## ALDEHYDES, KETONES AND CARRBOXYLIC ACIDS CARBOXYLIC ACID

## **GENERAL METHOD OF PREPARATION**

By oxidation of primary alcohol with acidic  $KMnO_4$  or acidic  $K_2Cr_2O_7$ 

$$R-CH_2OH + [0] \xrightarrow{KMnO_4/H^-}_{K_2Cr_2O_7/H^-} RCHO + H_2O \xrightarrow{[0]} RCOOH$$

## By oxidation of aldehydes

When aldehydes are subjected to oxidation using common oxidizing agents, they form carboxylic acids with an equivalent number of carbon atoms as the original aldehyde.

$$R-CHO + [0] \xrightarrow{\text{Tollen's Reagent}} R-COO^{-} \xrightarrow{H^{\oplus}} R-COOH$$

$$C_{6}H_{5}CHO + [0] \xrightarrow{\text{Tollen's Reagent}} C_{6}H_{5}COO^{1} \xrightarrow{H^{\oplus}} C_{6}H_{5}COOH$$

By oxidation of alkenes:

(a) RCH = CHR' 
$$\frac{(i) \operatorname{conc.KMnO_4/OH^{\Theta} heat}}{(ii)H_3O^{\oplus}}$$
 RCOOH + R'COOH  
(b) RCH = CHR'  $\frac{(i) O_3}{(ii)H_2\text{Distill}}$  RCOOH + R'COOH

By Carboxylation of Grignard Reagent:

$$R - Br \xrightarrow{Mg}_{dry \text{ ether}} RMgBr \xrightarrow{CO_2} R - C - OMgBr \xrightarrow{H_2O/H^+} R - C - OH$$

By hydrolysis of acyl derivatives of carboxylic acid:

$$\begin{array}{c} 0 \\ \parallel \\ R - C - Cl + H_2O \xrightarrow{H^{\oplus}} R - COOH + HCl \\ (R - CO)_2O + H_2O \xrightarrow{H^{\oplus}} R - COOH + R - \overset{O}{C} - OH \\ R - COOR' + H_2O \xrightarrow{H^{\oplus}} R - COOH + ROH \end{array}$$

## Chemistry

Class-12<sup>th</sup>

$$\begin{array}{c} 0 \\ \parallel \\ R - C - NH_2 + H_2 O \xrightarrow{H^{\oplus}} R - COOH + NH_4^{\oplus} \end{array}$$

Cyanide hydrolysis with dilute acids

 $R - CN \xrightarrow{H_3 O^{\oplus}} RCOOH$ 

The mechanism of hydrolysis of R-CN is as follows.



By oxidation of alkyl benzene



Alkyl groups lacking  $\alpha$ -hydrogen atoms will not undergo oxidation to form carboxylic acids (-COOH), whereas any alkyl group that contains at least one  $\alpha$ -hydrogen atom will undergo oxidation to yield benzoic acid as the final product.





The sequence in which benzoic acid is produced through the oxidation of alkylbenzenes.

Methyl benzene  $>1^{\circ}$  alkyl benzene  $>2^{\circ}$  alkyl benzene