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Course: CHM 102

### Carbonylic Assignment

- 1 a  $\text{HCOOH} \rightarrow$  Methanoic acid
- b  $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  pentan-1,5-dioic acid
- c  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  Butanoic acid
- d  $\text{HO}_2\text{C}-\text{CO}_2\text{H} \rightarrow$  Ethanedioic acid
- e  $\text{CH}_3(\text{CH}_2)_4\text{COOH} \rightarrow$  Hexanoic acid
- f  $\text{CH}_3\text{C}(\text{H})=\text{CHCH}_2\text{CH}_2\text{COOH} \rightarrow$  Hex-4-enoic acid

### 2 Properties of Carbonylic acid

#### (i) Physical appearance

All simple Aliphatic acids upto  $\text{C}_{10}$  are liquids at room temperature. Most of the other carbonylic acids are solid at room temperature while aromatic carbonylic acid or acetic acid or glacial ethanoic acid freeze to an ice-like solid at room temperature.

#### (ii) Boiling points

Aromatic carbonylic acids are crystalline solids

and have higher melting points than all other compounds. Carboxylic acids' boiling point increases with relative molecular mass.

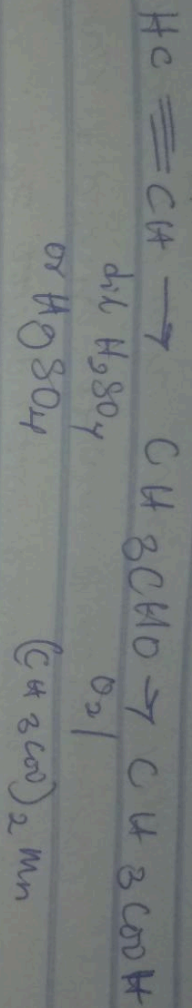
### (iii) Solubility

All carboxylic acids with low molecular mass with up to four carbon atoms are soluble in water, due to their ability to form hydrogen bonds with the water molecule. All carboxylic acids are soluble in organic solvents. The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature hence insoluble.

### 2 Industrial Preparation of Carboxylic acids

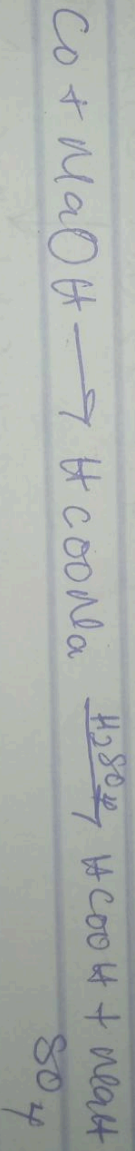
#### ① from Ethanol

Ethanoic acid is obtained commercially by the liquid phase air-oxidation of  $\text{C}_2\text{H}_5$  solution of ethanol to ethanoic acid using ~~the~~ manganese(II) acetate catalyst. Ethanol itself is obtained from ethylene.



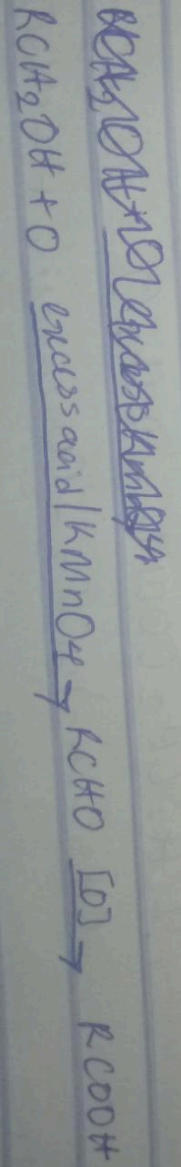
② From carbon(IV) oxide

Methanoic acid (formic acid) is manufactured by adding carbon(IV) oxide under pressure to hot aqueous solution of NaOH. The free carboxylic acid is liberated by the carbon reaction with potassium sulphate(VI) acid (K<sub>2</sub>SO<sub>4</sub>)



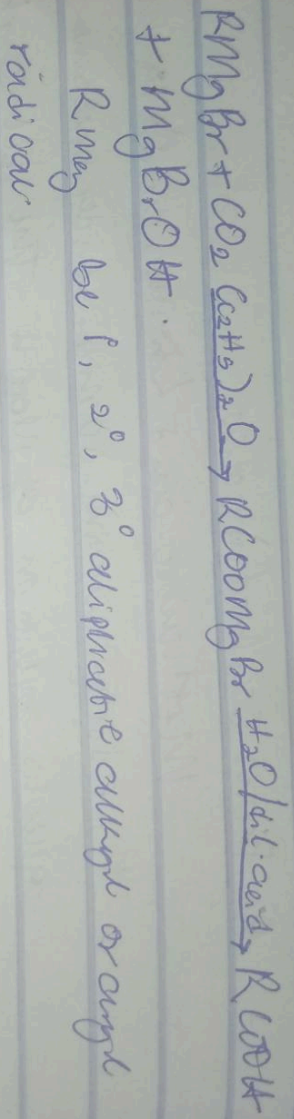
① Synthetic preparation of carboxylic acid

① Oxidation of primary alcohols and aldehydes by using the usual oxidising agents  
K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> or KMnO<sub>4</sub>

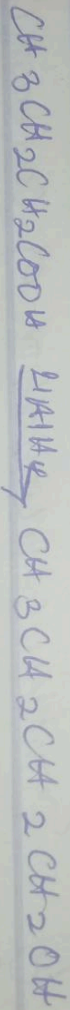
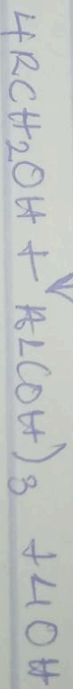


② Carbonation of Grignard reagent

Aliphatic carboxylic acids are obtained by heating carbon(<sup>2</sup>) oxide with the grignard reagent and then hydrolysed with dilute acid -



5 or reduction

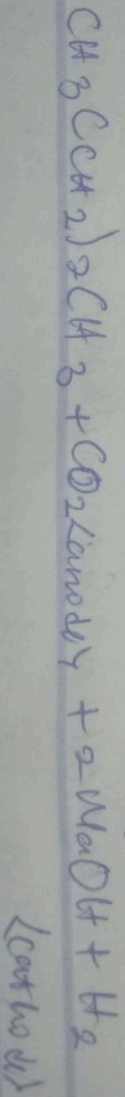
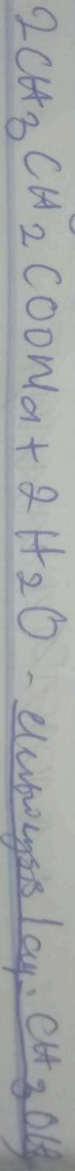


Butanoic acid

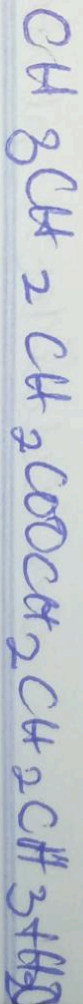
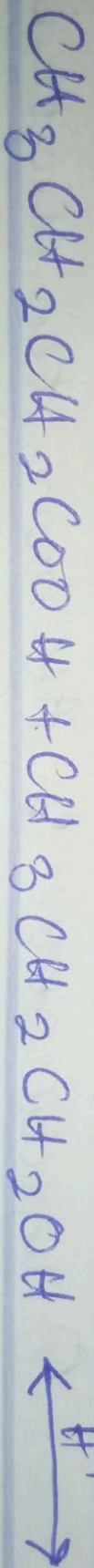
Butanol

b) Decarboxylation

Kolbe Synthesis



C Esterification



(propyl butanoate)