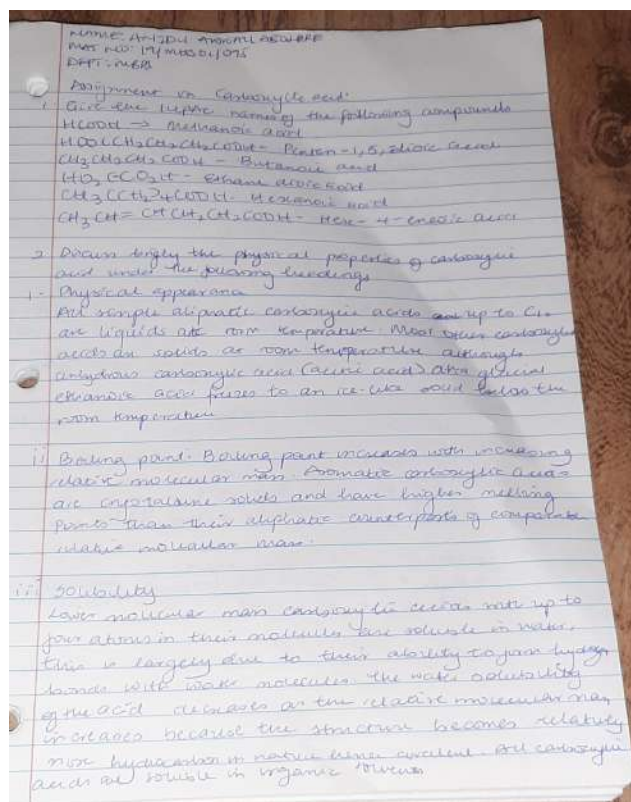


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Assignment on Carboxylic acids



3. Write two industrial preparations of carboxylic acids

- From carbon (C) or coke  
 Fumaric acid (fumaric acid) is manufactured by adding carbon (C) or coke under pressure to hot aqueous solution of calcium hydroxide. The free carboxylic acid is liberated by calcium reaction with acetic acid.  

$$CO \xrightarrow{NaOH} HCOONa \xrightarrow{H_2SO_4} HCOOH + Na_2SO_4$$
- From ethanal  
 Ethanoic acid is obtained by the liquid phase oxidation of 5% solution of ethanal to ethanoic acid using manganese (II) ethanoate catalyst. Ethanoic acid is obtained upon distillation.  

$$HC \equiv CH \xrightarrow{O_2, Mn(CH_3COO)_2, CH_3COOH} CH_3COOH$$

4. Write equations briefly explain the synthetic preparation of carboxylic acid

- Oxidation of primary alcohols and aldehydes  
 It can be prepared by using the usual oxidizing agents ( $K_2Cr_2O_7$  or  $KMnO_4$ ) in acidic solution.  

$$RCH_2OH \xrightarrow{[O]} RCHO \xrightarrow{[O]} RCOOH$$
- Carboxylation of Grignard reagent  

$$RMgBr + CO_2 \xrightarrow{H^+} RCOOH$$
  

$$\rightarrow RCOOH + MgBrOH$$
  
 R may be  $1^\circ, 2^\circ, 3^\circ$  or aliphatic allylic, propionic.

3. Hydrolysis of nitriles (cyanides) or esters  

$$RCN + 2H_2O \xrightarrow{H^+} RCOOH + NH_4^+$$
  
 R = alkyl or aryl groups  

$$RCOOR' \xrightarrow{H^+/H^+} RCOOH + R'OH$$
  

$$C_6H_5CO_2C_2H_5 + 2H_2O \xrightarrow{H^+} C_6H_5COOH + C_2H_5OH$$
  

$$CH_3CO_2C_2H_5 \xrightarrow{H^+/H^+} CH_3COOH + C_2H_5OH$$

5. Write chemical equation only oxidative reduction, decarboxylation and esterification of carboxylic acid

- Reduction  

$$4RCOOH + 3LiAlH_4 \xrightarrow{H^+} 4RCH_2OH + AlCl_3$$
  

$$+ 24H_2O + 4H_2 \xrightarrow{H^+} 4RCH_2OH + AlCl_3 + 24H_2O$$
- Decarboxylation  

$$CH_3CH_2CH_2COOH + NaOH \xrightarrow{heat} CH_3CH_2CH_3 + Na_2CO_3$$
- Esterification  

$$CH_3CO_2CH_3 + CH_3CH_2CH_2OH \xrightarrow{H^+} CH_3CO_2CH_2CH_2CH_3 + H_2O$$