Question Set 19

ACTION OF REAGENTS

Q. Explain the action of the following : ***(1 mark each)***

[**Note :** Action of a reagent on a compound involves a balanced equation for the reaction. Explain the action in words and then write the reaction along with the condition and the names of the compounds in the reaction.]

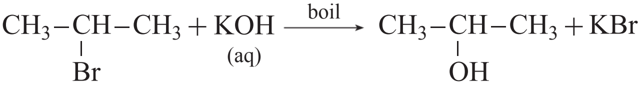
Chapter 10. Halogen Derivatives

Q. 1. Describe the action of aqueous KOH (or NaOH) on : (1) ethyl bromide (2) isopropyl bromide (3) tert-butyl chloride.

Ans. (1) Ethyl bromide : When ethyl bromide (bromoethane) is refluxed with aqueous potassium hydroxide, ethyl alcohol is formed. The reaction is called a hydrolysis reaction.

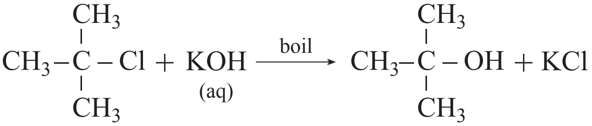
$$\underset{\text{ethyl bromide}}{CH_3-CH_2-Br} + \underset{\text{(aq)}}{KOH} \xrightarrow{\text{boil}} \underset{\text{ethanol}}{CH_3-CH_2-OH} + KBr$$

(2) Isopropyl bromide : When isopropyl bromide (2-bromopropane) is boiled with aqueous potassium hydroxide, isopropyl alcohol is formed.



$$\underset{\text{isopropyl bromide}}{CH_3-\underset{\displaystyle Br}{\underset{|}{C}H}-CH_3} + \underset{\text{(aq)}}{KOH} \xrightarrow{\text{boil}} \underset{\text{isopropyl alcohol}}{CH_3-\underset{\displaystyle OH}{\underset{|}{C}H}-CH_3} + KBr$$

(3) Tert-butyl chloride : When tert-butyl chloride is refluxed with aqueous potassium hydroxide, tert-butyl alcohol is formed.



$$\underset{\text{tert-butyl chloride}}{CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-Cl} + \underset{\text{(aq)}}{KOH} \xrightarrow{\text{boil}} \underset{\text{tert-butyl alcohol}}{CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-OH} + KCl$$

Q. 2. Describe the action of alcoholic potassium hydroxide (alc. KOH) on *n*-propyl bromide.

Ans. When *n*-propyl bromide is heated with alcoholic potassium hydroxide, propene is formed.

$$\underset{n\text{-propyl bromide}}{CH_3-CH_2-CH_2-Br} + \underset{\text{(alc.)}}{KOH} \xrightarrow{\text{heat}} \underset{\text{propene}}{CH_3-CH=CH_2} + KBr + H_2O$$

Q. 3. Describe the action of (1) AgCN on ethyl bromide and (2) excess of ammonia on *n*-propyl bromide.

Ans. (1) Ethyl bromide : When ethyl bromide is heated with alcoholic silver cyanide, ethyl isocyanide is formed.

$$\underset{\text{ethyl bromide}}{CH_3-CH_2-Br} + \underset{\text{(alc.)}}{AgCN} \xrightarrow{\text{heat}} \underset{\text{ethyl isocyanide}}{CH_3-CH_2-NC} + AgBr$$

(2) *n*-Propyl bromide : When *n*-propyl bromide is boiled under pressure with an excess of ammonia, *n*-propyl amine (propanamine) is formed.

$$\underset{n\text{-propyl bromide}}{CH_3-CH_2-CH_2-Br} + \underset{\substack{\text{(alc.)}\\\text{(excess)}}}{NH_3} \xrightarrow[\text{pressure}]{413\text{ K}} \underset{n\text{-propyl amine}}{CH_3-CH_2-CH_2-NH_2} + HBr$$

Q. 4. Describe the action of potassium nitrite on

(1) ethyl bromide (2) methyl chloride.

Ans. (1) Ethyl bromide : When ethyl bromide is treated with potassium nitrite, ethyl nitrite is formed.

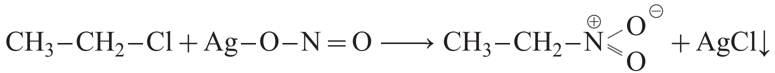
$$\underset{\text{ethyl bromide}}{CH_3-CH_2-Br} + \underset{\substack{\text{potassium}\\\text{nitrite}}}{\overset{+\,-}{KO}-N=O} \longrightarrow \underset{\text{ethyl nitrite}}{CH_3-CH_2-O-N=O} + KBr$$

(2) Methyl chloride : When methyl chloride is treated with potassium nitrite, methyl nitrite is formed.

$$\underset{\text{methyl chloride}}{CH_3-CH_2-Cl} + \underset{\substack{\text{potassium}\\\text{nitrite}}}{\overset{+\,-}{KO}-N=O} \longrightarrow \underset{\text{methyl nitrite}}{CH_3-O-N=O} + KCl$$

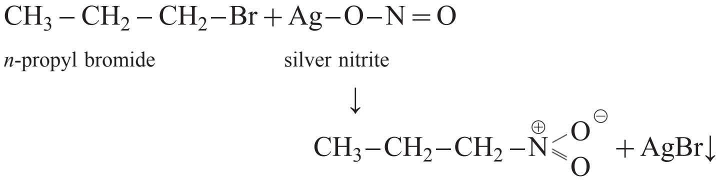
Q. 5. Describe the action of silver nitrite on (1) ethyl chloride (2) *n*-propyl bromide.

Ans. (1) Ethyl chloride : When ethyl chloride is treated with silver nitrite, nitroethane is obtained.



$$\underset{\text{ethyl choride}}{CH_3-CH_2-Cl} + \underset{\text{silver nitrite}}{Ag-O-N=O} \longrightarrow \underset{\text{nitroethane}}{CH_3-CH_2-\overset{\oplus}{N}\begin{smallmatrix}\nearrow O^{\ominus}\\ \searrow O\end{smallmatrix}} + AgCl\downarrow$$

(2) *n*-Propyl bromide : When *n*-propyl bromide is treated with silver nitrite, nitropropane is obtained.



$$\underset{n\text{-propyl bromide}}{CH_3-CH_2-CH_2-Br}+\underset{\text{silver nitrite}}{Ag-O-N=O}\longrightarrow\underset{\text{nitropropane}}{CH_3-CH_2-CH_2-\overset{\oplus}{N}\genfrac{}{}{0pt}{}{\nearrow O^{\ominus}}{\searrow\!\!\searrow O}}+AgBr\downarrow$$

Q. 6. What is the action of following on ethyl bromide :

(i) Na in dry ether (ii) Mg in dry ether? ***(March '22)***

Ans. (i) When ethyl bromide is treated with sodium in dry ether, *n*-butane is obtained.

$$\underset{\text{ethyl bromide}}{C_2H_5Br}+2Na+C_2H_5Br\xrightarrow{\text{dry ether}}\underset{n\text{-butane}}{CH_3-CH_2-CH_2-CH_3}+2NaBr$$

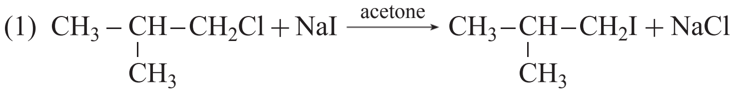
(ii) When ethyl bromide is treated with magnesium in dry ether, ethyl magnesium bromide (Grignard reagent) is obtained.

$$\underset{\text{ethyl bromide}}{C_2H_5Br}+Mg\xrightarrow{\text{dry ether}}\underset{\text{ethyl magnesium bromide}}{C_2H_5MgBr}$$

Q. 7. Write structure and IUPAC name of the major product in each of the following reaction :

Ans. Structure and IUPAC name :

(1)



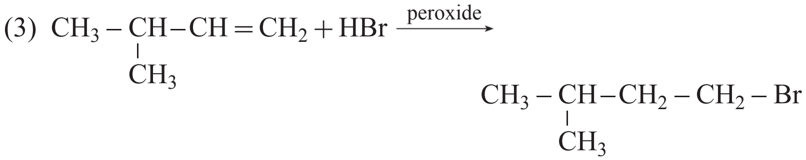
$$CH_3-\underset{\substack{|\\CH_3}}{CH}-CH_2Cl+NaI\xrightarrow{\text{acetone}}CH_3-\underset{\substack{|\\CH_3}}{CH}-CH_2I+NaCl$$

1-Iodo-2-methyl propane

(2) $CH_3-CH_2Br+SbF_3\longrightarrow F_2-\overset{1}{CH}-\overset{2}{CH_2}-Br$

1,1-difluoro-2-bromoethane

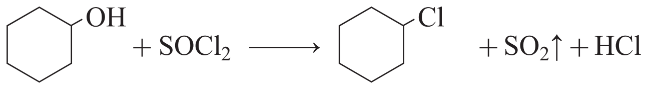
(3)



$$CH_3-\underset{\substack{|\\CH_3}}{CH}-CH=CH_2+HBr\xrightarrow{\text{peroxide}}CH_3-\underset{\substack{|\\CH_3}}{CH}-CH_2-CH_2-Br$$

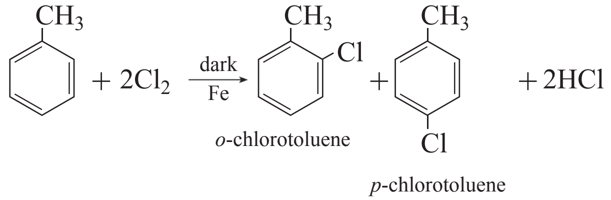
1-Bromo-3-methyl butane

(4)



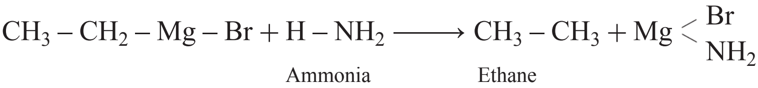
Chlorocyclohexane

(5)



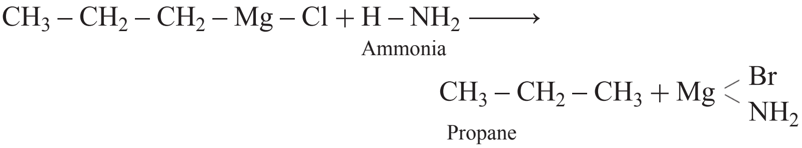
Q. 8. Describe the action of ammonia on (1) ethyl magnesium bromide (2) *n*-propyl magnesium chloride.

Ans. (1) Ethyl magnesium bromide : When ethyl magnesium bromide is treated with ammonia, ethane is formed.



$$\underset{}{CH_3-CH_2-Mg-Br}+\underset{\text{Ammonia}}{H-NH_2}\longrightarrow\underset{\text{Ethane}}{CH_3-CH_3}+Mg\begin{matrix}Br\\NH_2\end{matrix}$$

(2) *n*-Propyl magnesium chloride : When *n*-propyl magnesium chloride is treated with ammonia, propane is formed.



$$CH_3-CH_2-CH_2-Mg-Cl+\underset{\text{Ammonia}}{H-NH_2}\longrightarrow$$

$$\underset{\text{Propane}}{CH_3-CH_2-CH_3}+Mg\begin{matrix}Br\\NH_2\end{matrix}$$

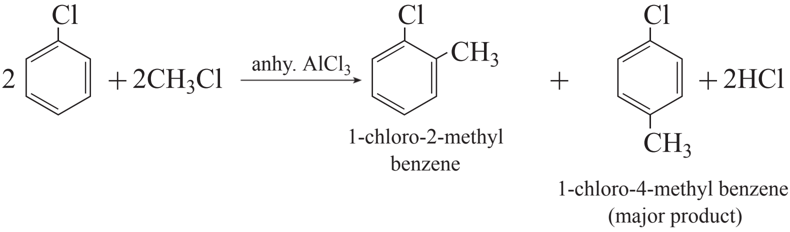
Q. 9. Describe the action of the following on chlorobenzene :

(1) Methyl chloride in the presence of anhydrous $AlCl_3$. ***(Sept. ’21)***

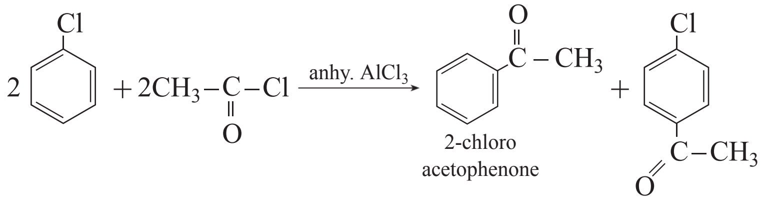
(2) Acetyl chloride in the presence of anhydrous $AlCl_3$.

(3) Fuming H_2SO_4. ***(Sept. ’21)***

Ans. (1) Methyl chloride in the presence of anhydrous $AlCl_3$: When chlorobenzene is treated with methyl chloride in the presence of anhydrous $AlCl_3$, a mixture of 1-chloro-4-methyl benzene (major product) and 1-chloro-2-methyl benzene is formed. Since, the alkyl group is introduced in the benzene ring, the reaction is termed as Friedel Crafts alkylation.



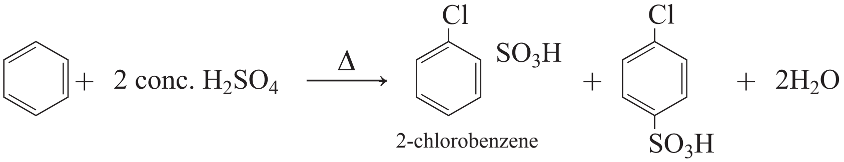
(2) Acetyl chloride in the presence of anhydrous $AlCl_3$: When chlorobenzene is reacted with acetyl chloride in the presence of anhydrous $AlCl_3$, a mixture of 2-chloro acetophenone and 4-chloro acetophenone (major product) is formed. Since the acetyl group is introduced in the benzene ring, the reaction is termed as Friedel Crafts acylation.



2-chloro acetophenone

4-chloro acetophenone (major product)

(3) Fuming sulphuric acid : When chlorobenzene is heated with fuming H_2SO_4, a mixture of 4-chlorobenzene sulphonic acid (major product) and 2-chlorobenzene sulphonic acid is formed.



2-chlorobenzene sulphonic acid

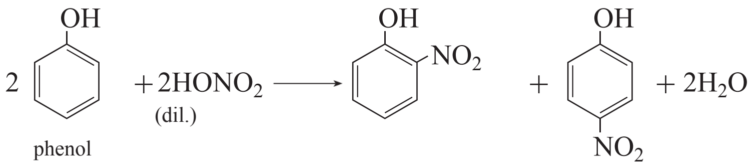
4-chlorobenzene sulphonic acid

Chapter 11. Alcohols, Phenols and Ethers

Q. 10. Explain the action of the following on phenol (carbolic acid) :

(1) Dilute nitric acid (2) Conc. H_2SO_4 at room temperature (3) Conc. H_2SO_4 at 373 K.

Ans. (1) Dilute nitric acid : When phenol is treated with dilute nitric acid, a mixture of *o*-nitrophenol and *p*-nitrophenol (major) is formed. In this reaction, *p*-nitrophenol is formed as the major product.

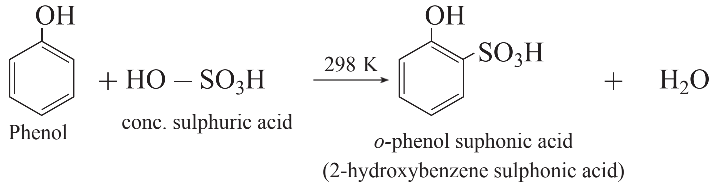


phenol

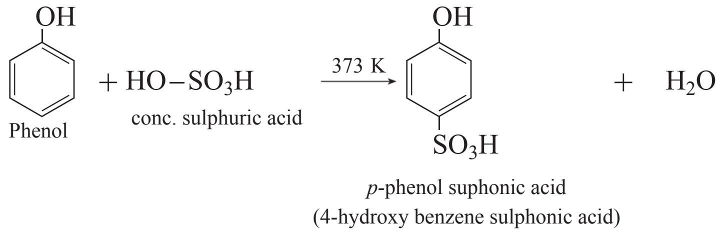
o-nitrophenol

o-nitrophenol (major)

(2) Conc. H_2SO_4 at room temperature : When phenol is treated with conc. H_2SO_4 at room temperature (about 300 K), *o*-phenol sulphonic acid is formed.



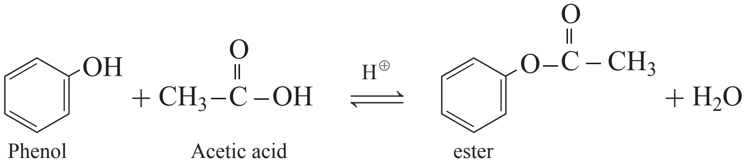
(3) Conc. H_2SO_4 at 373 K : When phenol is treated with conc. H_2SO_4 at about 373 K, *p*-phenol sulphonic acid is formed.



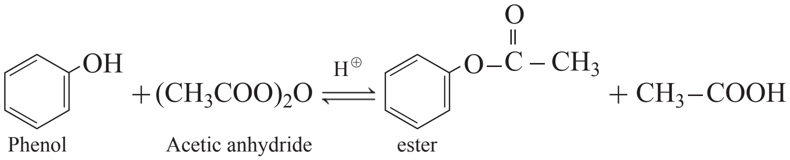
Q. 11. Explain the action of the following phenol :

(1) Acetic acid (2) Acetic anhydride (3) Acetyl chloride.

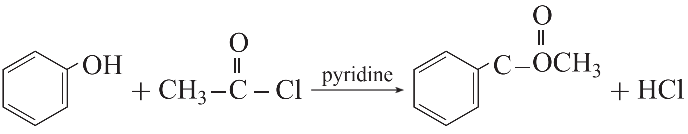
Ans. (1) Acetic acid : When phenol is treated with acetic acid in the presence of conc. sulphuric acid, ester is formed.



(2) Acetic anhydride : When phenol is treated with acetic anhydride in the presence of conc. sulphuric acid, ester is formed.



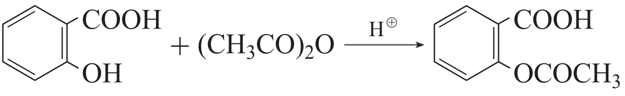
(3) Acetyl chloride : When phenol is treated with acetyl chloride in the presence of conc. sulphuric acid, ester is formed.



(Pyridine neutralizes HCl formed during reaction.)

Q. 12. What is the action of acetic anhydride on salicylic acid ?

Ans. When acetic anhydride is treated with salicylic acid in presence of glacial acetic acid, acetyl salicylic acid (aspirin) is obtained.



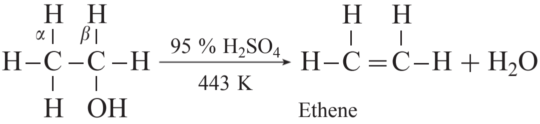
Aspirin is a common analgesic, antipyretic drug.

Q. 13. What is dehydration of alcohols ? Give the chemical reactions showing dehydration of primary (1°), secondary (2°) and tertiary (3°) alcohols.

Ans. Removal of water from an alcohol is called dehydration of alcohol. Alcohols having a β-hydrogen is heated with dehydrating agents like concentrated H_2SO_4 (or H_3PO_4 or P_2O_5 or Al_2O_3). The ease of dehydration of alcohols is in the following order :

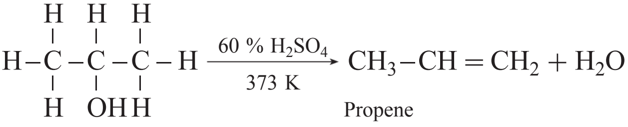
tert-alcohol (3°) $>$ secondary (2°) $>$ primary (1°)

(1) Primary (1°) alcohol is dehydrated by heating it with 95% H_2SO_4 at 443 K.

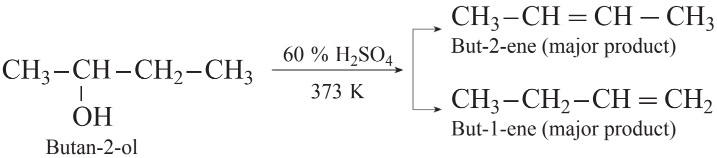


$$\underset{\text{Ethanol}}{H-\overset{\overset{H}{\alpha|}}{\underset{\underset{H}{|}}{C}}-\overset{\overset{H}{\beta|}}{\underset{\underset{OH}{|}}{C}}-H} \xrightarrow[443\ K]{95\ \%\ H_2SO_4} \underset{\text{Ethene}}{H-\overset{\overset{H}{|}}{C}=\overset{\overset{H}{|}}{C}-H} + H_2O$$

(2) Secondary alcohol (2°) is dehydrated by heating with 60 % H_2SO_4 at 373 K.

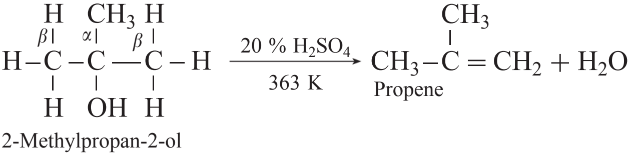


$$\underset{\text{Propan-2-ol}}{H-\overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}}-\overset{\overset{H}{|}}{\underset{\underset{OH}{|}}{C}}-\overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}}-H} \xrightarrow[373\ K]{60\ \%\ H_2SO_4} \underset{\text{Propene}}{CH_3-CH=CH_2} + H_2O$$



$$CH_3-\underset{\substack{|\\ OH}}{CH}-CH_2-CH_3 \xrightarrow[373\ K]{60\ \%\ H_2SO_4} \begin{cases} CH_3-CH=CH-CH_3 \\ CH_3-CH_2-CH=CH_2 \end{cases}$$

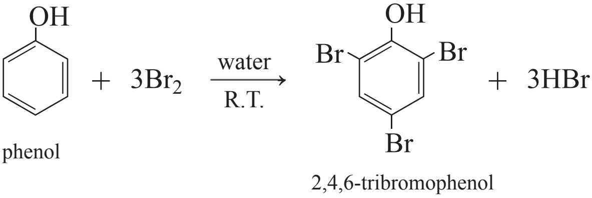
(3) A tertiary alcohol can be easily dehydrated by heating with 20 % H_2SO_4 at 363 K.



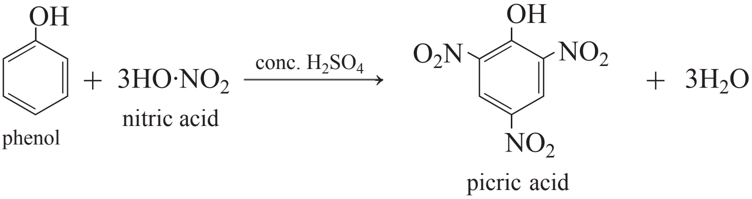
$$H-\underset{\substack{|\\ H}}{\overset{\substack{H\\ \beta|}}{C}}-\underset{\substack{|\\ OH}}{\overset{\substack{CH_3\\ \alpha|}}{C}}-\underset{\substack{|\\ H}}{\overset{\substack{H\\ \beta|}}{C}}-H \xrightarrow[363\ K]{20\ \%\ H_2SO_4} CH_3-\overset{\substack{CH_3\\ |}}{C}=CH_2+H_2O$$

Q. 14. Write balanced chemical reactions of the following reagents on carbolic acid : (i) Br_2 water (ii) conc. HNO_3. ***(July '22)***

Ans. (i) Br_2 water :



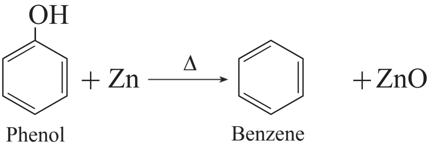
(ii) conc. HNO_3 :



Q. 15. Explain the action of zinc dust on phenol. *OR*

How is phenol converted into benzene ?

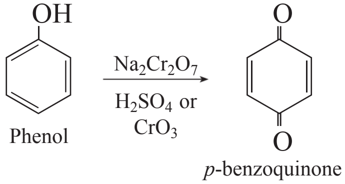
Ans. When phenol is heated with zinc dust, benzene is obtained.



Q. 16. Explain the action of chromic acid on phenol. *OR*

How is phenol converted into benzoquinone ?

Ans. When phenol is oxidized by chromic acid, a diketone, *p*-benzoquinone is formed. It is a conjugated diketone.



Q. 17. Describe the action of hydroiodic acid on the following :

(1) Diethyl ether (2) Methyl phenyl ether.

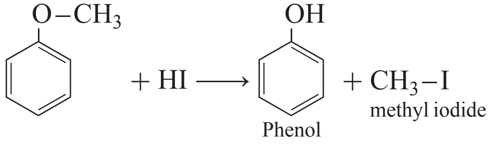
Ans. (1) Diethyl ether (ethoxy ethane) : When diethyl ether (ethoxy ethane) is treated with hydroiodic acid, a mixture of ethanol and ethyl iodide is formed.

$$\underset{\text{diethyl ether}}{C_2H_5{-}O{-}C_2H_5} + HI \longrightarrow \underset{\text{Ethanol}}{C_2H_5{-}OH} + \underset{\text{ethyl iodide}}{C_2H_5{-}I}$$

If excess of hydroiodic acid is available, then ethyl alcohol further reacts with hydroiodic acid at higher temperature to form ethyl iodide and water.

$$\underset{\text{Ethanol}}{C_2H_5{-}OH} + HI \longrightarrow \underset{\text{ethyl iodide}}{C_2H_5I} + H_2O$$

(2) Methyl phenyl ether (anisole) : When methyl phenyl ether (anisole) is treated with hydroiodic acid, phenol and methyl iodide is formed. Here, phenol does not react further with HI because $-OH$ group is attached to sp^2-hybridized carbon atom and it cannot be replaced by iodide (nucleophile).



Q. 18. Write chemical reactions of following reagents on methoxy ethane :

(i) Hot HI (ii) PCl_5 (iii) dilute H_2SO_4. ***(March '22)***

Ans. (i) Hot HI : When methoxy ethane is treated with Hot HI, ethyl iodide and methyl iodide is formed.

$$\underset{\text{methoxy ethane}}{C_2H_5-O-CH_3} + 2HI \xrightarrow{\text{hot}} \underset{\substack{\text{ethyl}\\\text{iodide}}}{C_2H_5I} + \underset{\substack{\text{methyl}\\\text{iodide}}}{CH_3I} + H_2O$$

(ii) PCl_5 : When methoxy ethane is heated with PCl_5 a mixture of ethyl chloride and methyl chloride is formed.

$$CH_3 - O - C_2H_5 + PCl_5 \xrightarrow{\Delta} \underset{\substack{\text{methyl}\\ \text{chloride}}}{CH_3Cl} + \underset{\substack{\text{ethyl}\\ \text{chloride}}}{C_2H_5Cl} + POCl_3$$

(iii) Dilute H_2SO_4 : Methoxy ethane on hydrolysis give a mixture of ethanol and methanol.

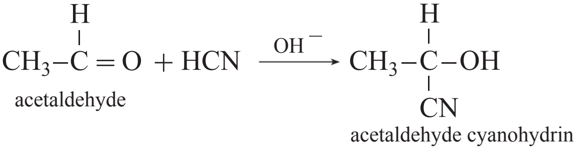
$$CH_3 - O - C_2H_5 + H_2O \xrightarrow[\substack{\Delta,\ \text{under}\\ \text{pressure}}]{\text{dil. } H_2SO_4} CH_3 - OH + C_2H_5 - OH$$

Chapter 12. Aldehydes, Ketones and Carboxylic Acids

Q. 19. What is the action of hydrogen cyanide on the following :

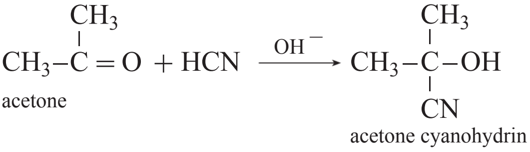
(1) Acetaldehyde (2) Acetone ?

Ans. (1) Action of HCN on acetaldehyde : When acetaldehyde is treated with hydrogen cyanide, acetaldehyde cyanohydrin is formed.



$$\underset{\text{acetaldehyde}}{CH_3-\overset{\overset{\displaystyle H}{|}}{C}=O} + HCN \xrightarrow{OH^-} \underset{\text{acetaldehyde cyanohydrin}}{CH_3-\underset{\underset{\displaystyle CN}{|}}{\overset{\overset{\displaystyle H}{|}}{C}}-OH}$$

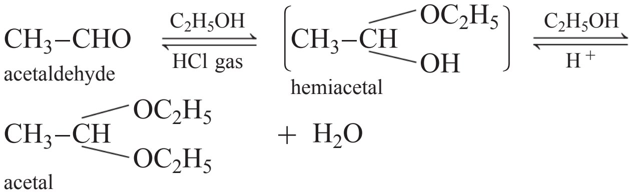
(2) Action of HCN on acetone : When acetone is treated with hydrogen cyanide, acetone cyanohydrin is formed.

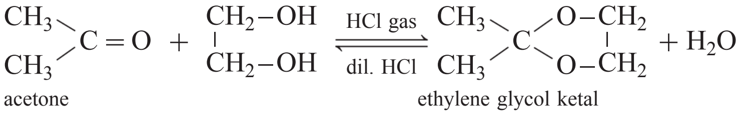


$$\underset{\text{acetone}}{CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}=O} + HCN \xrightarrow{OH^-} \underset{\text{acetone cyanohydrin}}{CH_3-\underset{\underset{\displaystyle CN}{|}}{\overset{\overset{\displaystyle CH_3}{|}}{C}}-OH}$$

Q. 20. What is the action of ethanol on acetaldehyde ? What is the action of ethylene glycol on acetone ?

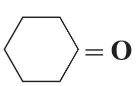
Ans. Aldehyde reacts with one equivalent of monohydric alcohol in the presence of dry hydrogen chloride to form an intermediate known as hemiacetal, which further adds another molecule of alcohol to form a gem-dialkoxy compound known as acetal. Ketone reacts with ethylene glycol under similar conditions to form cyclic products known as ethylene glycol ketals.



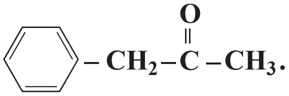


Q. 21. Write the structure of the products obtained from the following ketones by action of hydrazine in the presence of (1) slightly acidic medium (2) strong base KOH.

(a)

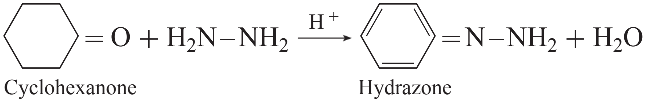


(b)

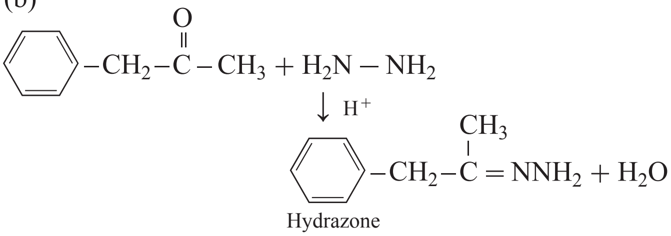


Ans. (1) In slightly acidic medium :

(a)

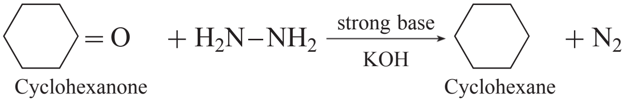


(b)

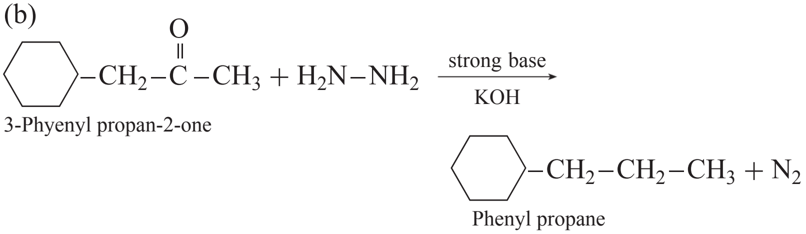


(2) In the presence of strong base KOH :

(a)

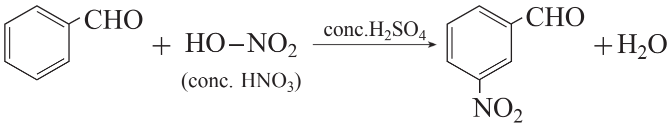


(b)



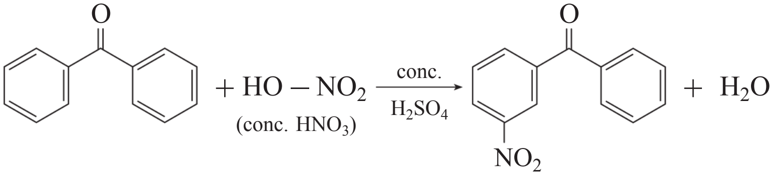
Q. 22. What is the action of concentrated nitric acid on (1) Benzaldehyde (2) Benzophenone ?

Ans. (1) Benzaldehyde on reaction with concentrated nitric acid in the presence of conc. H_2SO_4 forms *m*-nitrobenzaldehyde.



m-nitrobenzaldehyde

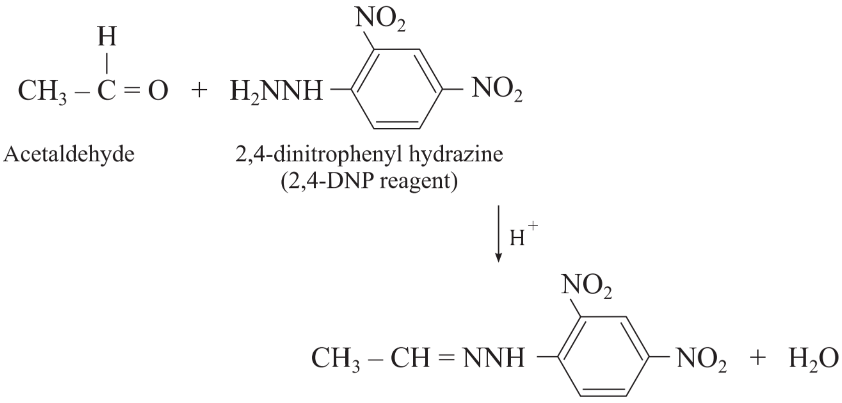
(2) Benzophenone on reaction with concentrated nitric acid in the presence of conc. H_2SO_4 forms *m*-nitrobenzophenone.



m-nitrobenzophenone

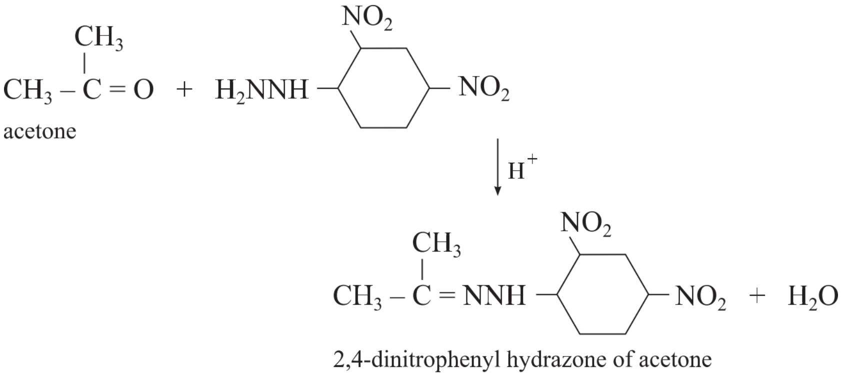
Q. 23. What is the action of 2,4-dinitrophenyl hydrazine on (1) acetaldehyde (2) acetone ?

Ans. (1) Acetaldehyde on reaction with 2,4-dinitrophenyl hydrazine forms 2,4-dinitrophenyl hydrazone.



2,4-dinitrophenyl hydrazone of acetaldehyde

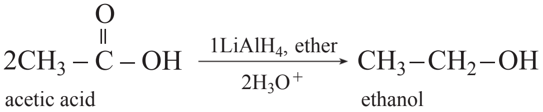
(2) Acetone on reaction with 2,4-dinitrophenyl hydrazine forms 2,4-dinitrophenyl hydrazone.



Q. 24. Explain the action of the following on acetic acid :

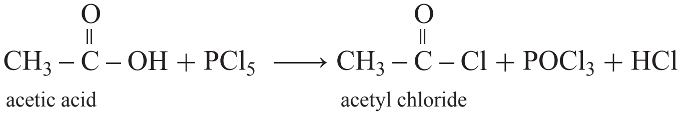
(1) $LiAlH_4/H_3O^+$ (2) PCl_5 (3) NH_3.

Ans. (1) Action of $LiAlH_4/H_3O^+$ on acetic acid : Acetic acid is reduced in the presence of $LiAlH_4$ in dry ether, forms ethanol.



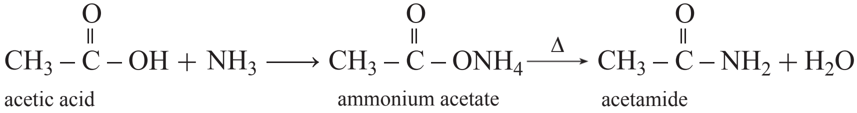
$$\underset{\text{acetic acid}}{2CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-OH} \xrightarrow[2H_3O^+]{1LiAlH_4,\ \text{ether}} \underset{\text{ethanol}}{CH_3-CH_2-OH}$$

(2) Action of PCl_5 : Acetic acid reacts with phosphorus pentachloride to give acetyl chloride.



$$\underset{\text{acetic acid}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-OH} + PCl_5 \longrightarrow \underset{\text{acetyl chloride}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-Cl} + POCl_3 + HCl$$

(3) Action of NH_3 : Acetic acid reacts with ammonia to give ammonium acetate, which on further strong heating at high temperature decompose to give amides.



$$\underset{\text{acetic acid}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-OH} + NH_3 \longrightarrow \underset{\text{ammonium acetate}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-ONH_4} \xrightarrow{\Delta} \underset{\text{acetamide}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2} + H_2O$$

Chapter 13. Amines

Q. 25. What is the action of acetyl chloride on :

(1) ethylamine (ethanamine)

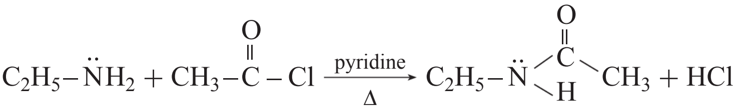
(2) diethylamine (N-ethylethanamine)

(3) triethyl amine? *OR*

Write a short note on acylation of amines.

Ans. The reaction of amines with acetyl chloride is called acetylation of amines.

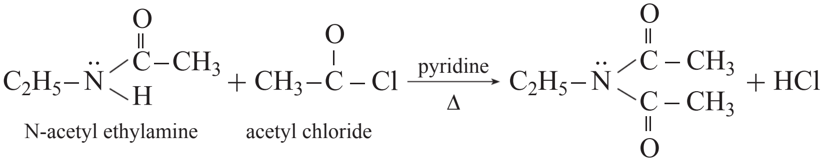
(1) Acetyl chloride on reaction with **ethyl amine** forms monoacetyl derivative, N-ethyl acetamide (or N-acetyl ethylamine)



$$C_2H_5-\ddot{N}H_2 + CH_3-\overset{\overset{O}{\|}}{C}-Cl \xrightarrow[\Delta]{\text{pyridine}} C_2H_5-\ddot{N}\begin{matrix}\diagup\overset{\overset{O}{\|}}{C}\diagdown CH_3\\ \diagdown H\end{matrix} + HCl$$

ethylamine acetyl chloride N-ethyl acetamide (N-acetyl ethylamine)

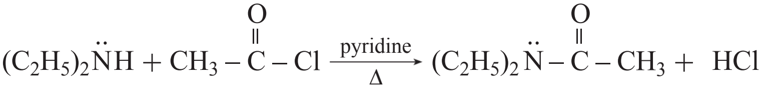
with the excess of acetyl chloride it forms diacetyl derivative.



$$C_2H_5-\ddot{N}\begin{matrix}\diagup\overset{\overset{O}{\|}}{C}-CH_3\\ \diagdown H\end{matrix} + CH_3-\overset{\overset{O}{|}}{C}-Cl \xrightarrow[\Delta]{\text{pyridine}} C_2H_5-\ddot{N}\begin{matrix}\diagup\overset{\overset{O}{\|}}{C}-CH_3\\ \diagdown\underset{\underset{O}{\|}}{C}-CH_3\end{matrix} + HCl$$

N-acetyl ethylamine acetyl chloride N, N-diacetyl ethylamine

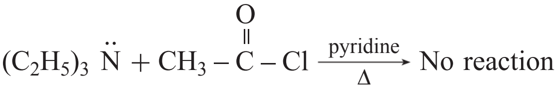
(2) Diethyl amine on reaction with acetyl chloride forms N-acetyl diethylamine.



$$(C_2H_5)_2\ddot{N}H + CH_3-\overset{\overset{O}{\|}}{C}-Cl \xrightarrow[\Delta]{\text{pyridine}} (C_2H_5)_2\ddot{N}-\overset{\overset{O}{\|}}{C}-CH_3 + HCl$$

diethylamine N-acetyl diethylamine

(3) Triethyl amine, being a tertiary amine, does not have H atom attached to nitrogen of amine, hence it does not react with acetyl chloride.



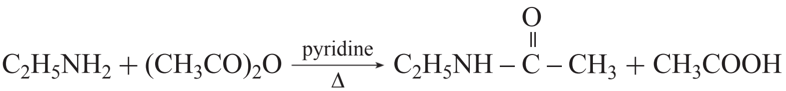
$$(C_2H_5)_3\ \ddot{N} + CH_3-\overset{\overset{O}{\|}}{C}-Cl \xrightarrow[\Delta]{\text{pyridine}} \text{No reaction}$$

triethyl amine

Q. 26. What is the action of acetic anhydride on

(a) ethylamine (b) diethylamine?

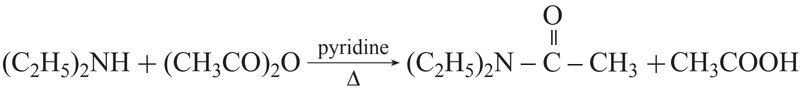
Ans. (a) Acetic anhydride on reaction with ethyl amine forms monoacetyl derivative N-ethyl acetamide.



$$C_2H_5NH_2 + (CH_3CO)_2O \xrightarrow[\Delta]{\text{pyridine}} C_2H_5NH-\overset{\overset{O}{\|}}{C}-CH_3 + CH_3COOH$$

ethylamine acetic anhydride N-ethyl acetamide

(b) Acetic anhydride on reaction with diethylamine forms N-acetyl diethylamine.

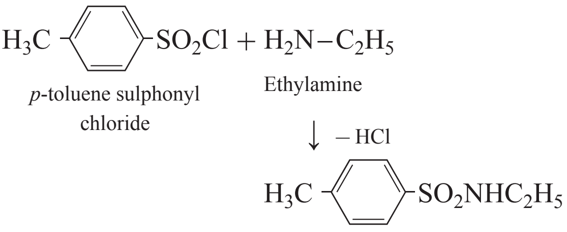


$$(C_2H_5)_2NH + (CH_3CO)_2O \xrightarrow[\Delta]{\text{pyridine}} (C_2H_5)_2N - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 + CH_3COOH$$

N-acetyl diethylamine

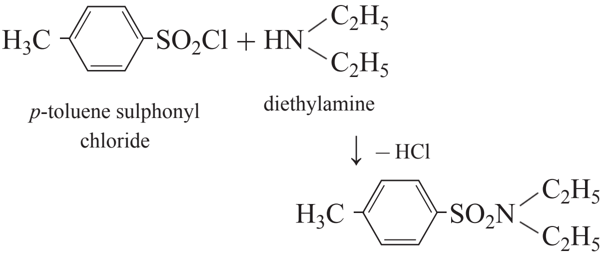
Q. 27. What is the action of *p*-toluene sulphonyl chloride on ethyl amine and diethyl amine ?

Ans. (1) When ethyl amine is treated with *p*-toluene sulphonyl chloride, N-ethyl *p*-toluene sulphonamide is obtained.



N-ethyl *p*-toluene sulphonamide

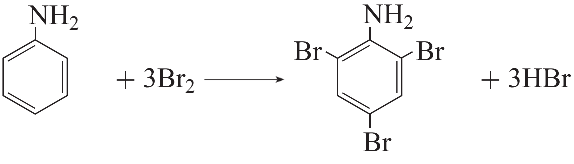
(2) When diethylamine is treated with *p*-toluene sulphonyl chloride, N,N-diethyl *p*-toluene sulphonyl amide is formed.



N,N-diethyl *p*-toluene sulphonyl amide

Q. 28. What is the action of aqueous bromine on aniline ?

Ans. Action of aqueous bromine on aniline : When aniline is treated with bromine water at room temperature, a white precipitate of 2,4,6-tribromoaniline is obtained.

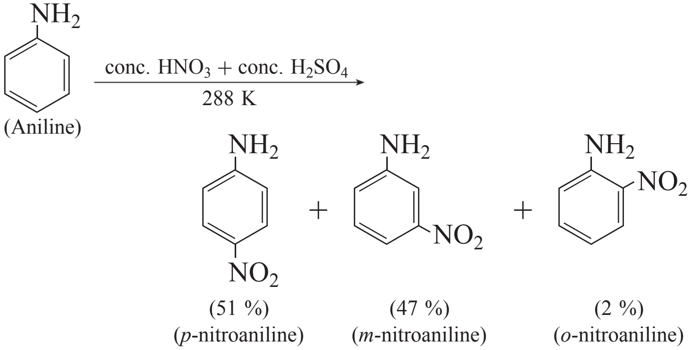


Aniline

2,4,6-Tribromoaniline

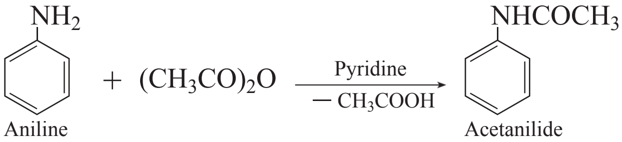
Q. 29. Explain the action of conc. nitric acid (nitrating mixture) on aniline.

Ans. When aniline is warmed with a mixture of conc. nitric acid and conc. sulphuric acid (a nitrating mixture), a mixture of ortho, meta and para nitroaniline is obtained.



Q. 30. What is the action of acetic anhydride on aniline ?

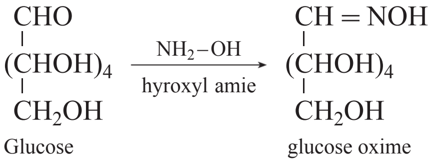
Ans. When aniline is heated with acetic anhydride, an acetanilide is obtained.



Chapter 14. Biomolecules

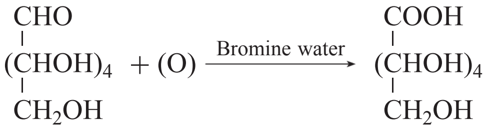
Q. 31. Describe the action of following reagents on glucose : (1) Hydroxyl amine (2) Bromine water (3) Dil. Nitric acid (4) Acetic anhydride.

Ans. (1) Action of hydroxyl amine : Glucose reacts with hydroxyl amine in an aqueous solution to form glucose oxime.



$$\begin{array}{l} \text{CHO} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \\ \text{Glucose} \end{array} \xrightarrow[\text{hyroxyl amie}]{\text{NH}_2-\text{OH}} \begin{array}{l} \text{CH}=\text{NOH} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \\ \text{glucose oxime} \end{array}$$

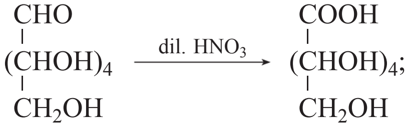
(2) Action of bromine water : Glucose on oxidation with mild oxidising agent like bromine water gives gluconic acid, which shows that the carbonyl group in glucose is aldehyde group.



$$\begin{array}{c} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} + (O) \xrightarrow{\text{Bromine water}} \begin{array}{c} COOH \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array}$$

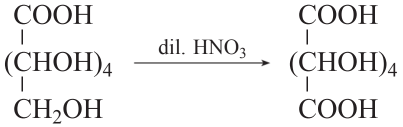
Glucose Gluconic acid

(3) Action of dil. nitric acid : Glucose on oxidation with dilute nitric acid forms dicarboxylic acid, saccharic acid. This indicates the presence of a primary alcoholic group ($-CH_2OH$) in glucose.



$$\begin{array}{c} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} \xrightarrow{\text{dil. } HNO_3} \begin{array}{c} COOH \\ | \\ (CHOH)_4; \\ | \\ CH_2OH \end{array}$$

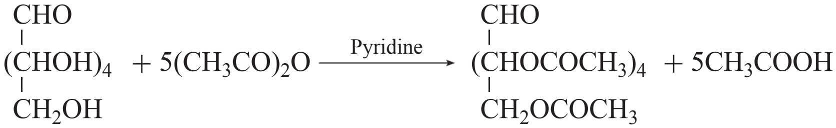
Glucose Saccharic acid



$$\begin{array}{c} COOH \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} \xrightarrow{\text{dil. } HNO_3} \begin{array}{c} COOH \\ | \\ (CHOH)_4 \\ | \\ COOH \end{array}$$

Gluconic acid Saccharic acid

(4) Action of acetic anhydride : When glucose is heated with acetic anhydride in the presence of catalyst pyridine, glucose penta acetate is formed. It indicates that glucose is a stable compound and contains five hydroxyl groups.



$$\begin{array}{c} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} + 5(CH_3CO)_2O \xrightarrow{\text{Pyridine}} \begin{array}{c} CHO \\ | \\ (CHOCOCH_3)_4 \\ | \\ CH_2OCOCH_3 \end{array} + 5CH_3COOH$$

Glucose Glucose penta acetate