

ORGANIC CHEMISTRY

(ALCOHOL, PHENOL & ETHERS, AMINES)

- General Mistakes by the students during the examination
 1. Nomenclature- Alphabetical order of name of side chain, use of comma and hyphen.
 2. Name reactions- Name of reagent, temperature and balancing of the equation
 3. Distinction- Indication of colour, smell, precipitates
 4. Reason Based Questions- Proper reasons
 5. Mechanism- Steps of Mechanism, use of proper arrow
 6. Conversion- Name of reagent, temperature
 7. Word Problems- Road maps, reactions
 8. Fill in the blanks- Name of the reagent, temperature
- IMPORTANT AREA

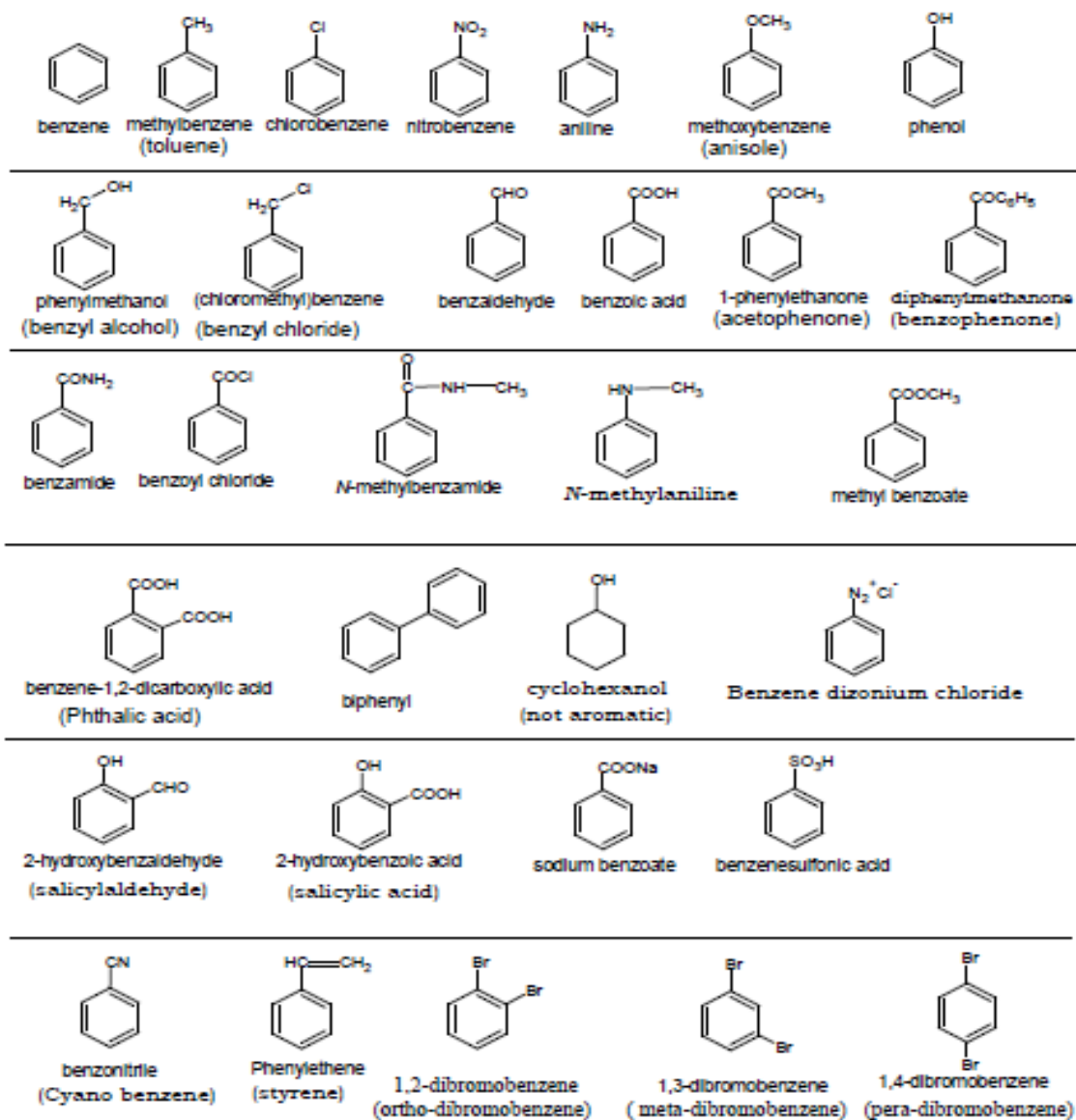
1. NOMENCLATURE	2 MARKS
2. NAME REACTION	2 MARKS
3. DISTINCTION	2 MARKS
4. REASON BASED QUESTIONS	4 MARKS
5. MECHANISM	2 MARKS
6. CONVERSION OR WORD PROBLEMS	4 MARKS
7. FILL IN THE BLANKS (IMPORTANT REACTION)	2 MARKS

NOMENCLATURE

1. GENERAL RULES FOR NOMENCLATURES OF ORGANIC COMPOUNDS CONTAINING FUNCTIONAL GROUPS SPECIALLY DOUBLE BOND, HALO, ALCOHOL, ETHERS, ALDEHYDE, KETONES, CARBOXYLIC ACID, AMINES & COMPOUNDS CONTAINING MORE THAN ONE FUNCTIONAL GROUPS.

2. COMMON NAME OF AROMATIC COMPOUNDS

IUPAC Names of Aromatic Compounds (common name in bracket)



3. PRACTICES OF NOMENCLATURES

(I)WRITE THE NAMES OF COMPOUNDS

(II) WRITE THE FORMULA OF COMPOUNDS

(iii)IUPAC NOMENCLATURE

NAME REACTIONS

- IMPORTANT NAME REACTION CHAPTER WISE

- ALCOHOL & ETHERS

1. REIMER TIEMAN REACTION

2. KOLBE'S REACTION

3. WILLIAMSON SYNTHESIS

- AMINES

4. GABRIEL PHTHALIMIDE REACTION

5. HOFFMAN BROMAMIDE DEGRADATION REACTION

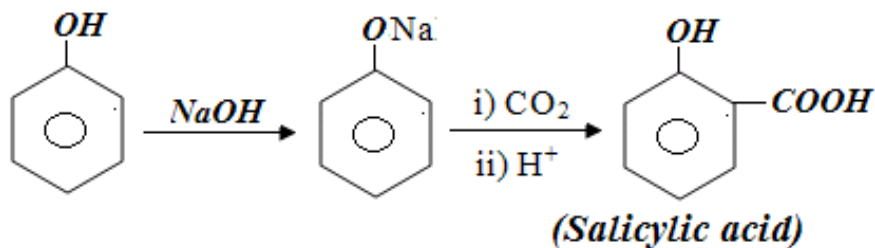
6. CARBYL AMINE REACTION

7. DIAZOTISATION REACTION

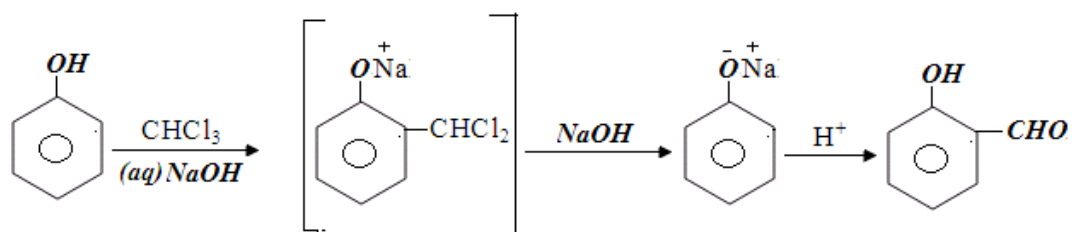
8. COUPLING REACTION

IMPORTANT NAME REACTIONS

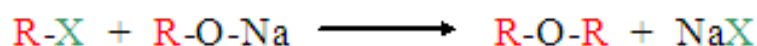
1) KOLBE'S REACTION:



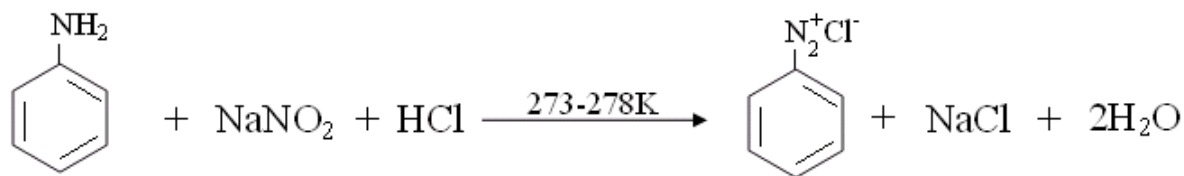
2) REIMER-TIEMANN REACTION:



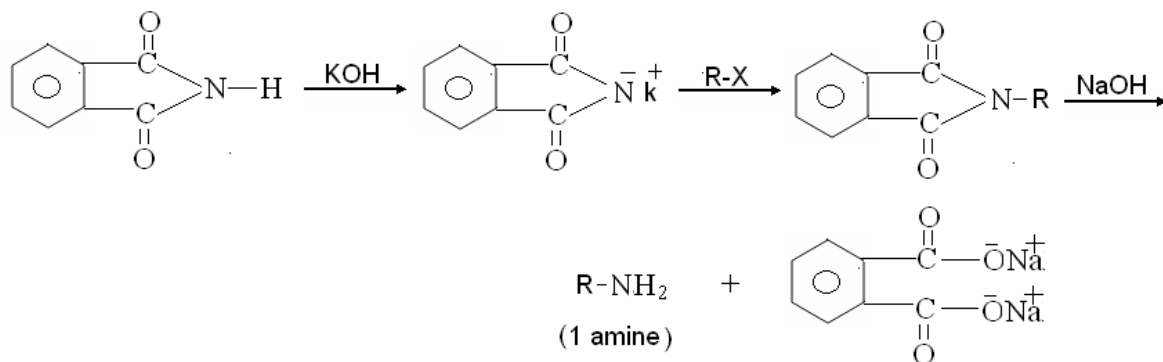
3) WILLIAMSON SYNTHESIS:



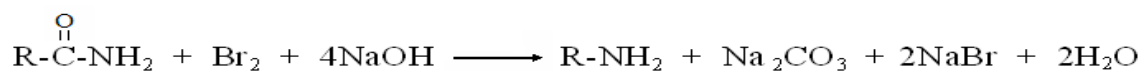
4) DIAZOTIZATION:



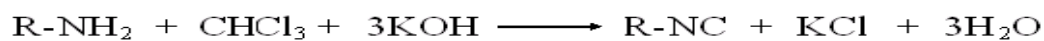
5) GABRIEL PHTHALIMIDE SYNTHESIS:



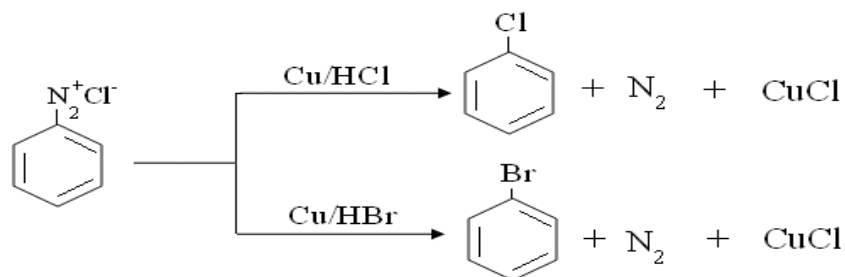
6) HOFFMANN BROMAMIDE DEGRADATION REACTION:



7) CARBYLAMINE REACTION (ISOCYANIDE TEST):



8) GATTERMAN REACTION:



DISTINGUISH BETWEEN PAIRS OF ORGANIC COMPOUNDS

1. LUCAS REAGENT TEST – 1^o, 2^o, 3^o ALCOHOL

2. NEUTRAL FERRIC CHLORIDE TEST- ONLY FOR PHENOL

3. IODOFORM TEST- (I) ALCOHOL CONTAINING $\text{CH}_3\text{-CH-}$ GROUP
 $\begin{array}{c} | \\ \text{OH} \end{array}$

(II) ALDEHYDE- ONLY ETHANAL

(III) KETONE – METHYL KETONE ($\text{CH}_3\text{-CO-}$)

4. CARBYL AMINE TEST – ONLY 1^o ALIPHATIC & AROMATIC AMINES

5. HINSBERG REAGENT TEST – 1^o, 2^o, 3^o AMINES

6. COUPLING TEST- ONLY FOR ANILINE & PHENOL

NAME OF TEST	TEST	RESULT
1. LUCAS REAGENT TEST	O.C. + Zn + HCl	1. Turbidity appears immediately- 3 ^o Alcohol 2. Turbidity appears after 5 min- 2 ^o Alcohol 3. Turbidity not appears at room temp- 1 ^o Alcohol
2. NEUTRAL FERRIC CHLORIDE TEST	O.C. + ferric Chloride solution	Voilet colour appears- Phenol
3. IODOFORM TEST	O.C. + I ₂ + NaOH	Formation of orange red ppt- 1. Alcohol- Ethanol 2. Aldehyde- Ethanal 3. Ketone- all ketone containing -COCH ₃ group at terminal
4. CARBYL AMINE TEST	O.C. + CHCl ₃ + KOH	Foul smelling compound formed- Aliphatic & aromatic 1 ^o Amine
5. HINSBERG REAGENT TEST	O.C. + Benzene sulphonyl chloride	1. Product soluble in alkali- 1 ^o amine 2. Product insoluble in alkali- 2 ^o amine 3. No reaction- 3 ^o amine
6. COUPLING TEST	O.C. + NaNO ₂ + HCl $\xrightarrow{0-5C}$	Product + Aniline - Orange dyes formed = Aniline

REASON BASED QUESTIONS

1. **ALCOHOLS & ETHERS** – (i) Acidic character of alcohol
(ii) Acidic character of Phenol & effects of substituents on acidic character
(iii) Reactivity of ethers
2. **AMINES** – (i) Basic character of amines. Effect of substituents on basic character (pK_b values)
(ii) Formation of tiary products on nitration
(iii) Phthalimide synthesis not suitable for preparation of aromatic amines
(iii) Fridel craft reaction not possible with Aniline

CHARACTERS OF AMINES

Basic strength in gaseous phase $\text{Et}_3\text{N} > \text{Et}_2\text{NH} > \text{EtNH}_2 > \text{NH}_3$

Basic strength in aqueous $\text{Et}_2\text{NH} > \text{EtNH}_2 > \text{NH}_3 > \text{PhNH}_2$

Basic strength $p\text{-Toluidine} > \text{Aniline} > p\text{-Nitroaniline}$

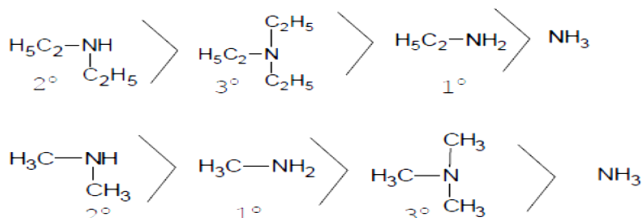
pK_b value $\text{PhNH}_2 > \text{PhNHCH}_3 > \text{EtNH}_2 > \text{Et}_2\text{NH}$

Solubility $\text{EtNH}_2 > \text{Et}_2\text{NH} > \text{PhNH}_2$

Basic strength $\text{Et}_2\text{NH} > \text{CH}_3\text{NH}_2 > \text{PhNMe}_2 > \text{PhNH}_2$

Boiling point $\text{EtOH} > \text{EtNH}_2 > \text{Et}_2\text{NH}$

Basic strength in Aqueous medium



MECHANISM

1. ALCOHOL & ETHERS – (I) Hydration of Ethene to form Alcohol

(ii) Hydration of Ethene to form Ether

(iii) Dehydration of Alcohol to form Ethene

(iv) Reaction of Grignard Reagent with Carbonyl Compound (preparation of 1^o, 2^o and 3^o Alcohol)

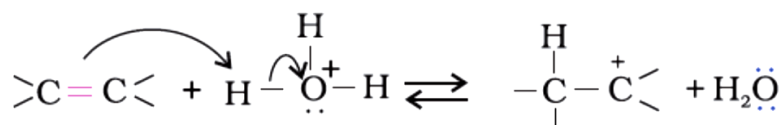
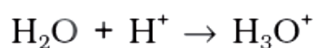
(v) Hydride shift

(i) HYDRATION OF ETHENE

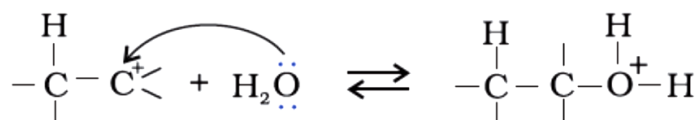
Mechanism

The mechanism of the reaction involves the following three steps:

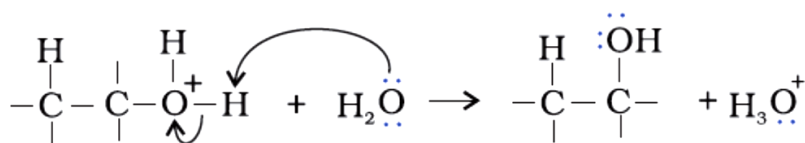
Step 1: Protonation of alkene to form carbocation by electrophilic attack of H₃O⁺.



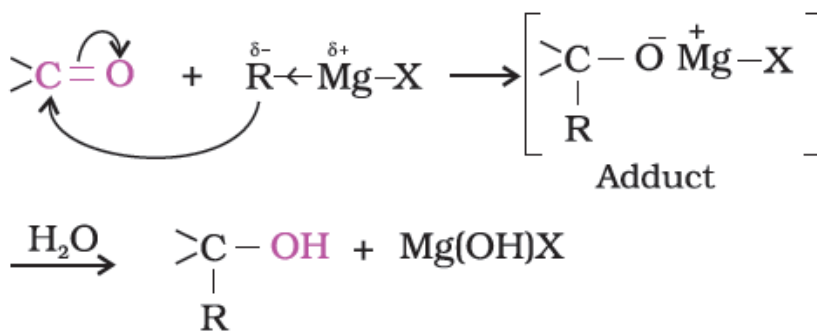
Step 2: Nucleophilic attack of water on carbocation.



Step 3: Deprotonation to form an alcohol.



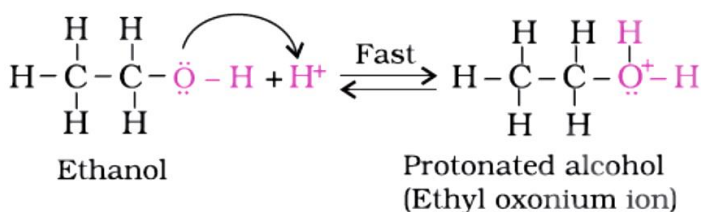
(ii) Reaction of Grignard Reagent with Carbonyl Compound (preparation of 1^o, 2^o and 3^o Alcohol)



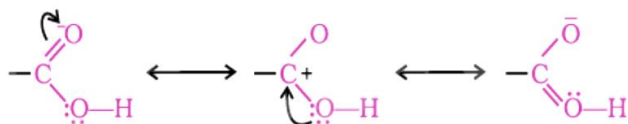
(iii) Dehydration of Alcohol to give ethene

Mechanism

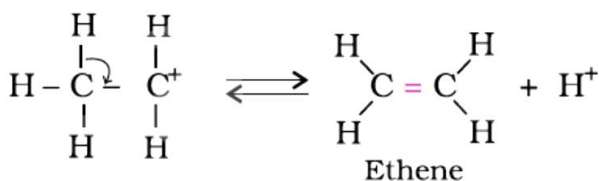
Step 1: Formation of protonated alcohol.



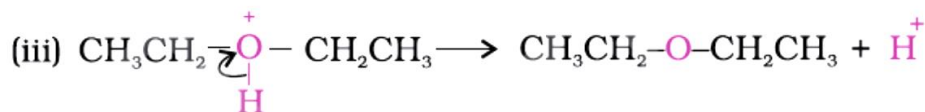
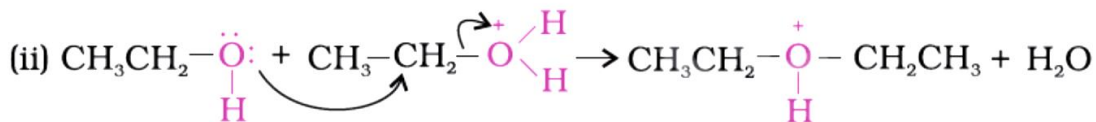
Step 2: Formation of carbocation: It is the slowest step and hence, the rate determining step of the reaction.



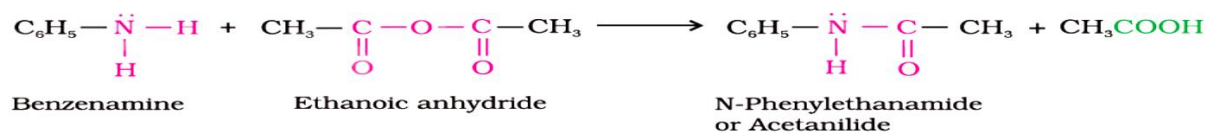
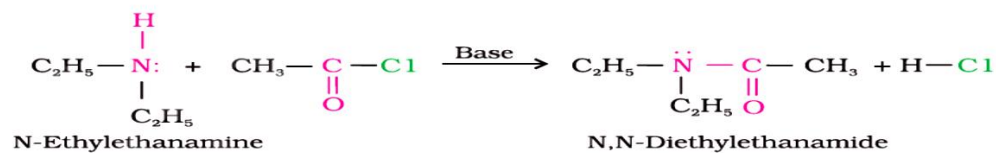
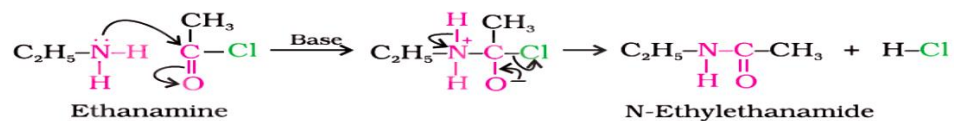
Step 3: Formation of ethene by elimination of a proton.



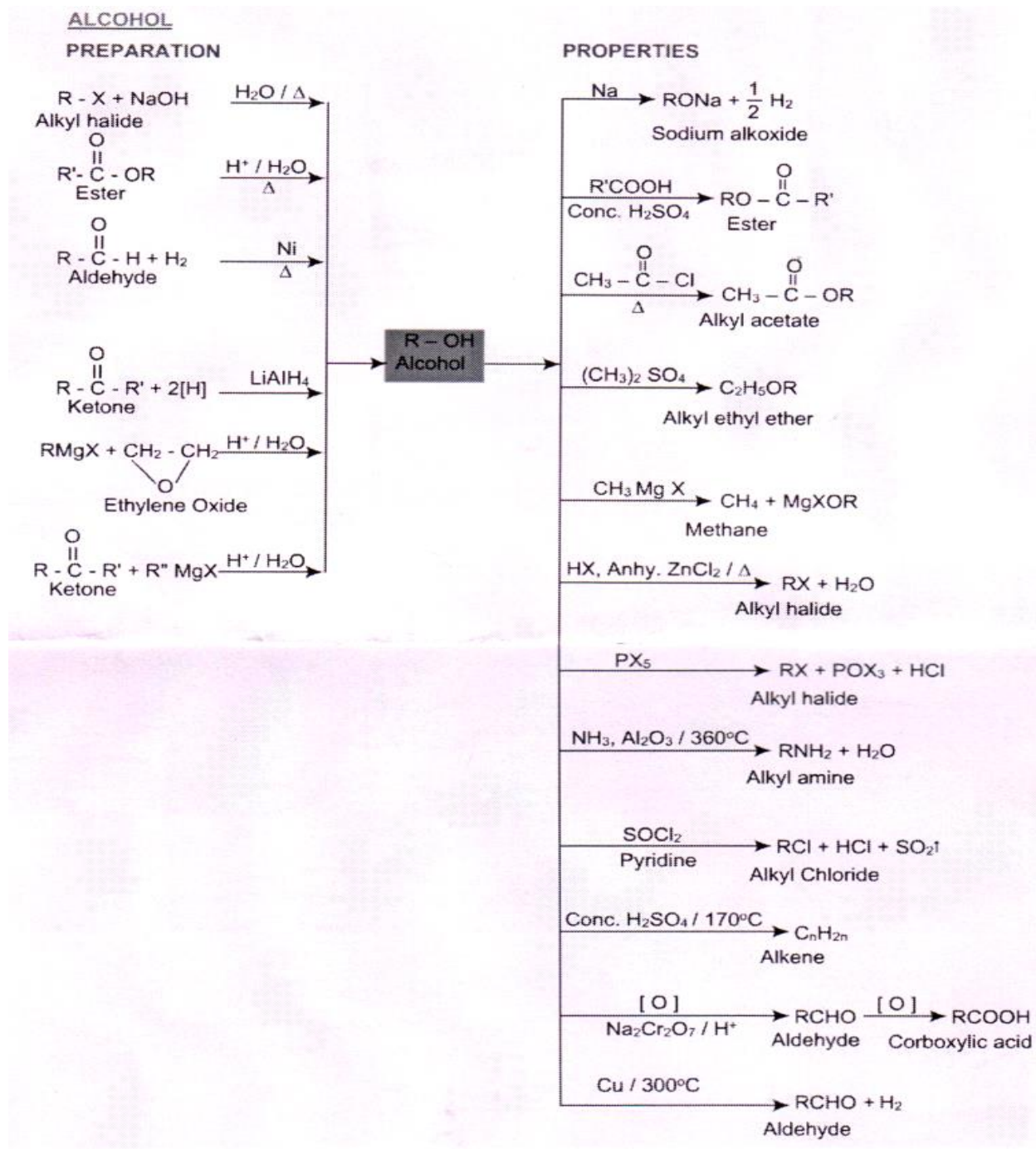
(iv) Dehydration of Alcohol to give Ether



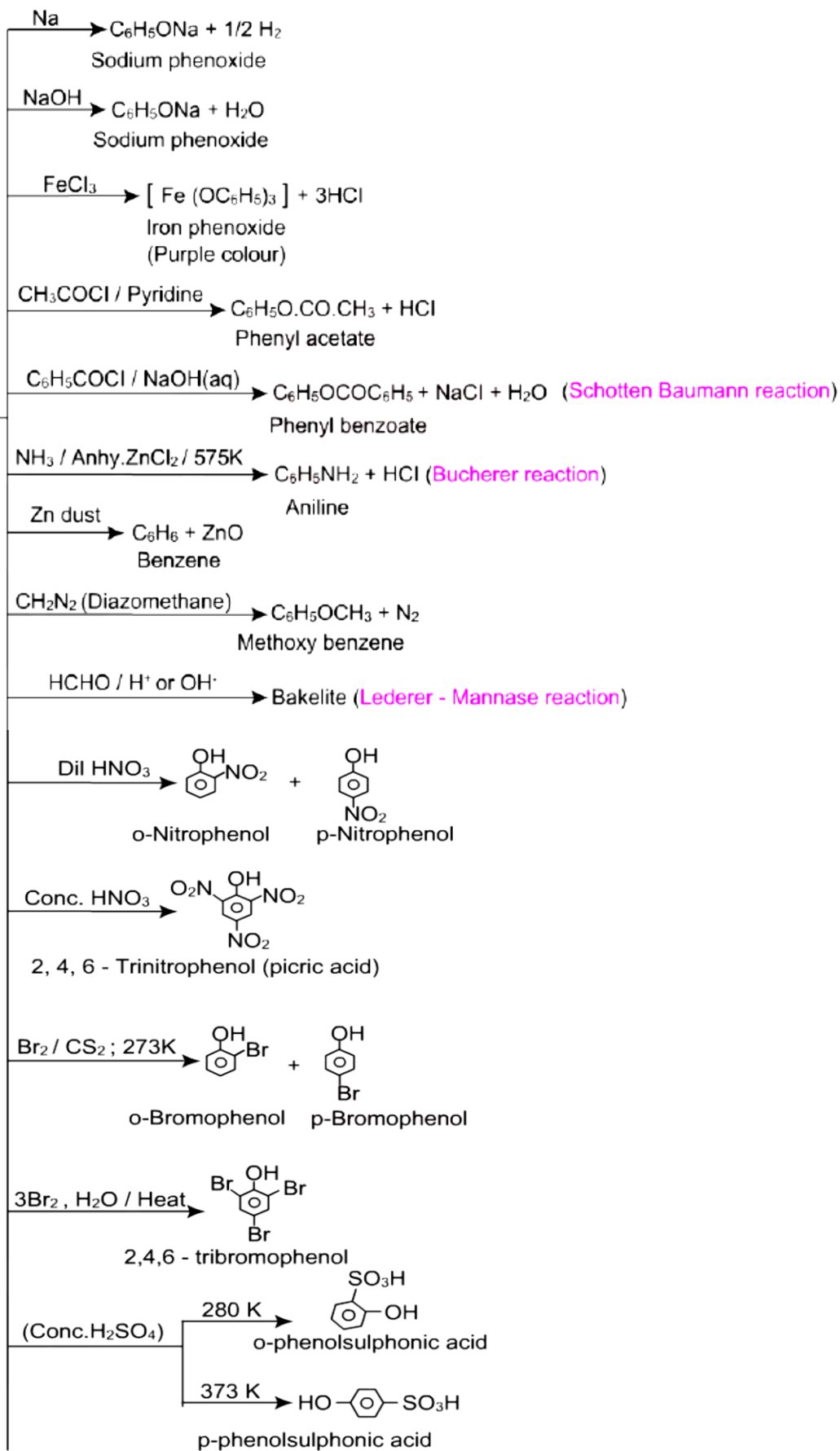
2.Amines – Reaction of amines with Acetyl chloride

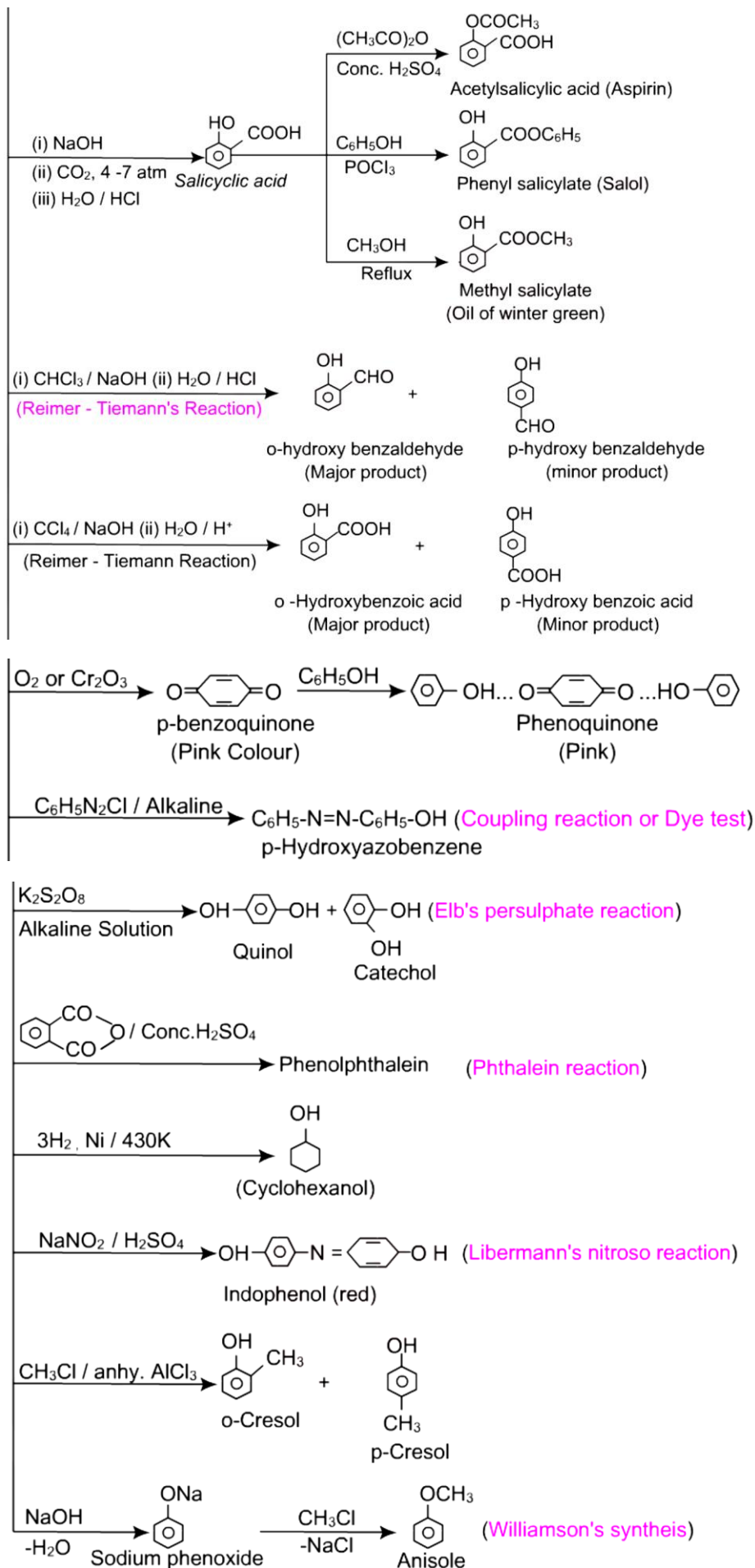


CONVERSION(IMPORTANT REACTION)



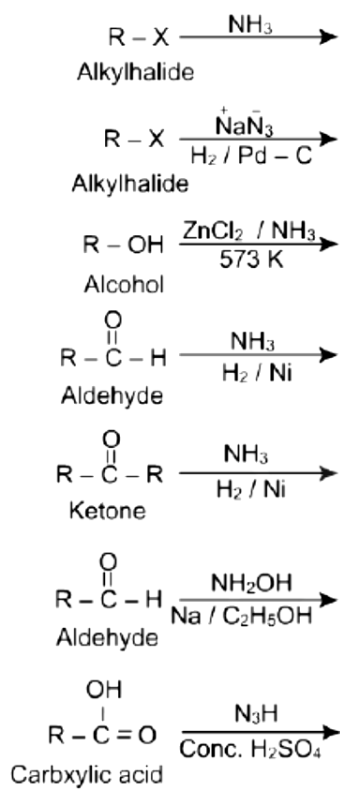
C₆H₅OH
Phenol





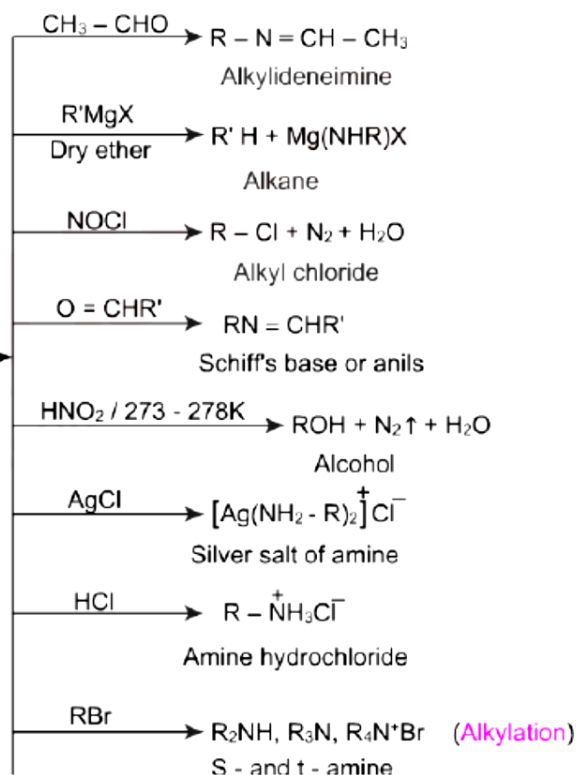
ALIPHATIC AMINES

PREPARATION



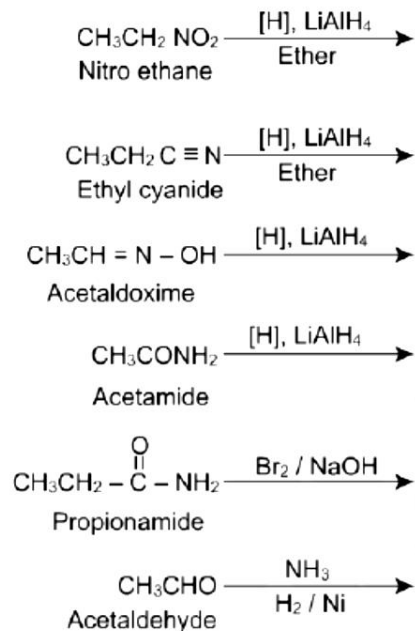
**R-NH₂
Amine**

PROPERTIES



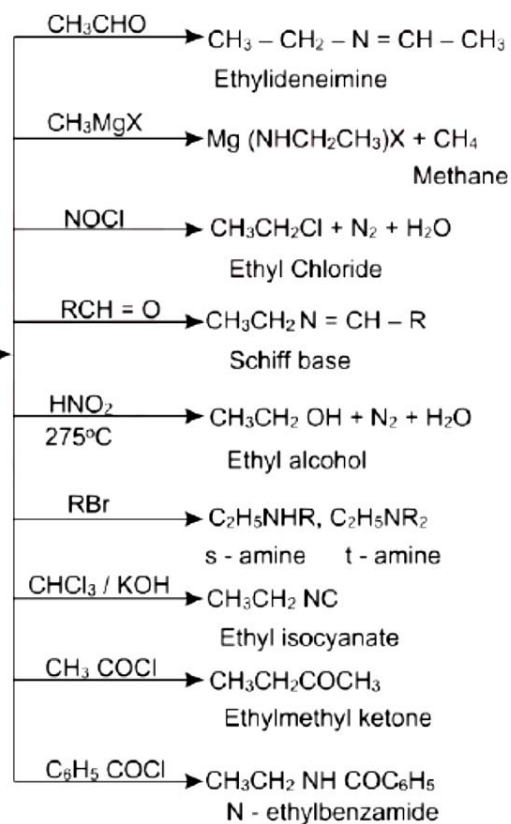
ETHYL AMINE

PREPARATION



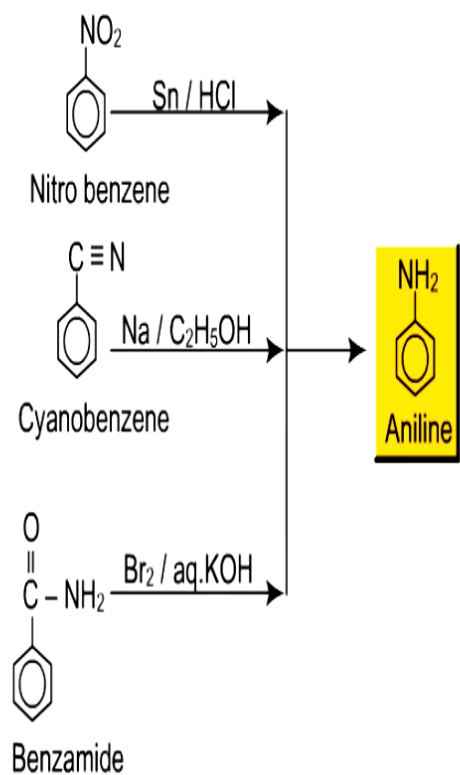
**CH₃CH₂NH₂
Ethyl amine**

PROPERTIES

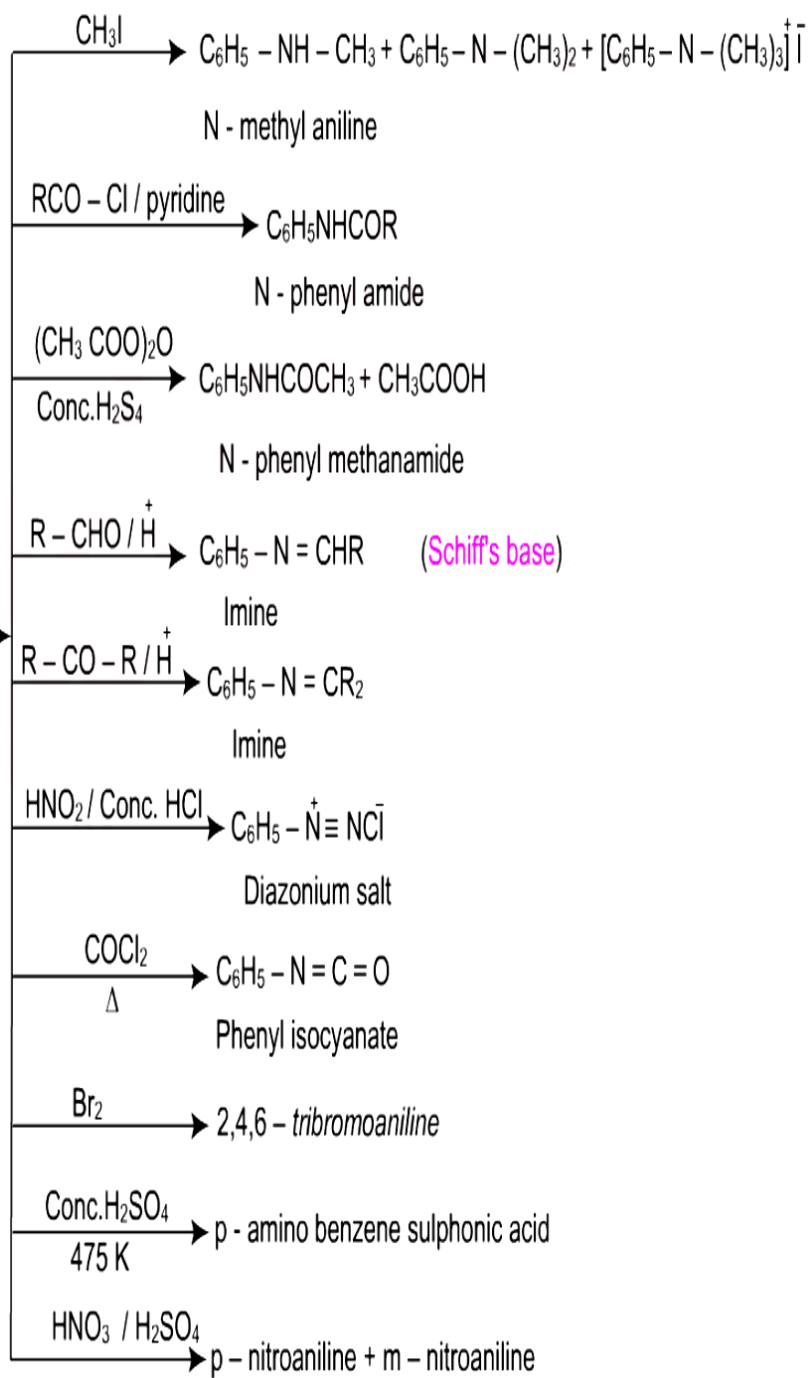


ANILINE

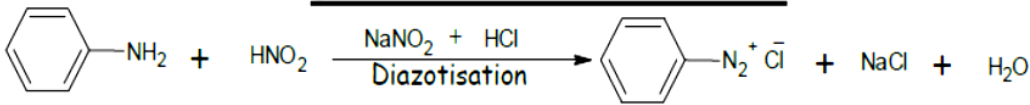
PREPARATION



PROPERTIES

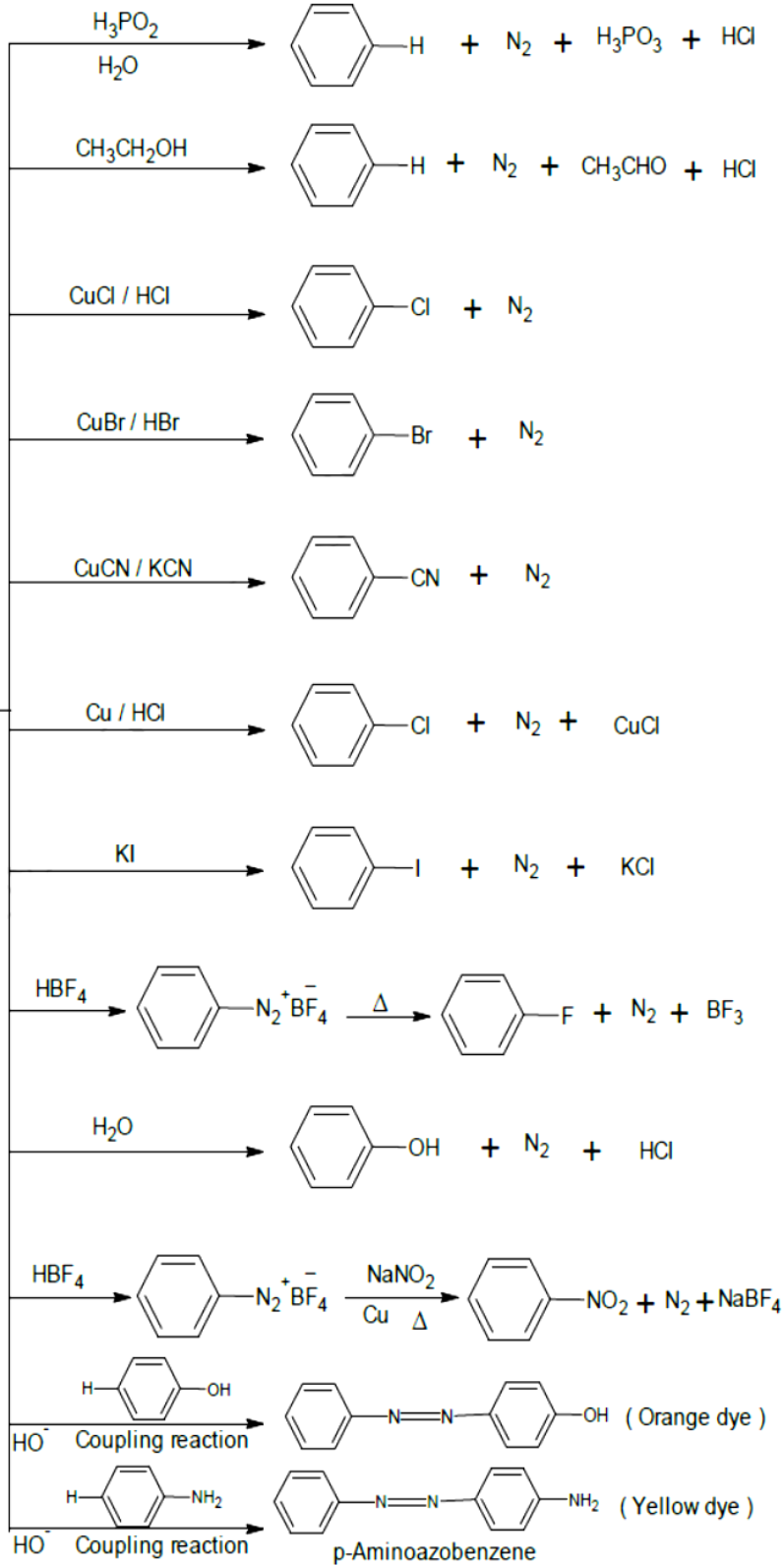
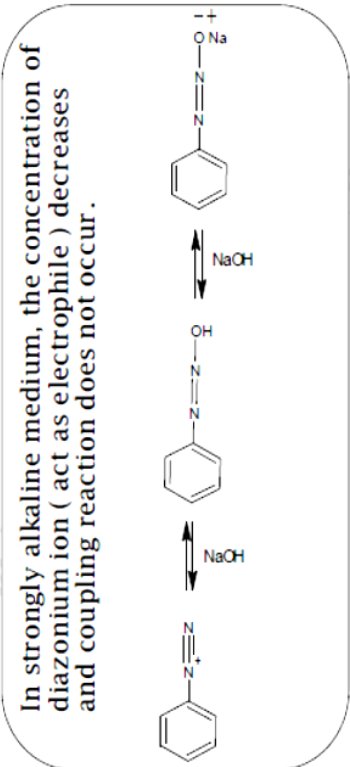
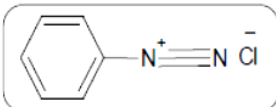
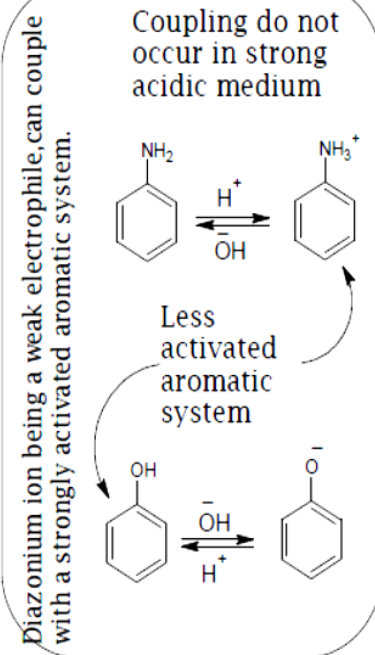


Benzenediazonium Chloride



Benzenediazonium chloride

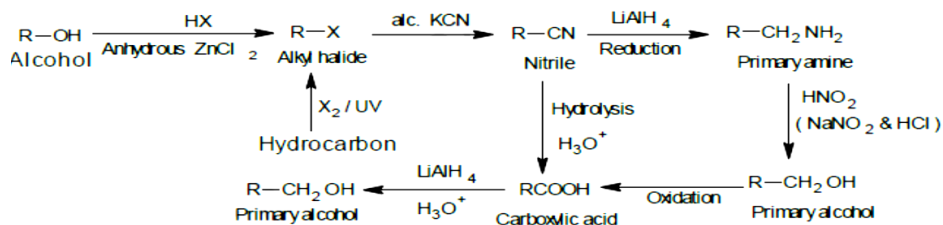
Benzenediazonium chloride is stable due to resonance.



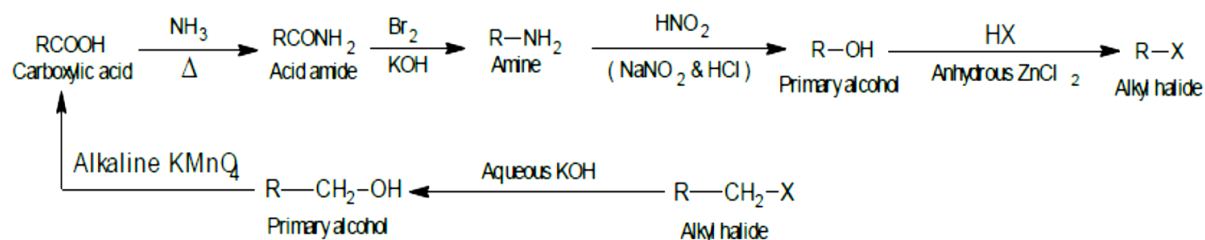
CONVERSIONS

Aliphatic Conversions

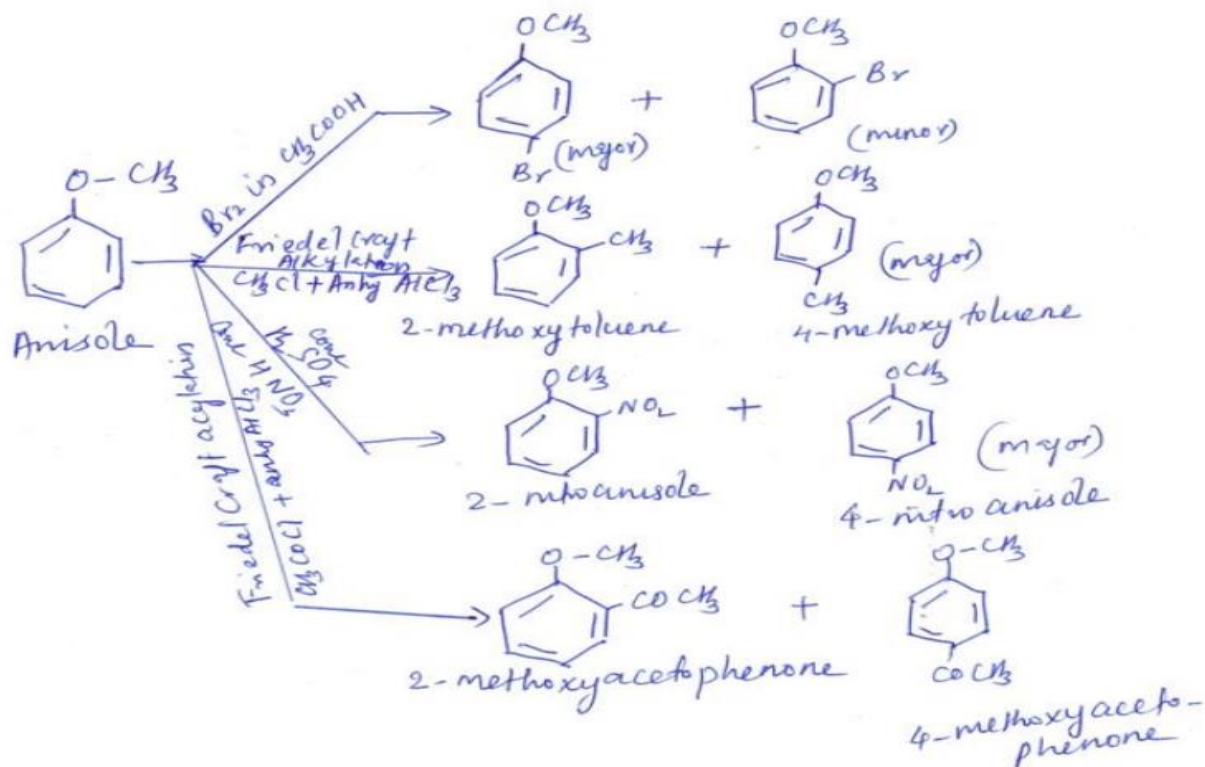
For stepping up the series



For stepping down the series



Reactions of Anisole



ORGANIC CONVERSIONS ARE GENERALLY BASED

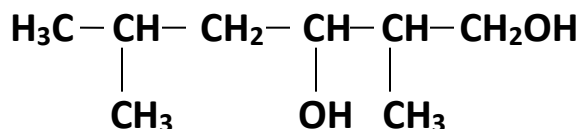
- 1. ON NAME REACTION (70-80%)**
- 2. IMPORTANT REACTION RELATED TO PREPARATION & PROPERTIES OF ORGANIC COMPOUNDS**
- 3. ASCENDING OF SERIES (INCREASING NO. OF CARBON ATOM)**
- 4. DESCENDING OF SERIES (DECREASING NO. OF CARBON ATOM)**

QUESTION BANK

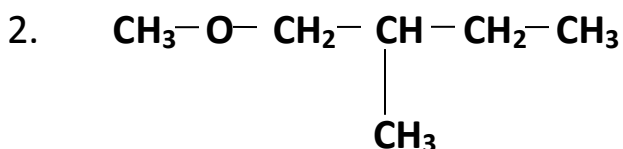
ALCOHOLS PHENOLS AND ETHER

• Very short Answer type Questions: (1 Mark)

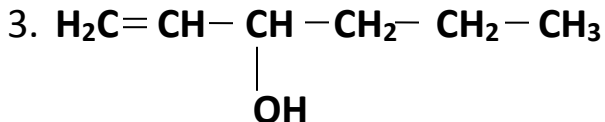
1. Write the IUPAC name of the following:



Ans: 2,5 dimethylhexane-1,3-diol



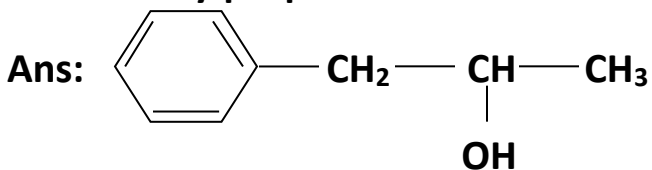
Ans: 1-Methoxy-2-methylbutane



Ans: hex-1-en-3-ol

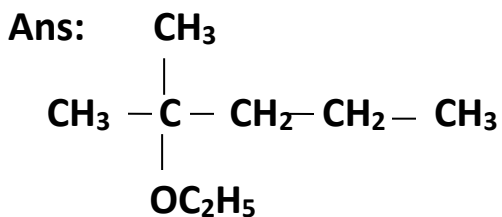
4. Write the structure of the molecule of a compound whose IUPAC name is

1- Phenylpropan-2-ol

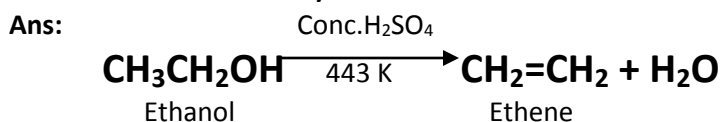


5. Write the structure of the molecule of a compound whose IUPAC name is

2-methyl-2-ethoxypentane

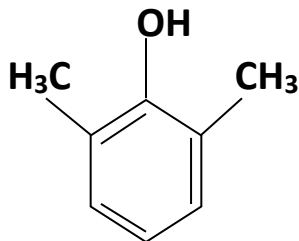


6. How would you convert ethanol to ethane?



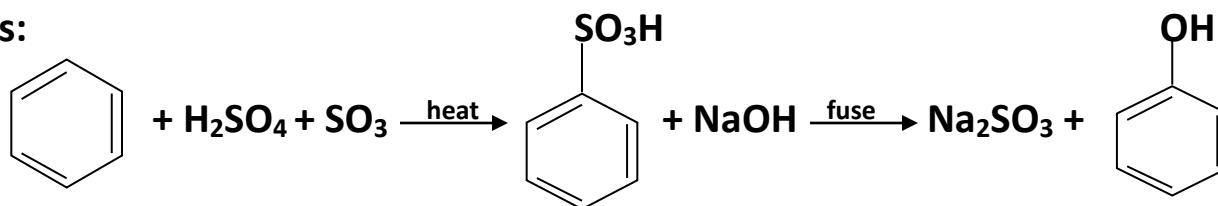
7. Draw the structure of **2,6-dimethylphenol**

Ans.

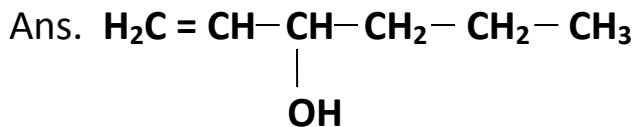


8. Write the Chemical equation for the preparation of **phenol** from **benzene** using oleum and Sodium Hydroxide.

Ans:

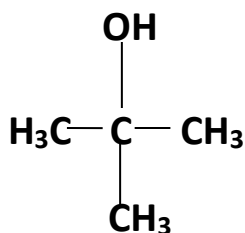


9. Draw the structure of **hex-1-ene-3-ol** compound.

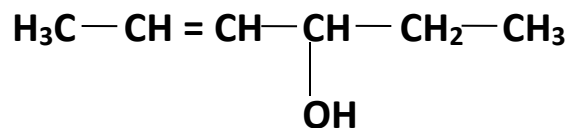


10. Draw the Structural formula of **2-methylpropan-2-ol** molecule.

Ans:



11. Write the IUPAC name of the following compound



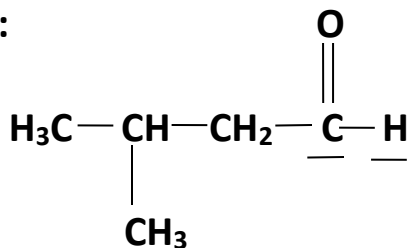
Ans: **Hex-4-en-3-ol**

12. Write the IUPAC name of $\text{H}_3\text{C}-\underset{\text{Cl}}{\text{CH}}-\text{CH}_2-\text{CH}=\text{CH}_2$

Ans: 4-Chloropent-1-ene

13. Write the structure of **3-methylbutanal**.

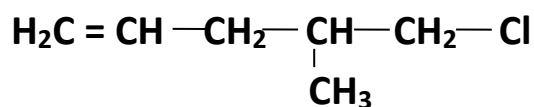
Ans:



14. Write the IUPAC name of $(\text{CH}_3)_2\text{CHCH}(\text{Cl})\text{CH}_3$.

Ans: 2-Chloro-3-methylbutane

15. Write the IUPAC name of the following compound:

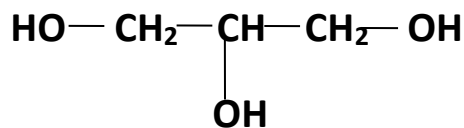


Ans: 5-Chloro-4-methylpentene

16. Which of the following isomers is more volatile:
o-nitrophenol or p-nitrophenol

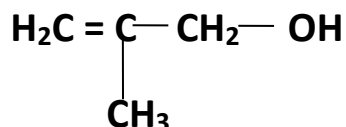
Ans: o-nitrophenol is more volatile.

17. Write the IUPAC name of the following compound:



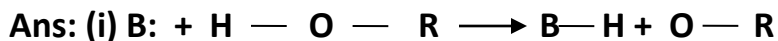
Ans: Propane 1,2,3-triol

18. Write the IUPAC name of the given compound:

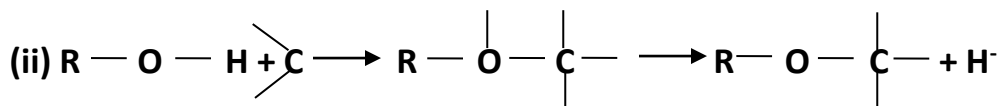


• **Short answer type questions: (2 Marks)**

1) Describe the mechanism of alcohols reacting both as nucleophiles and as electrophiles in their reactions.



Nucleophile Electrophile H



2) Give one chemical test each to distinguish between the following pairs of compounds:

(i) Phenol to Benzoic acid

(ii) 1-Propanol and 2-Propanol

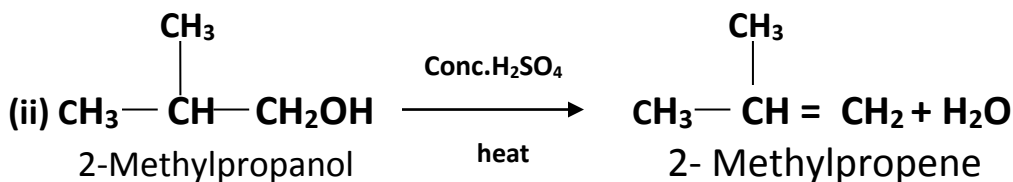
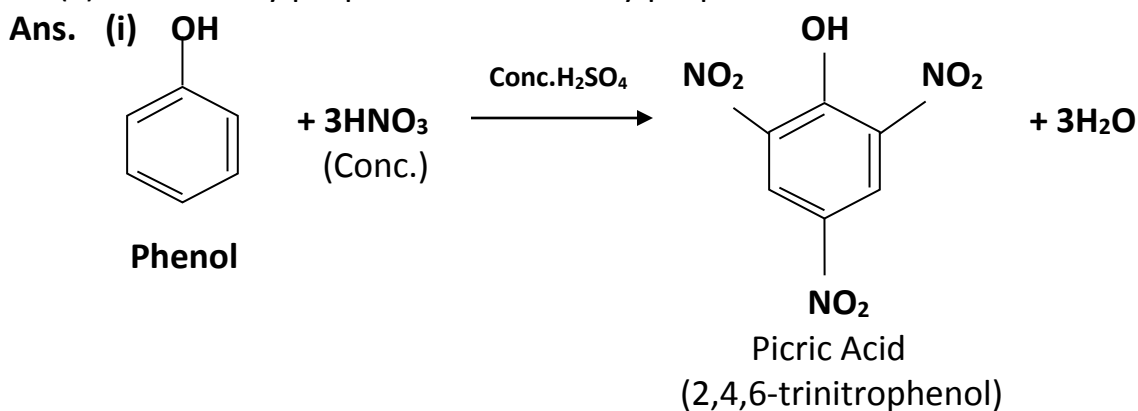
Ans: (i) Add $NaHCO_3$ to each. Phenol will not react, benzoic acid will give brisk effervescence due to CO_2 .

(ii) Add I_2 and $NaOH$. 2-Propanol will give yellow ppt. of iodoform, whereas 1-propanol will not give yellow ppt.

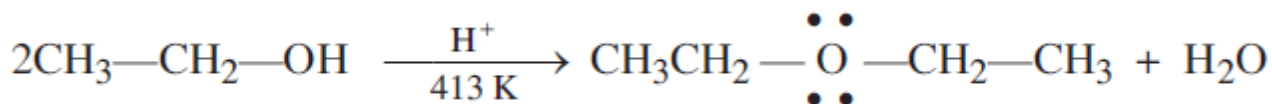
3) How would you obtain

(i) Picric acid (2,4,6-trinitrophenol) from Phenol.

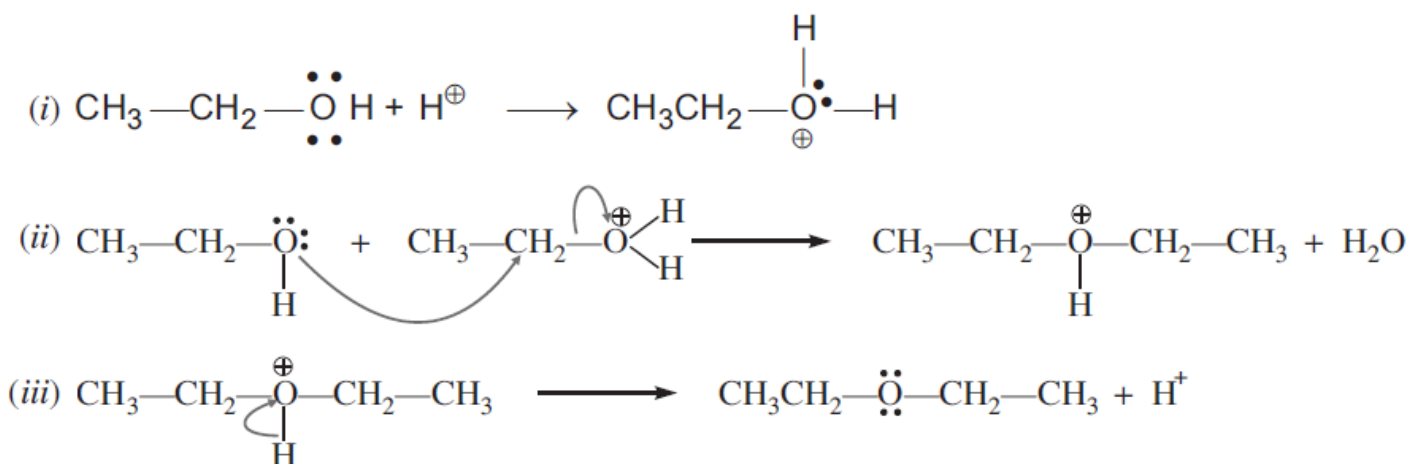
(ii) 2-Methylpropene from 2-methylpropanol?



4) Explain the mechanism of the following reaction:



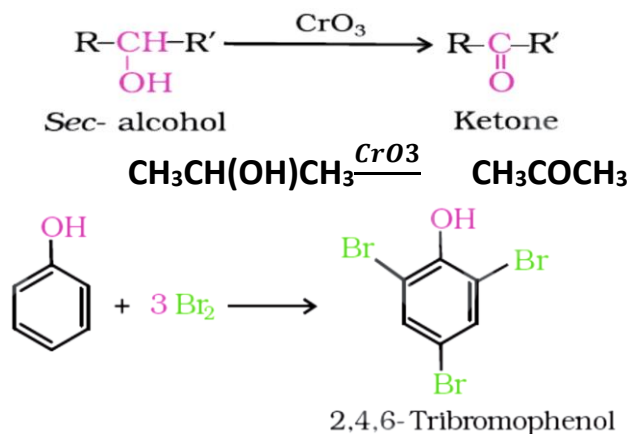
Ans:



5) How will you convert the following?

- Propan-2-ol to propanone
- Phenol to 2,4,6-tribromophenol

Ans:



- 6) (a) Why does p-dichlorobenzene have a higher melting point than its o- and m- isomers?
(b) Why is (±) – Butan-2-ol is optically inactive?

Ans: (a) It is symmetrical and fits into crystal lattice more readily.

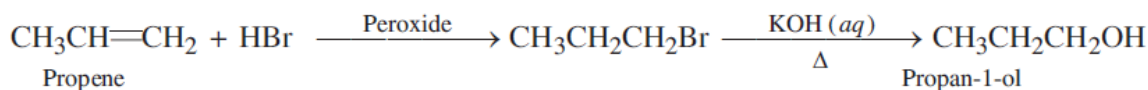
(b) It contains equal amount of (+) and (-) Butan-2-ol which rotate planer polarized light equal in magnitude but opposite in sign, such that no optical rotation is zero, i.e. this racemic mixture is optically inactive.

7) How will you convert:

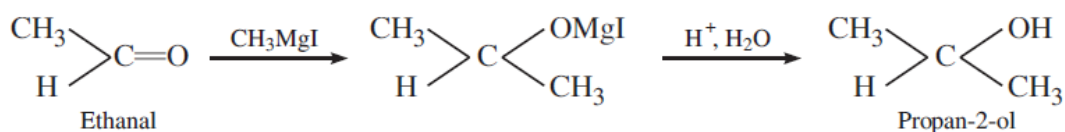
- Propene to Propan-2-ol?
- Ethanal to Propan-2-ol?

Ans:

(i) Propene to Propan-1-ol



(ii) Ethanal to Propan-2-ol

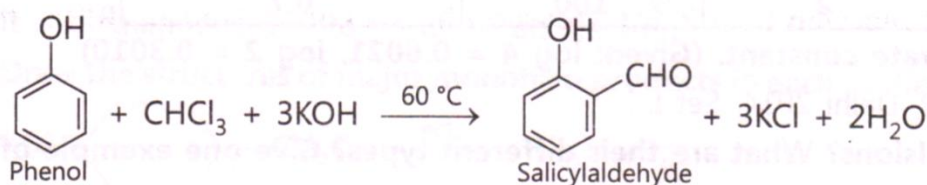


8. Write the equations involved in the following reactions:

(i) Reimer - Teimann Reaction

(ii) Williamson synthesis

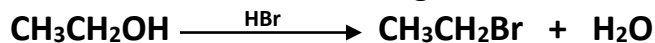
Ans: (i) Reimer - Teimann Reaction



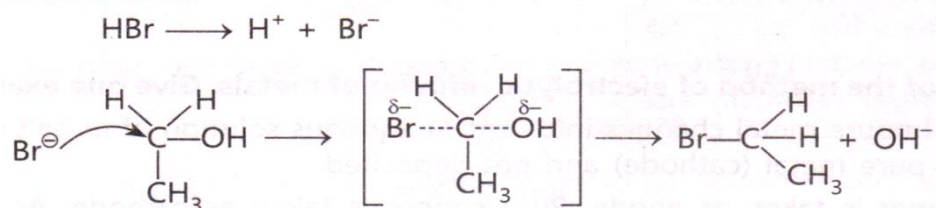
(ii) **Williamson synthesis:**



9. Write the mechanism of the following reaction:



Ans: **Mechanism:**



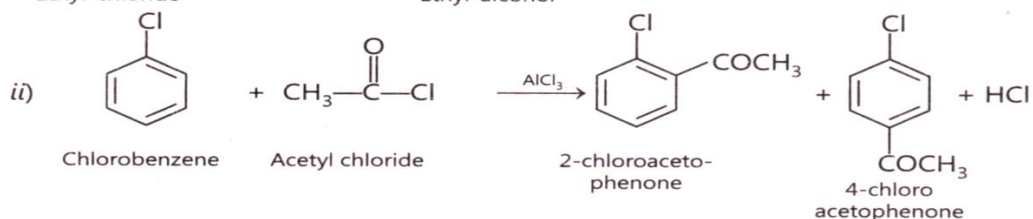
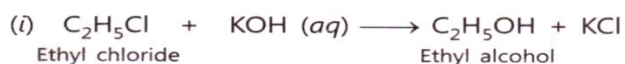
It follows $\text{S}_{\text{N}}2$ mechanism.

10. Write chemical equations when :

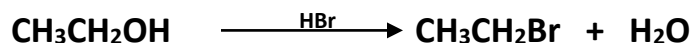
i. Ethyl chloride is treated with aqueous KOH

ii. Chlorobenzene is treated with CH_3COCl in presence of anhydrous AlCl_3

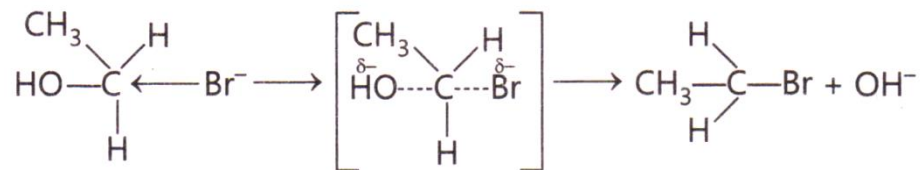
Ans:



11. Write the mechanism of the following reaction:



Ans: **Mechanism:** $\text{H}-\text{Br} \longrightarrow \text{H}^+ + \text{Br}^-$

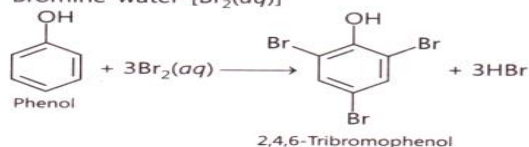


12. Name the reagents used in the following reactions:

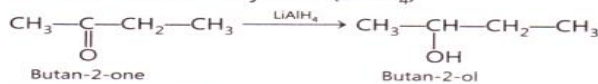
- Bromination of phenol to 2,4,6-tribromophenol
- Butan-2-one to Butan-2-ol
- Friedel-Crafts alkylation of anisole
- Oxidation of primary alcohol to carboxylic acid

Ans:

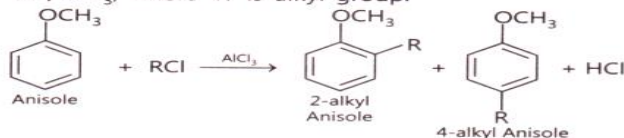
(i) Bromine water [$\text{Br}_2(\text{aq})$]



(ii) Lithium aluminium hydride (LiAlH_4)



(iii) RCl/AlCl_3 , where 'R' is alkyl group.



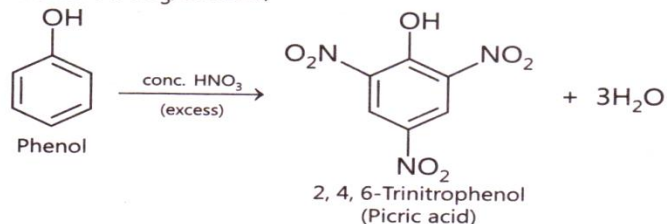
(iv) $\text{KMnO}_4/\text{H}_2\text{SO}_4(\text{dil.})$

13. Name the reagents used in the following reactions:

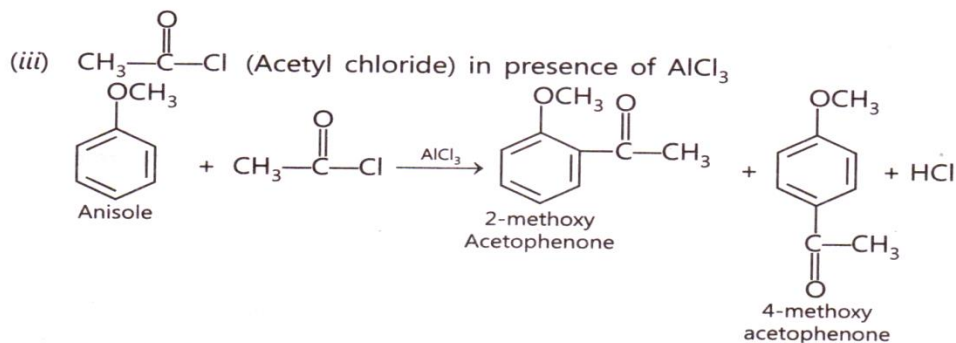
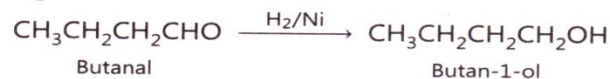
- Nitration of Phenol to 2,4,6-trinitrophenol
- Butanal to Butanol
- Friedel-Crafts acetylation of anisole
- Oxidation of primary alcohol to aldehyde

Ans:

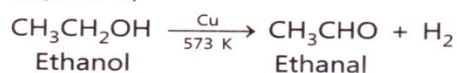
(i) Conc. HNO_3 /excess;



(ii) H_2/Ni ;



(iv) $\text{Cu}/573\text{ K}$;

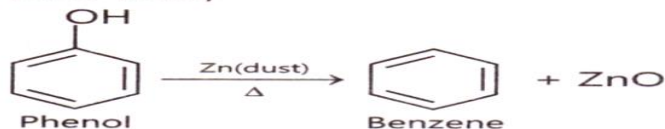


14. Name the different reagents needed to perform the following reactions:

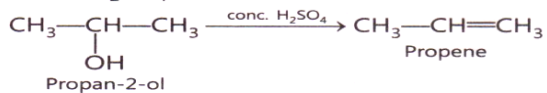
- Phenol to Benzene
- Dehydration of propan-2-ol to propene
- Friedel-Crafts acylation of anisole
- Dehydrogenation of ethanol to ethanal

Ans:

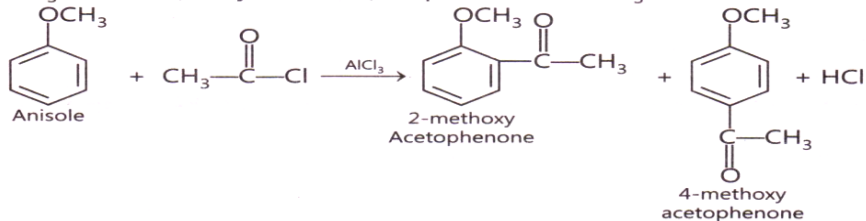
(i) Zinc dust;



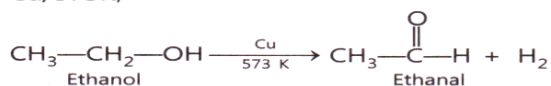
(ii) Conc. H_2SO_4 ;



(iii) CH_3COCl (Acetyl chloride) in presence of AlCl_3



(iv) $\text{Cu}/573\text{ K}$;



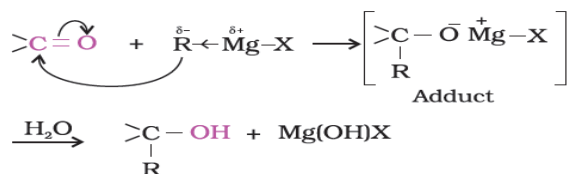
Short Answer type Questions: (3 Marks)

1. Explain the mechanism of the following reactions:

- Addition of Grignard's reagent to the carbonyl group of a compound forming an adduct followed by hydrolysis.
- Acid catalysed dehydration of an alcohol forming an alkene.
- Acid catalysed hydration of an alkene forming an alcohol.

Ans:

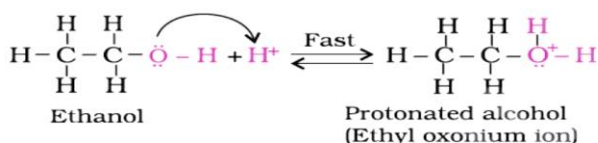
(i)



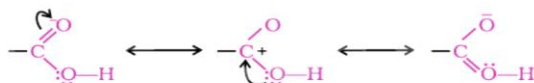
(ii)

Mechanism

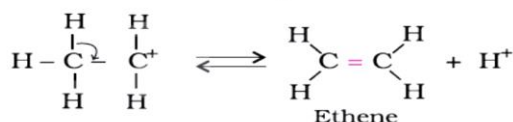
Step 1: Formation of protonated alcohol.



Step 2: Formation of carbocation: It is the slowest step and hence, the rate determining step of the reaction.



Step 3: Formation of ethene by elimination of a proton.

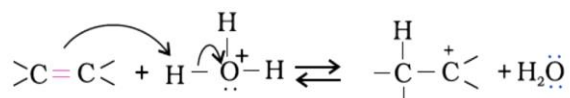
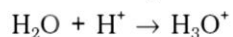


(iii)

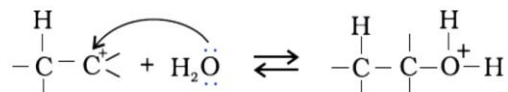
Mechanism

The mechanism of the reaction involves the following three steps:

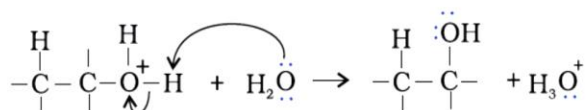
Step 1: Protonation of alkene to form carbocation by electrophilic attack of H_3O^+ .



Step 2: Nucleophilic attack of water on carbocation.



Step 3: Deprotonation to form an alcohol.



2. Explain the following observations:

(1) The boiling point of Methanol is higher than that of methoxymethane.

(2) Phenol is more acidic than ethanol.

(3) O^- and p-nitrophenols are more acidic than phenol.

Ans: (i) It is because ethanol is associated with intermolecular H-bonding. Therefore, ethanol has higher boiling point than that of methoxymethane which is not associated with Intermolecular H-bonding.

(ii) Phenol is more acidic than ethanol because phenoxide ion is more stable due to resonance as compared to ethoxide ion which is unstable due to positive inductive effect of ethyl group.

(iii) It is because $-\text{NO}_2$ group is electron withdrawing ($-\text{R}$ effect), it increases the stability of o- and p-nitrophenoxide ion (phenolate ion) as compared to phenoxide ion.

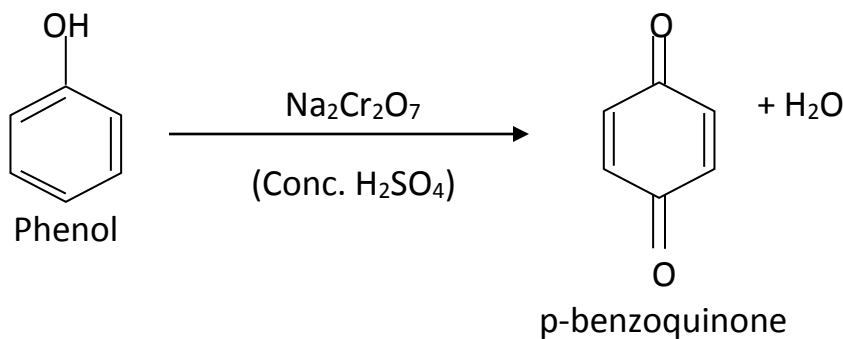
3. How would you convert the following?

(i) Phenol to benzoquinone

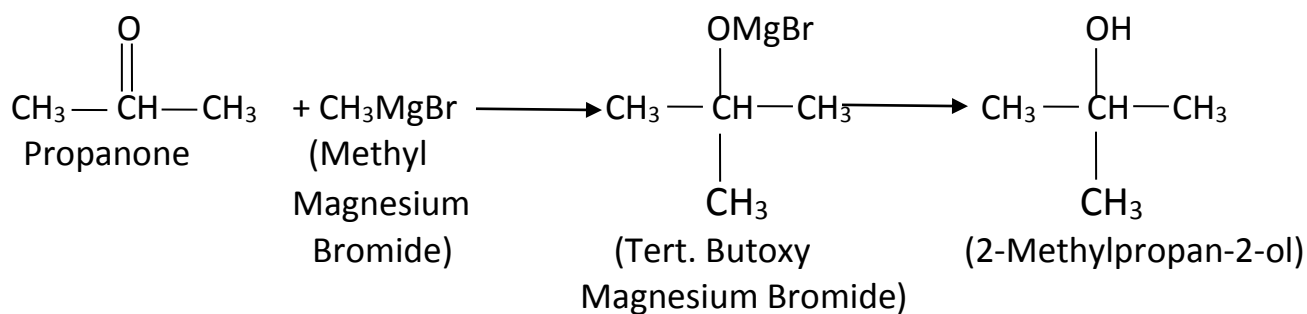
(ii) Propanone to 2- methylpropan-2-ol

(ii) Propene to propan-2-ol

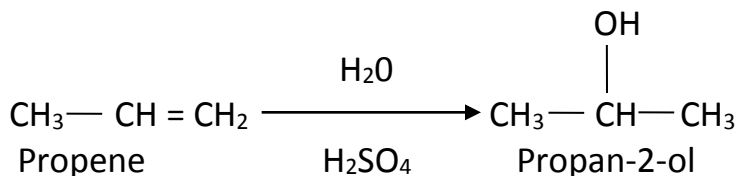
Ans: (i)



(ii)



(iii)



4. Account for the following:

- i. Propanol has higher boiling point than Butane.
- ii. Ortho-nitrophenol is more acidic than ortho-methoxyphenol.
- iii. Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method.

Ans: (i) It is because alcohols can form H-bonds with water molecules, whereas hydrocarbons do not.

(ii) It is because NO₂ group is electron withdrawing and OCH₃ group is electron releasing. Therefore, o-nitrophenoxide ion is more stable than o-methoxyphenoxide ion.

(iii) It is because secondary and tertiary alcohols on dehydration lead to the formation of alkene and not ethers due to the stability of 2° and 3° carbocation.

5. Account for the following:

- i. The boiling point of ethanol is higher than that of methanol.
- ii. Phenol is a stronger acid than an alcohol.
- iii. The boiling points of ethers are lower than isomeric alcohols.

Ans:

- i. **It is due to the higher molecular weight, more surface area, more van der Waals forces of attraction in C₂H₅OH than CH₃OH.**
- ii. **Phenol is a stronger acid than alcohol because phenoxide ion is more stable than ethoxide ion.**
- iii. **It is because ethers are not associated with intermolecular H-bonding, whereas ethanol is associated with intermolecular H-bonding.**

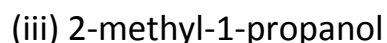
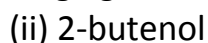
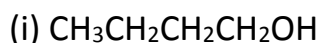
6. Account for the following:

- i. The boiling points of alcohols decrease with increase in branching of the alkyl chain.
- ii. Phenol does not give protonation reaction readily.
- iii. Phenylmethyl ether reacts with HI to give Phenol and Methyl iodide and not iodobenzene and methyl alcohol.

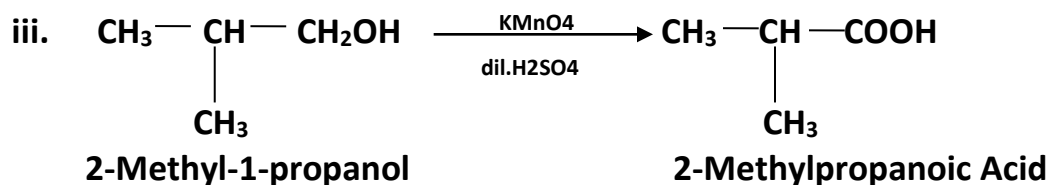
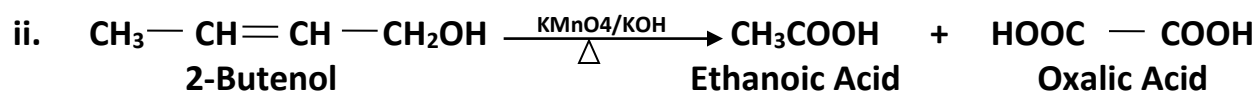
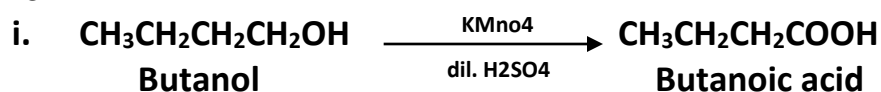
Ans:

- i. **It is because branched chain alcohols have minimum surface area therefore minimum force of attraction, hence, they have lower boiling point.**
- ii. **It is due to +ve charge on 3 out of 5 resonating structures of Phenol. It cannot be protonated easily.**
- iii. **It is because phenoxide ion is stabilized by resonance, whereas, methoxide ion is not.**

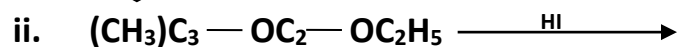
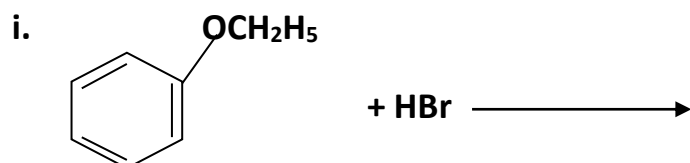
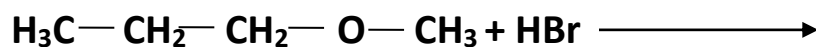
7. Draw the structure and name of the product formed if the following alcohols are oxidized. Assume that an excess of oxidizing agent is used.



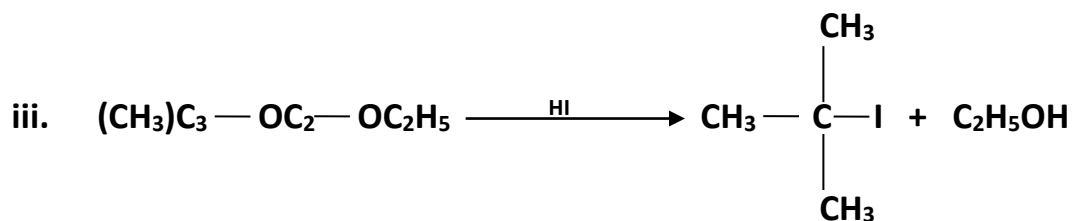
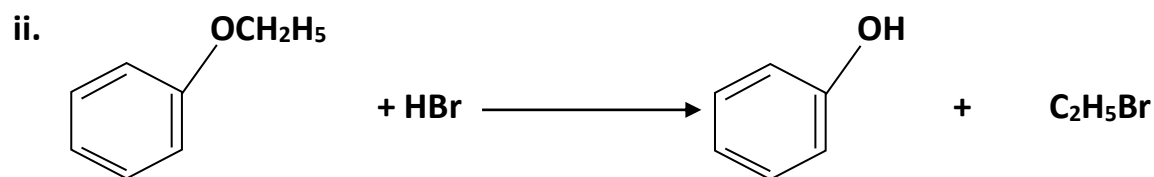
Ans:



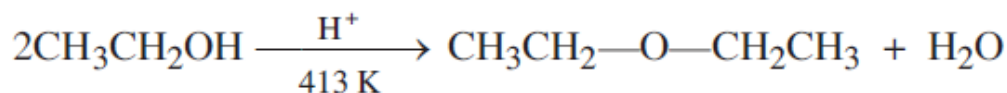
8. State the product of the following reactions:



Ans:

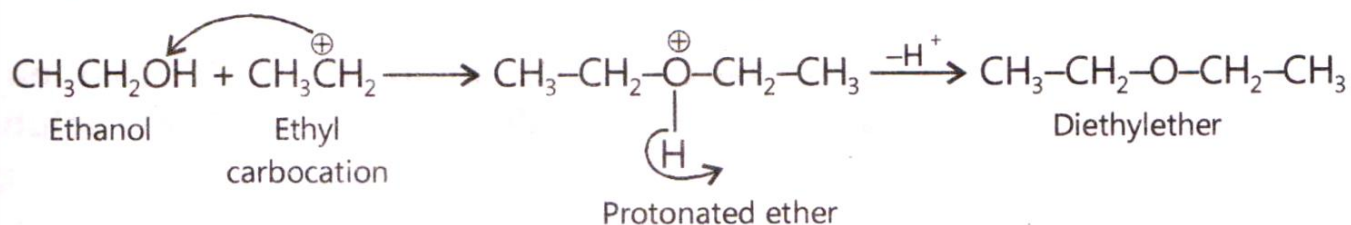


9. (a) Explain the mechanism of the following reaction:

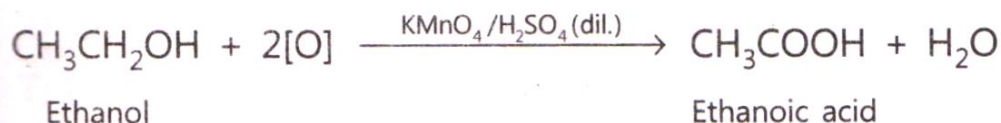


(b) Name the reagent used in the oxidation of ethanol to ethanoic acid.

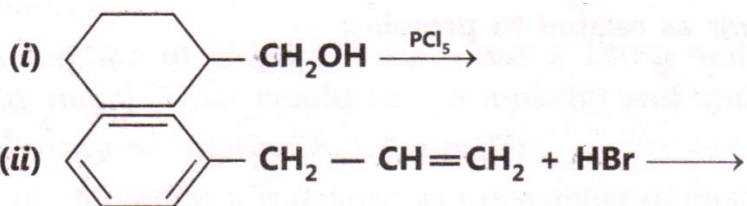
Ans:



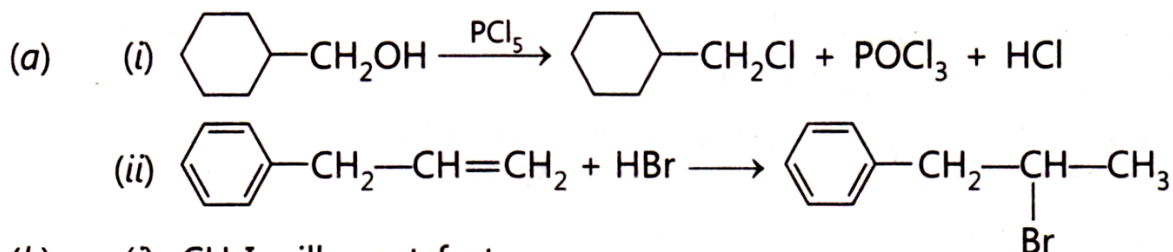
Acidified KMnO_4 is used in oxidation of ethanol to ethanoic acid.



10. Draw the structure of the major monohalo products in each of the following reactions:

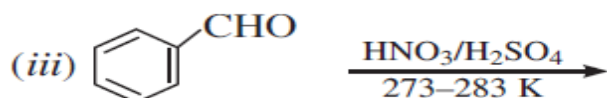
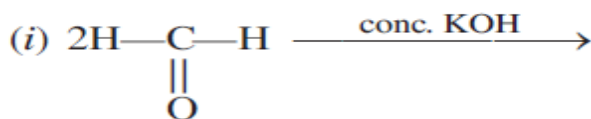


Ans:



LONG ANSWERS:

1. (a) Complete the following reactions:

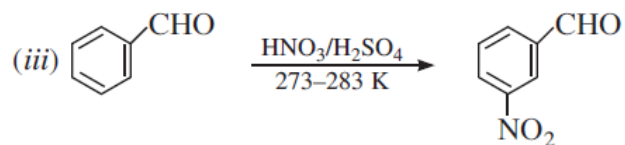
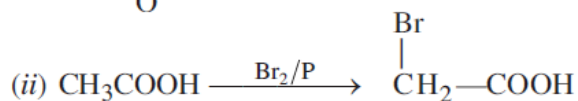
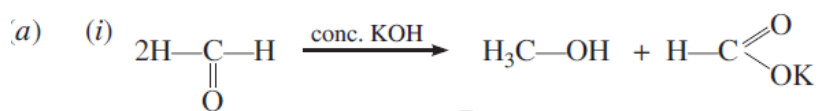


(b) Give simple chemical tests to distinguish between the following pairs of compounds:

(i) Ethanal and propanal

(ii) Benzoic acid and Phenol.

Ans:



(b) (i) **Ethanal (CH_3CHO) and propanal ($\text{CH}_3\text{CH}_2\text{CHO}$):** Ethanal responds to iodoform test and gives a yellow precipitate on addition of NaOH and I_2 , while propanal does not.

(ii) **Phenol and benzoic acid:** Benzoic acid reacts with NaHCO_3 giving CO_2 gas with effervescence, whereas phenol does not. Phenol decolourises Br_2 water giving white precipitate, whereas benzoic acid does not.

2. Give reasons:

a. Ethanol has higher boiling point in comparison to methoxymethane .

Ans : Due to presence of intermolecular hydrogenbond in ethanol.

b. Phenols are more acidic than alcohols.

Ans : Due to $-\text{R}$ effect of phenoxide ion produced after the loss of proton from phenol, phenoxide ion is more stable than alkoxide ion

c. o-nitrophenol is steam volatile while p-nitrophenol not.

Ans : Due to presence of intramolecular hydrogen bond

d. Cleavage of phenyl alkyl ether with HI always gives phenol and alkyl iodide

Ans : Due to resonance C-O bond of phenyl will acquire double bond character hence difficult to break.

3. Arrange the following as property indicated: -

(i) pentan-1-ol, pentanal, ethoxyethane (increasing order of boiling point)

Ans : n-butane < ethoxyethane < pentanal < pentan-1-ol

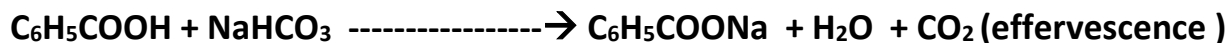
(ii) pentan-1-ol, phenol, 4-methylphenol, 3-nitrophenol (increasing order of acid strength)

Ans : pentan-1-ol < 4-methylphenol < phenol < 3-nitrophenol.

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

(i) Phenol and Benzoic acid. (ii) Propan-1-ol and Propan-2-ol.

Ans: (i) $C_6H_5OH + NaHCO_3 \longrightarrow$ No effervescence



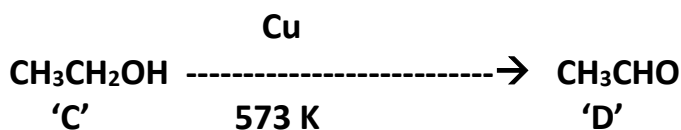
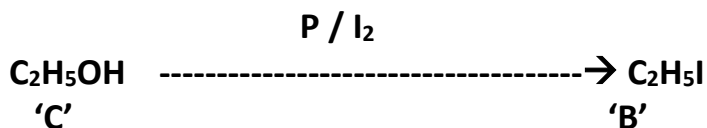
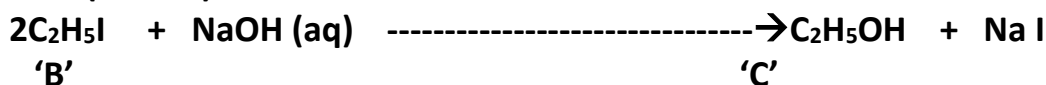
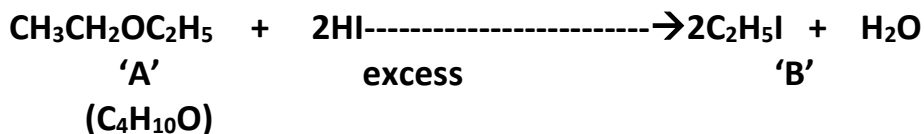
Lucas Reagent

(ii) $CH_3-CH_2-CH_2OH \longrightarrow$ No Turbidity

$CH_3-CHOH-CH_3 \longrightarrow$ Turbidity produced with in five minutes

5. A compound 'A' with molecular formula $C_4H_{10}O$ is unreactive towards sodium metal. It does not add Bromine water and does not react with $NaHSO_3$ solution. On refluxing 'A' with excess of HI gives 'B' which reacts with aq. NaOH to form 'C'. 'C' can be converted into 'B' by reacting with P and I_2 . 'C' on heating with aqueous alkali to form 'E' which forms 'F' on heating with conc. H_2SO_4 . 'F' decolourises bromine water. Identify A to F and write the reactions involved.

Ans :- 'A' is not alcohol therefore it does not react with Sodium metal. 'A' is not aldehyde and ketone as it does not react with $NaHSO_3$. 'A' is not unsaturated hydrocarbon as it does not add Br_2 (aq). It is likely to be ether.



VALUE BASED QUESTION

Chapter-11: ALCOHOLS, PHENOLS AND ETHERS

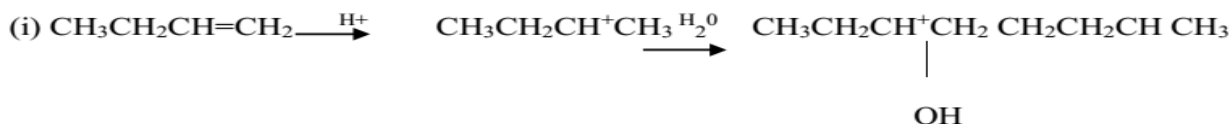
1. Miss. Kamala was asked to synthesise alcohol by acidic hydration of 1-butene. She was unaware of the fact that the vessel she used had some coating of metal, and in addition to alcohol (bp.373 k), compound X (b.p.353K) was also isolated. X forms bisulphite compound as well as 2,4-dinitrophenyl hydrazone. Separation of alcohol could be made by physical as well as chemical methods.

(i) How is alcohol acid X formed?

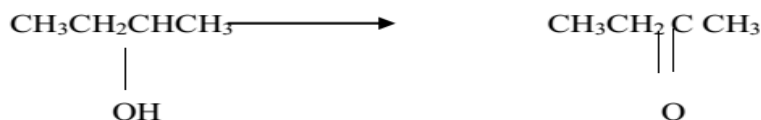
(ii) Can alcohol acid X give iodoform test?

(iii) Give the different methods of separation.

Answers)



Since X forms bisulphite and 2,4-dinitrophenyl hydrazone, it means X has carbonyl group formed due to oxidation of alcohol. This oxidation is due to coating of metal (Cu)



(ii) Alcohol and X both give iodoform test.

(iii) Alcohol and can be separated by (i) distillation (ii) bisulphite formation only (X) forms bisulphite complex (solid) which can be decomposed.

2. Ethanol, commonly called as alcohol is an excellent solvent and is used in medicines and synthesis of many chemical compounds. However in spite of its benefits to man its impact on social behavior has always been questioned. Media have often shown abnormal behavior of people while drunk. It is considered as a curse in the lives of those who are addicted to alcohol called alcoholic people because it not only affects their own lives but they are also a threat to the lives of others. Anger and rude behavior are some of its ill effects.

A) Comment on the statements 'should production of alcohol be banned'. Give three valid reasons to justify

B) As a student of chemistry what initiative would you take in the common concern of 'save life, do not drink '. give suggestion

Ans)(A) though ethanol is one of the most important industrial chemicals, it has many harmful effects of the use of ethanol are

- 1) It causes death of many people
- 2) Many adolescents get affected out of it and become addict to alcohol.
- 3) It is being misused even where it is of important use, such as in painting shops, industries etc.

Keeping in view its ill effects, its production should be banned

Ethanol is the only alcohol used for drinking purpose in spite of its many harmful effects. But in addition to drinking purposes which causes many harmful effects, it has many important uses:

- 1) It is used as solvent for resins, fats, oils, fatty acids and hydrocarbon.
- 2) It is used in so many ways for medicines, lacquers, varnishes, perfumes etc.
- 3) It is used as disinfectant.

So it should not be banned but its production and supply should be regulated.

B – As a student of chemistry and keeping in view the ill effects and importance of ethanol, the following initiatives should be taken to “save life, do not drink “

- 1) Slogan writing
- 2) Skits or dramas showing ill effects of alcohol

Q 3) The labourers of a colony used to drink cheaper alcohol from unauthorized sources. This alcohol contained some methanol. One day a few labourers complained of drowsiness and pain, and loss of eyesight after consuming the liquor. Their family members took them to the hospital and the doctors tried to treat them. One of the labourers died and the other complained loss of their eyesight. As a student of science, how would you analyse this serious situation?

- 1) How does drinking of cheap alcohol cause problem?
- 2) What message would you give to the persons who consume spurious alcohol?

Ans) 1) Due to the presence of highly toxic methanol

- 2) People should be educated not to drink cheap alcohol from unauthorized sources

Q3) In a slum area large number of people fell ill after drinking liquor sold by a local vendor. Many people started vomiting, some complained of not being able to see properly and some others were unconscious. Gautam's father also suffered from severe stomach ache after consuming liquor. Gautam calmed down his mother and helped her to call ambulance for his father and also for other people. They also informed the police about the incident.

- 1) Mention the values shown by Gautam
- 2) WRITE THE PROBABLE CAUSE OF POISONING BY LIQUOR
- 3) Write the reaction showing the conversion of molasses to ethyl alcohol using yeast

AMINES

1 MARKS QUESTION;

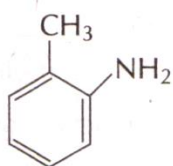
1. Arrange the following in increasing order of their basic strength in aqueous solution. $\text{CH}_3\text{NH}_2, (\text{CH}_3)_3\text{N}, (\text{CH}_3)_2\text{NH}$
2. Write the structure of prop-2-en-1-amine.

Ans: $\text{CH}_2 = \text{CH} - \text{CH}_2\text{NH}_2$

Prop-2-en-1-amine

3. Write the structure of 2-aminotoluene.

Ans:



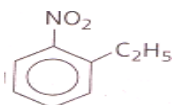
2-amino toluene

4. Write the structure of N-methylethanamine.

Ans: $\text{CH}_3 - \text{CH}_2 - \text{NH} - \text{CH}_3$

N-methyl ethanamine

5. Write the IUPAC name of the following



Ans: 2-ethyl nitrobenzene

6. Arrange the following compound in an increasing order of basic strengths in their aqueous solutions. $\text{NH}_3, \text{CH}_3\text{NH}_2, (\text{CH}_3)_2\text{NH}, (\text{CH}_3)_3\text{N}$

Ans: $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N} > \text{NH}_3$

7. Arrange the following compound in an increasing order of their solubility in water. $\text{C}_6\text{H}_5\text{NH}_2, (\text{C}_2\text{H}_5)_2\text{NH}, \text{C}_2\text{H}_5\text{NH}_2$

Ans: Increasing order of solubility in water is $\text{C}_6\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH} < \text{C}_2\text{H}_5\text{NH}_2$

8. Write one reaction that can be used as a test for primary amines.

Ans: Carbylamine reaction in which 1^o amines produce a bad smelling compound, when treated with chloroform in the presence of alkali.

9. Rearrange the following in increasing order of their basic strength.



Ans: $C_6H_5NH_2 < C_6H_5N(CH_3)_2 < CH_3NH_2 < (C_2H_5)_2NH$

10. Give a chemical test to distinguish between ethylamine & aniline.

Ans: Ethylamine and aniline can be distinguished by azo dye test. When aniline is treated with HNO_2 followed by treatment with alkaline solution of 2-naphthol, an orange dye is obtained but ethylamine gives N_2 gas with the formation of 1^o alcohols.

11. Give IUPAC name of $H_2N-CH_2-CH_2-CH=CH_2$

Ans: But-3-en-1-amine

12. Give a chemical test to distinguish between aniline and N-methyl aniline.

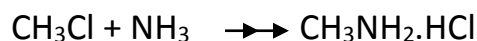
Ans: On adding $CHCl_3$ and KOH , aniline will give offensive smell due to formation of phenyl Carbylamine (phenyl isocyanide), while N-methylaniline will not react.

13. Why electrophilic substitution takes place more readily in aromatic amines than benzene?

Ans: Due to strong activating effect of the $-NH_2$ group, aromatic amines undergo electrophilic substitution reactions readily and it is difficult to stop the reaction at the monosubstitution range.

14. Write a chemical equation to illustrate the ammonolysis reaction.

Ans:



15. Rearrange in increasing order of their basic strength.



Ans: p-toluidine > Aniline > p-nitroaniline

16. Write a chemical reaction in which iodide ion displaces diazonium group from a diazonium salt.

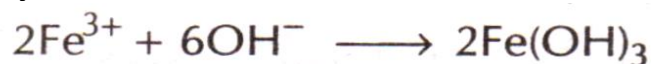


17. Account methylamine in water reacts with ferric chloride to give precipitate of ferric hydroxide.

Ans: Methyl amine being more basic than water accepts a proton from water liberating OH^- ions.



These OH^- ions combine with Fe^{3+} ions present in H_2O to form a brown ppt of hydrated ferric hydroxide.



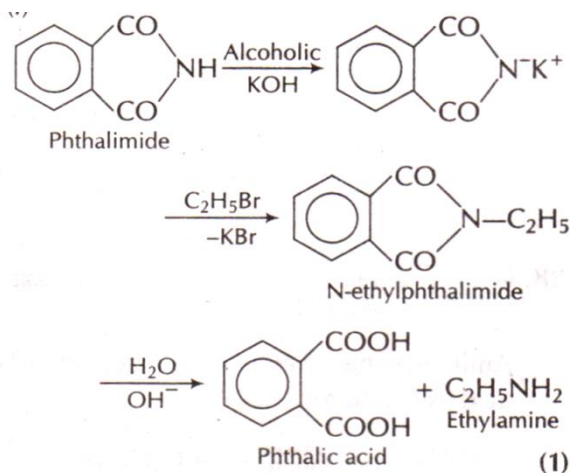
2 MARKS QUESTION;

18. Explain the following reactions.

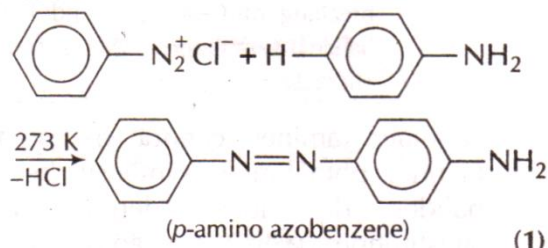
(1). Gabriel phthalimide reaction.

(2). Coupling reaction.

Ans: (i)



(iii) **Coupling Reaction:** Benzene diazonium chloride reacts with aniline, in which the molecule at its para position is coupled with the diazonium salt to form p-amino azobenzene. This is an example of the coupling reaction.



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

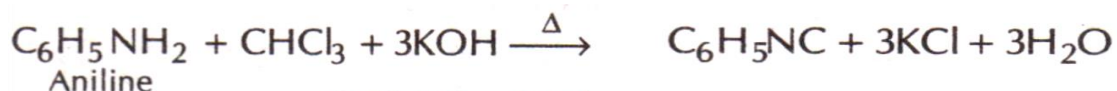
- (1). Aniline and Ethylamine.
- (2). Ethylamine and Dimethylamine.

Ans: (i) On adding NaNO_2 and HCl and then cooling it to 0°C . Then on adding alkaline solution of phenol, aniline gives orange red dye whereas no such dye is formed in case of ethylamine.

19. Describe the following giving the relevant chemical equation in each case.

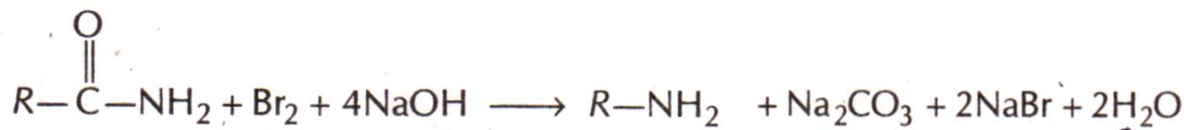
- (1). Carbylamine reaction.
- (2). Hoffmann's bromamide reaction.

Ans: (1). Carbylamine reaction: Aliphatic and aromatic primary amines on heating with chloroform and ethanolic potassium hydroxide form isocyanides or carbylamines which are foul smelling substances. This reaction is known as Carbylamine reaction.



This reaction is used as a test for primary amine.

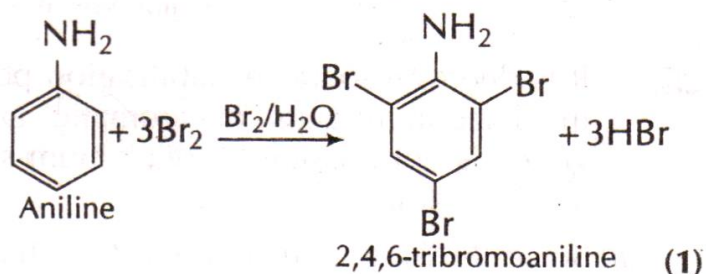
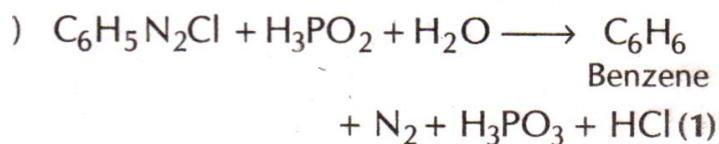
(2). Hoffmann's bromamide reaction: It is a method for the preparation of primary amines by treating an amide with bromine in an aqueous or ethanolic solution of sodium hydroxide. The amines so formed contain one carbon less than that present in the parent amide.



20. Complete the following reaction equations

- (i) $\text{C}_6\text{H}_5\text{N}_2\text{Cl} + \text{H}_3\text{PO}_2 + \text{H}_2\text{O} \longrightarrow$
- (ii) $\text{C}_6\text{H}_5\text{NH}_2 + \text{Br}_2 (\text{aq}) \longrightarrow$

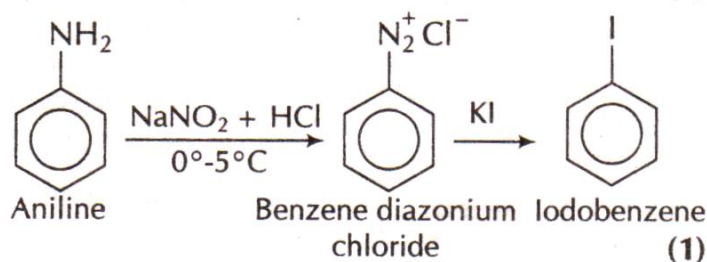
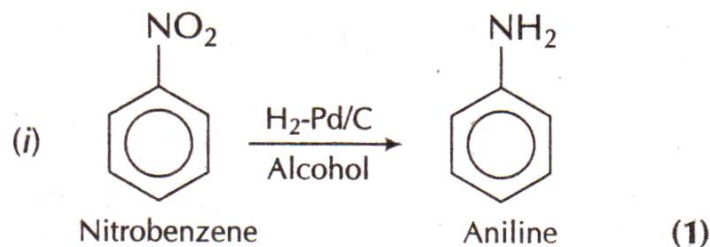
Ans:



21. How will you convert

- (i) nitrobenzene to aniline?
- (ii) aniline to iodobenzene?

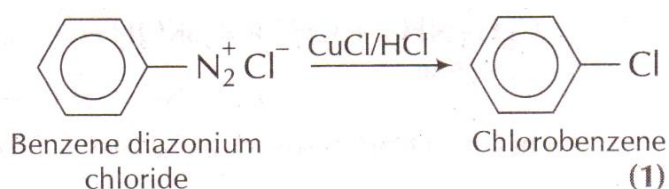
Ans:



22. Illustrate the following with an example of reaction in each case.

- (i) Sandmeyer's reaction
- (ii) Coupling reaction

Ans: Sandmeyer Reaction: By this reaction nucleophiles like Cl^- , Br^- , CN^- , etc. can easily be introduced in the benzene ring by treating the diazonium salt solution with corresponding halogen acid in the presence of Cu(I) ion.



23. Convert

(1) Nitrobenzene to phenol

(2) Aniline to chlorobenzene

ANS : See the conversion table

24. Account for the following

(1) Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

(2) Amines are more basic than alcohols of comparable molecular masses.

Ans(1) Due to resonance diazonium salt are stabilised, where as no resonance is possible in aliphatic diazonium salt.

(2) In case amine Nitrogen is less electronegative than oxygen of alcohol, hence lone pair of electron of nitrogen is easily available.

25. How will you convert

(1) Aniline to benzonitrile?

(2) Ethanamine to ethanoic acid?

ANS : See the conversion table

26. How will you bring about the following conversions?

(1). Methylamine into iodomethane.

(2). Chlorobenzene into p-chloroaniline.

ANS : See the conversion table

27.(1). Why aniline does not undergo Friedel-Craft's reaction?

(2). Why can primary aromatic amines are not prepared by Gabriel phthalimide synthesis?

Ans: (i) Aniline being a Lewis base reacts with Lewis Acid ($AlCl_3$) to form a salt. As a result, N acquires a positive charge so it acts as a strong deactivating group for electrophilic substitution reaction. Thus, aniline does not undergo Friedel-Crafts reaction.

(ii) Aromatic amines cannot be prepared by the Gabriel phthalimide synthesis because aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.

28. Write the equations for

(i) Gabriel phthalimide reaction

(ii) Hoffmann's bromamide reaction

29. Give a chemical test to distinguish between.

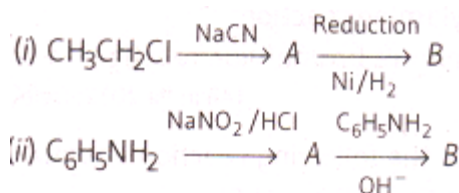
(1) Methylamine and dimethylamine

(2) Aniline and N-methyl amine

Ans: (i) Methyl Amine gives carbylamines test i.e., on treatment with alc. KOH and chloroform, followed by heating it gives offensive odour of methyl isocyanide. Dimethyl amine does not give this test.

(ii) Aniline gives carbylamines test i.e., on treatment with alc. KOH and chloroform followed by heating it gives offensive odour of phenylisocyanide but N-methyl aniline being secondary amine, does not show this test.

30. Identify A and B in each of the following processes



31. Write one chemical reaction each illustrate the following

- (1) Acetylation
- (2) Gabriel phthalimide synthesis

32. Assign reasons for

- (1) Amines are less acidic than alcohols of comparable molecular masses.
- (2) Aliphatic amines are stronger bases than aromatic amines.

Ans: (i) Loss of proton from amines gives RNH^- ion whereas loss of proton from the alcohol forms alkoxide ion. Since, O is more electronegative than N, therefore, RO^- can accommodate the negative charge more easily than RN^- . Further O—H bond is more polar than N—H bond. Hence, amines are less acidic than alcohol.

(ii) In aromatic amines, the lone pair of electrons present on nitrogen takes part in resonance and hence, not available for donation. However, in aliphatic amines, the lone pair is available for donation. That's why aliphatic amines are more basic than aromatic amines.

33. How are the following conversions carried?

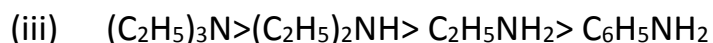
- (1) Aniline to nitrobenzene.
- (2) Ethanamine to N-ethylethanamide

ANS : See the conversion table

34. Arrange the following substances $\text{C}_6\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $(\text{C}_2\text{H}_5)_3\text{N}$, $\text{C}_2\text{H}_5\text{NH}_2$

- (1) In an increasing order of basic strength in water.
- (2) In a decreasing order of basic strength in gas phase.

ANS- (i) Basic nature of amines given in aq. Media is – $(\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{NH}_2$



35. State the reactions and reaction conditions for the following conversions.

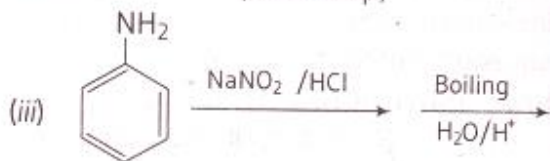
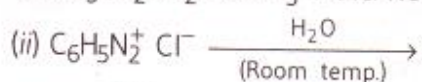
(1) Benzene diazonium chloride to nitrobenzene.

(2) Aniline to benzene diazonium chloride.

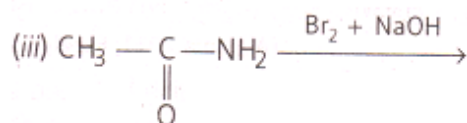
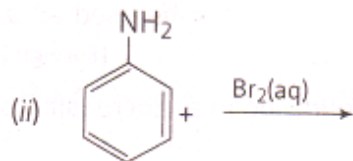
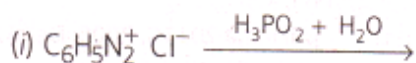
ANS : See the conversion table

3 MARKS QUESTION;

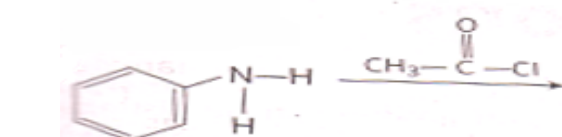
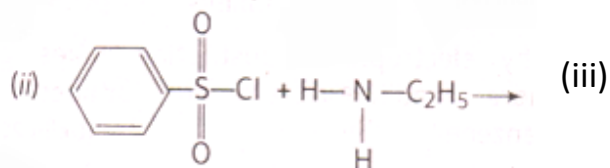
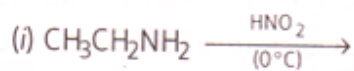
36. Complete the following reactions



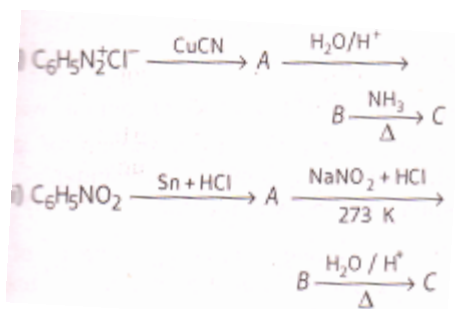
37. Write the main products of the following reactions



38. Write the main products of the following reactions.



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



40. Illustrate the following with a suitable example in each case.

(1) Ammonolysis.

(2) Coupling

(3) Acetylation of amine

41. Describe Hinsberg method for identification of primary secondary and tertiary amines. Also write chem. Equation of reaction involve.

42. Write the structure of main product when benzene diazonium chloride reactants with following reagents.

(1) $\text{HBF}_4 /$

(2) Cu/HBr

43. Write the structure of A, B and C in following

44. Accomplish the following conversion.

(1) Nitrobenzene to benzoic acid

(2) Benzene to m-bromophenol

(3) Benzoic acid to aniline

(4) Aniline to 2, 4, 6-tribromoflorobenzene.

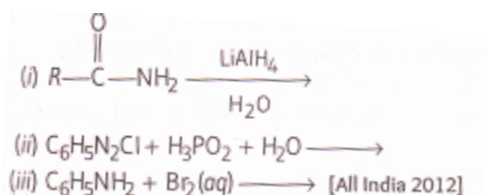
(5) Benzyl chloride to 2-phnelyethana

(6) Cholrobenzene t p-chloroaniline

(7) Benzamide to toluene

(8) Aniline to benzyl alcohol

45. Complete the following reaction equations



CONVERSION & FILL IN THE BLANKS CAN BE SOLVED BY USING CONVERSION TABLE.

46. State reasons for the following.

(i) pK_b value for aniline is more than that for methylamine.

(ii) Ethylamine is soluble in water whereas aniline is not soluble in water.

(iii) Primary amines have higher boiling points than tertiary amines.

Ans: (i) In aniline the lone pair of electrons of N-atom are delocalized over the benzene ring. As a result, electron density on the nitrogen decreases. In contrast, in $\text{CH}_3\text{—NH}_2$, +I effect of —CH_3 group increases the electron density on the N-atom.

Therefore aniline is weaker base than methylamine and hence its pK_b value is higher than that of methylamine.

(ii) Aniline is not soluble in water while ethylamine is soluble. This is because ethylamine forms intermolecular hydrogen bonds with water while in aniline, the aryl group possess steric hindrance and hence does not result in H-bonding.

(iii) Primary amines because of the presence of two H-atoms, attached directly with N, results in excessive H-bonding, whereas tertiary amines due to lack of H-atom, attached directly with N, cannot form H-bonding. Due to excessive H-bonding, large heat is required to break it. Thus the boiling point of 1° amine is higher than 3° amines.

VALUE BASED QUESTION

Chapter-13:AMINES

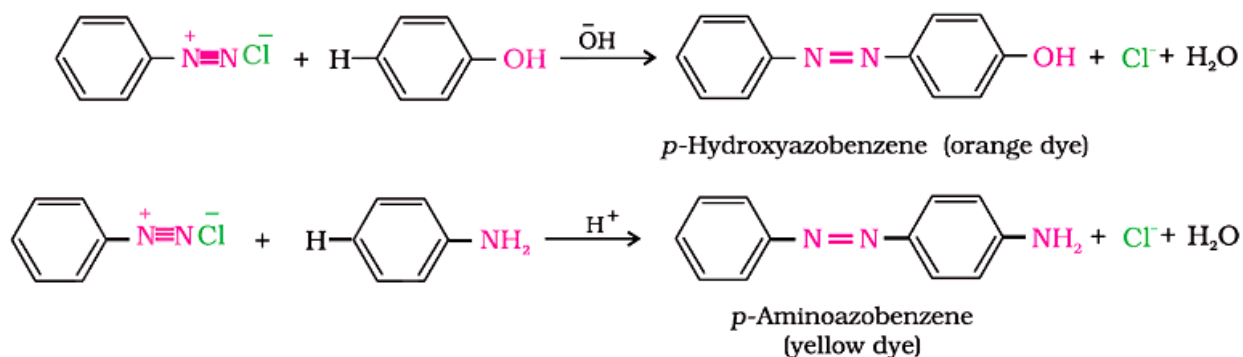
1) Sushil's friend want to play Holi with synthetic colours, eggs, muddy water etc. Sunil persuades his friends to play Holi with natural colours. He reminds them that last time one of their friends had developed skin allergy after playing Holi with synthetic colours. It took him along time to recover. Sushil's friends agreed and prepared natural colours using leaves and flowers.

(i) Mention the values shown by Sushil.

(ii) Write the names and reaction of preparation of two azo dyes (synthetic)

Ans (i) Environmental conservation, respect of multireligious and multicultural country.

(ii)



2) A mother brought her 2 year old child to a clinic with a complaint that the child would not stop crying and was profusely vomiting. The doctor noticed the child shirt collar colour was faded.

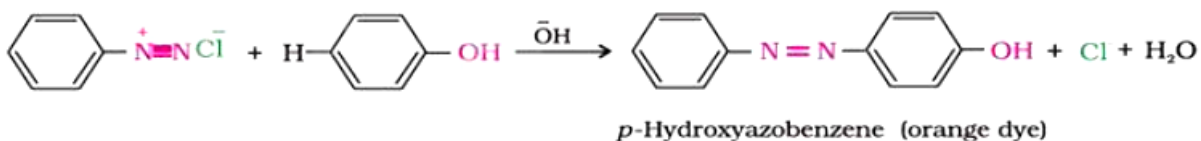
a) Why dyes are coloured? Give 2 reasons?

b) What is coupling reaction? Give equation

c) What are the values involved in this?

Ans (a) Dyes are aromatic compounds their structure includes aryl rings which have delocalized electron systems. These are responsible for the absorption of electromagnetic radiation of varying wavelengths transmitting the rest to the eye.

(b) Arenediazonium salts react with highly reactive aromatic compounds such as phenols and amines to form bright coloured azo compounds. This reaction is called coupling reaction.



(c) Keen observation.

Q3. A solution contains 1 g mol each of p-toluenediazonium chloride and p-nitrophenyldiazonium chloride. To this 1 g mol of alkaline solution of phenol is added. Predict the major product. Explain your answer. While performing this chemical reaction Rohit utilized resources as minimum as possible. Why did he do so, justify your answer in two lines, writing down any one basic value associated.

Q4. Dyes are an important class of organic compounds. A class of organic compounds containing nitrogen are used as a starting material for the manufacture of azo dyes. It reacts with nitrous acid to form diazonium salt, which can undergo coupling reaction to form azo compound. Low molecular weight compounds are toxic, and some are easily absorbed through the skin. Many higher molecular weight compounds are, biologically, highly active. Identify the compounds and write the value associated with it.

Q5. Rahgu and Raghav took organic compound synthesis as their chemistry project. They prepare benzenediazonium chloride. Raghav wanted to store it and synthesis dye from it next day but Raghav said we can store it and need to use immediately after preparation. Whom do you think is right and why? Write the value associated with it.