B.pt. Of alkyl halides (RX) is higher than hydrocarbons Because R-X is polar so there is dipole-dipole attraction
- 8 B.pt :  $\text{R-I} > \text{R-Br} > \text{R-Cl} > \text{R-F}$   
Because molecular mass decreases so Van der Waals force decreases from RI to RF
- 9 B.pt :  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-Br} > \text{CH}_3\text{-CH}_2\text{-CH}(\text{Br})\text{-CH}_3 > (\text{CH}_3)_3\text{CBr}$   
Because as the branching increases surface area decreases so Van der Waals force of attraction decreases
- 10 p-dichloro benzene has higher m.pt than ortho and meta isomer  
Because p-dichloro benzene has symmetrical structure so it fits well in the crystal lattice
- 11 Alkyl halide (RX) with KCN gives alkyl cyanide (RCN) whereas with AgCN it gives isocyanide (RNC) KCN is ionic and  $\text{CN}^-$  is ambident nucleophile but it links through C because C-C bond is more stable than C-N. In the other hand AgCN is covalent and links through N only.
- 12  $\text{S}_2$  reactivity : ( $1^\circ > 2^\circ > 3^\circ$ )  
Due to steric hindrance nucleophile can not approach easily. In  $\text{S}_2$  path release of X and linking of  $\text{Nu}^-$  take place simultaneously
- 13  $\text{S}_\text{N}1$  reactivity: ( $1^\circ < 2^\circ < 3^\circ$ )  
Because  $\text{S}_\text{N}1$  path involves formation of carbocation intermediate. And stability of Carbocation is in the order : ( $1^\circ < 2^\circ < 3^\circ$ )
- 14  $\text{S}_\text{N}1$  reactivity :  $\text{R-I} > \text{R-Br} > \text{R-Cl} > \text{R-F}$   
Because as the size of halogen increases C-X bond becomes weaker
- 15 Aryl halides ( $\text{C}_6\text{H}_5\text{-X}$ ) are less reactive than alkyl halides ( $\text{R-X}$ ) towards nucleophilic substitution Because in aryl halide C-X bond has partial double bond character and X is attached to  $\text{sp}^2\text{C}$ , there is also the repulsion between  $\text{Nu}^-$  and benzene ring which is electron rich.
- 16 Chloroform is stored in dark coloured bottles as closed and completely filled, because in air and light it converts into poisonous phosgene gas ( $\text{COCl}_2$ ).



CHEMISTRY

- 17 In many countries DDT has been banned now, because of its slow metabolism and it has toxic effect on aquatic animals.
- 18 Cyclohexyl chloride has greater dipole moment than chloro benzene.
- 19 Alkyl halides are immiscible in water although they are polar, in water there is intermolecular H-bonding but there is less attraction between R-X and H<sub>2</sub>O.
- 20 Grignard reagent (RMgX) should be prepared in anhydrous condition because RMgX reacts with water and gives corresponding alkane.
- 21 Alkyl halides undergo substitution when treated with aq KOH but in presence of alc KOH elimination takes place. Alcohol + KOH produces RO<sup>-</sup> which is a strong base so it extracts H<sup>+</sup> and elimination takes place.
- 22 C-O-H bond angle in alcohol is less than regular tetrahedral angle due to lp-lp repulsion.
- 23 In phenol the C-O bond length is less  
Due to i) partial double bond character ii) O is attached to sp<sup>2</sup> carbon.
- 24 In ether the R-O-R bond angle is greater, due to repulsion between two bulkier R-groups.
- 25 To convert acid into alcohol LiAlH<sub>4</sub> is not used, because it is expensive so: RCOOH → RCOOR' then ester is reduced into RCH<sub>2</sub>OH by Hg<sub>2</sub>/Pd.
- 26 b.pt of alcohol (ROH) is higher than alkane (RH), ether (R-O-R), alkyl halide (R-X) and aryl halide (Ar-X), due to intermolecular H-bonding in R-O-H.
- 27 b.pt : n-butyl alcohol > sec. butyl alcohol > tert. Butyl alcohol, because as the branching increases surface area decreases so Van der Waals force of attraction decreases.
- 28 Alcohols are highly miscible in water, due to H-bonding with water.



- 29 Acidity of alcohol :  $R-CH_2-OH > R_2CH-OH > R_3C-OH$   
 Because as the R gr increases +I effect increases so alkoxide ion becomes less stable.
- 30 Alcohol is weaker acid than water, because  $R-O^-$  is less stable than  $HO^-$
- 31 Phenol (Ph-OH) is acidic in nature  
 Because phenoxide ion (  $Ph-O^-$  ) is resonance stabilized.
- 32 Acidity: nitrophenol > phenol > methylphenol.  
 Because  $-NO_2$  group is electron withdrawing it further increases the stability of phenoxide ion where as  $-CH_3$  group is electron donating it destabilizes phenoxide ion.
- 33 Esterification is carried out in presence of small amount of conc.  $H_2SO_4$  because it absorbs the water produced and accelerates the forward reaction.
- 34  $R'COCl + R-OH \rightarrow R'COOR + HCl$ . Pyridine is used in this reaction. It is to remove HCl produced and to prevent the backward reaction.
- 35 Tert. Alcohols are easier to dehydrate  
 Because the intermediate tert. carbo cation is stable.
- 36 -OH group in benzene ring is ortho and para directing for electrophilic substitution, due to +R effect it increases the electron density at ortho and para positions.
- 37 O-nitro phenol is steam volatile ( low b.pt ) but p-nitro phenol is not  
 In o-nitro phenol there is intra molecular H-bonding. But in p-nitro phenol there is inter molecular H-bonding so molecules get associated and hence it has comparatively higher b.pt.
- 38 Phenol with aq bromine gives 2,4,6-tribromophenol but in non polar medium mono-substitution takes place.
- 39  $CuSO_4$  and pyridine are mixed with ethanol used for industrial purpose, to prevent its misuse.  $CuSO_4$  gives colour pyridine gives smell.
- 40 Ethers (  $R-O-R$  ) are polar.
- 41 Ethers are soluble in water, due to H-bond with water and ether.
- 42 Aldehydes (  $R-CHO$  ) and ketones (  $R-CO-R$  ) have higher b.pt than hydrocarbon and ether, because they are polar so there is dipole-dipole attraction in aldehyde and ketones.
- 43 Lower aldehydes and ketones are miscible with water, because they form hydrogen bond with water
- 44 Aldehydes (  $R-CHO$  ) are more reactive than ketones (  $R-CO-R$  ) in nucleophilic addition, in ketone the two alkyl groups (  $R$  ) have +I effect so they reduce the electrophilicity



carbonyl carbon. Also there is steric hindrance in ketone.

- 45 Benzaldehyde (  $C_6H_5CHO$  ) is less reactive than propanal (  $CH_3CH_2CHO$  ) due to resonance the electrophilicity of carbonyl carbon is less in benzaldehyde.
- 46  $NaHSO_3$  is used for separation of aldehydes.  
It forms a soluble compound with aldehyde which on hydrolysis gives back the aldehyde.
- 47 A-H of aldehyde and ketone is acidic in nature, because the corresponding carbanion is resonance stabilized.
- 48 Carboxylic acids (  $R-COOH$  ) do not give nucleophilic addition reaction like  $RCHO$  &  $RCOR$  although it has  $>C=O$  due to resonance the carbonyl carbon loses its electrophilicity.
- 49 Carboxylic acids have higher b.pt than aldehyde, ketones and even than alcohols.  
There is extensive inter molecular H-bonding in carboxylic acid (  $RCOOH$  ). Even in vapour phase it exists as dimer.
- 50 Carboxylic acids are miscible in water, due to H-bonding with water.
- 51  $R-COOH$  is acidic in nature, because the conjugate base  $R-COO^-$  (carboxylate ion) is stable due to resonance
- 52 Acidic Strength :  $Cl-CH_2-COOH > CH_3-COOH > CH_3CH_2-COOH$   
Because  $Cl$  has  $-I$  effect which stabilizes the conjugate base and ethyl gr has  $+I$  effect.
- 53 In amines the  $C-N-H/C$  bond angle is less than  $109.5^\circ$ , due to  $lp-bp$  repulsion.
- 54 For reduction of nitro compounds into amines  $Fe/HCl$  is preferred instead of  $Sn/HCl$ , because  $Fe+HCl \rightarrow FeCl_2$ . On hydrolysis  $FeCl_2$  gives  $HCl$ , so just small quantity of  $HCl$  is required to initiate the reaction.
- 55 To convert alkyl halide ( $R-X$ ) into amines ( $R-NH_2$ ) ammonolysis is not suitable, because on ammonolysis a mixture of pri, sec, tert and quaternary amine will be produced.
- 56 Aniline on exposure to air and light turns into coloured, due to atmospheric oxidation.
- 57 Lower amines are soluble in water, due to H-bonding with water. In case of higher amine alkyl group is larger which is hydrophobic.
- 58 Amines ( $R-NH_2$ ) are less soluble than alcohols ( $R-OH$ ), in alcohol the H-bonding with water is stronger because  $O$  is more electronegative than  $N$ .
- 59 Amines ( $R-NH_2$ ) are lower boiling than alcohols ( $R-OH$ ), in alcohol the intermolecular H-bonding is stronger because  $O$  is more electronegative than  $N$ .
- 60 Order of b.pt : primary amine  $>$  sec. amine  $>$  tert. amine

The no. of N-H bond decreases so extent of H-bonding also decreases.



61 In gaseous phase the order of basic strength:  $3^\circ\text{-amine} > 2^\circ\text{-amine} > 1^\circ\text{-amine} > \text{NH}_3$

Due to +I effect of alkyl groups the electron density on N increases. So  $3^\circ$  is strongest as it has 3 alkyl groups.

62 In aqueous state the base strength order :  $(2^\circ > 3^\circ > 1^\circ > \text{NH}_3)$  :  $(2^\circ > 1^\circ > 3^\circ > \text{NH}_3)$

In aqueous state +I effect, steric effect and solvation effect interplay. So the order is not regular 63  $\text{R-NH}_2$  is stronger base than  $\text{NH}_3$

Due to +I effect of alkyl group electron density on N increases in  $\text{R-NH}_2$

64 Aniline ( $\text{C}_6\text{H}_5\text{-NH}_2$ ) is weaker base than  $\text{NH}_3$  and  $\text{R-NH}_2$

In aniline the lone pair of electron of N is involved in resonance. So it is less available.

65 Base strength : p-methoxy aniline > aniline > p-nitro aniline

Methoxy group ( $-\text{OCH}_3$ ) has +R effect whereas  $-\text{NO}_2$  group has -R effect so electron density in the first case increases but in the second case it decreases.

66 Acylation of aniline is carried out in presence of pyridine. Pyridine removes  $\text{HCl}$  produced and favours forward reaction.

67  $-\text{NH}_2$  group in benzene ring is ortho - para directing for electrophilic substitution. Due to +R effect it increases the electron density at ortho and para position.

68 Bromination of aniline gives 2,4,6-tribromo aniline

Because  $-\text{NH}_2$  group activates benzene ring by +R effect. So for monosubstitution  $-\text{NH}_2$  group is acylated.

69 Nitration of aniline gives an unusual meta-nitro aniline although  $-\text{NH}_2$  group is

ortho-para directing. In presence of acid  $-\text{NH}_2$  is converted into  $-\text{NH}^+$  which is meta directing

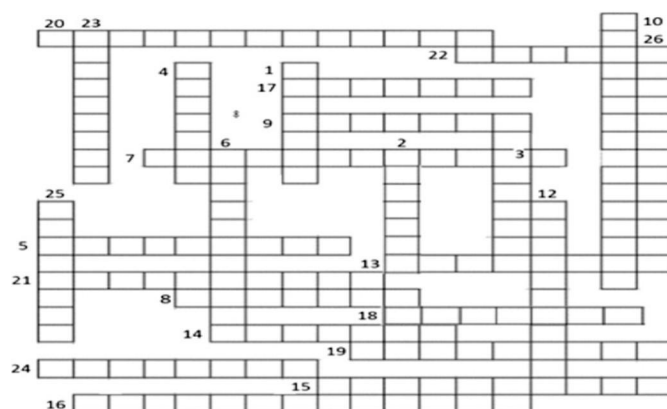
70 Aniline does not undergo Friedel-Craft reaction

Aniline is a base and reacts with anhydrous  $\text{AlCl}_3$  so N becomes positive which deactivates benzene ring.



## CHEMISTRY

## APPENDIX E



TOP TO BOTTOM	LEFT TO RIGHT
1. Biological macromolecules with which drugs usually interact.	5. This type of polymer has extensive cross links between its chains.
2. An analgesic prepared from salicylic acid.	7. Globular proteins on heating or due to pH change undergoes coagulation & lose biological activity. The Phenomenon is-
3. The building blocks of a polymer are small molecules.	8. In DNA thymine pairs with -
4. Natural Catalyst.	9. Optically inactive amino acid –
6. Nucleic acids are polymers in which _____ are the monomers.	11. Commercial name of poly tetrafluoroethylene is
12. Monomer of nylon 6 is –	13. Polymerization of chloroprene forms -
23. Proteins embedded in the cell membrane to receive chemical messenger □	14. Element with Which natural rubber is heated for vulcanization-
25. Cetyltrimethyl ammonium chloride is an example of _____ Detergent.	15. The polymers in which polymer chains are held together by van der Waals' forces are known as –
26. Soaps are safer to use from the environmental point of view because they are □	16. _____ and a terpeneol are the main constituents of an antiseptic Dettol.
	17. Ranitidine is an-
	18. A high potency artificial sweetener -
	19. A sweetener that decomposes at low temperature-
	20. Drugs which reduce anxiety and produce a feeling of well-being –
	21. It is added to soap to impart antiseptic properties-
	22. Chloramphenicol is a _____ Spectrum Antibiotic.
	24. Medicines used for the relief of post-operative pain & Cardiac pain –





## EXAMINATION TIPS FOR STUDENTS

**Self motivation-** Honestly write down your aim and all the desires in your life. It will propel you towards success.

**Setup a routine-** Prepare smart and successful studying programme.

Find a **quiet place**, away from distractions and figure out time of the day you can contribute best and that fits into your schedule.

**Make a good time table-** A schedule of every subject should be made with different priorities like tough subjects and the one in which you are weak should be given more hours. Study at the same place & at the same time every day. Sit in an **alert posture**.

Stay **healthy** mentally and physically get adequate rest, exercise and balanced nutrition.

**Manage distractions** like cellphones, friends, sms, TV, video games, surfing etc which are biggest time drains. **Avoid doing “marathon” session** (i.e. larger than 1 hour) as it is least productive. Our attention span ranges from 30-60 minute.

**Unwind and relax-** 10 to 15 min break after every study session.

Study difficult topics first. When mentally fresh, brain can process information more quickly. Short term planning is more achievable than long term plans.

Don't spend more than three days a week in coaching/tuition as **self study is the only real study**. Therefore **at least** four days for uninterrupted self study.

**Prepare a competitive study group-** share useful concepts and questions, your knowledge, skills and resources, clarify doubts, take help of a friend who is an expert in that topic/unit.

Give yourself enough time to study. don't leave until the last minute. Use flow charts & mind maps.

**Test yourself before actual test—practice previous year's examination papers.**

**Review clear doubts revise-** attempt questions of textbook and previous year CBSE papers.

**NIGHT BEFORE THE EXAM - don't cram.**

**Reduce** stress and anxiety.. avoid stressful friends....relax.. eat some brain snacks.. sleep..review main points. **Prepare to be prepared:** before going to bed before an exam make sure to collect everything that you will need for exam— stationery , admit card, wrist watch....

Ensure location of exam centre.

**ON EXAMINATION DAY..** leave home in time and ensure your arrival at centre in time..so that you go to your exam calmly rather than in a frantic rush sweaty.

**DURING TEST-**

**Focus** on your exam and not on what other students are doing

**Start strategically**..begin your exam by skimming through the question quickly and note down any initial thoughts or related memorised facts beside each question.

**Start with the question you know best.** This will boost your confidence and give you a good start.

- ⌚ Read the instructions carefully and follow.
  - ⌚ Answer as per marking scheme.
  - ⌚ Write neat and present well.
  - ⌚ Attempt the easiest part and the units you are most confident.
- Manage time so that time can be allotted to difficult portion.
- ⌚ Attempt complete question paper.
  - ⌚ Never cheat
  - ⌚ Review and make sure you have not left out any question unattempted.

**CHASE YOUR GOALS. ALL THE BEST**

