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DEPT: MBBS.  
MATRIC NUM: 19/MHS01/275.

### CHM 102 ASSIGNMENT

- 1)  $\Rightarrow$   $\text{HCOOH}$  - methanoic acid.  
 $\Rightarrow$   $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$  - pentan-1,5-dioic acid  
 $\Rightarrow$   $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$  - Butanoic acid  
 $\Rightarrow$   $\text{HO}_2\text{C}-\text{CO}_2\text{H}$  - Ethanedioic acid.  
 $\Rightarrow$   $\text{CH}_3(\text{CH}_2)_4\text{COOH}$  - Hexanoic acid.  
 $\Rightarrow$   $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$  - Hexan-4-enedioic acid.

2)  $\Rightarrow$  Physical appearance!

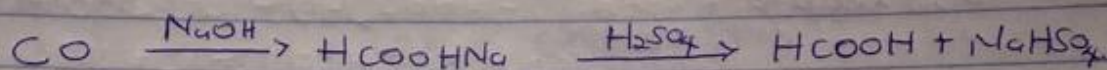
All simple aliphatic carboxylic acids ~~need~~ up to  $\text{C}_{10}$  are liquids in room temperature. Most other carboxylic acids are solid at room temperature although anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

$\Rightarrow$  Boiling point! Boiling point increases with increasing molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

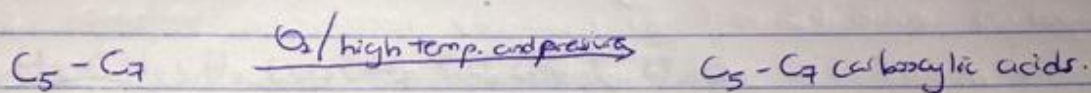
$\Rightarrow$  Solubility! Lower molecular mass carboxylic acids with up to four carbon atoms in their molecule are soluble in water; this largely due to their ability to form hydrogen bond with water molecules. The water solubility of acids ~~be~~ decreases as their relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

### 3. Industrial preparation of carboxylic acids.

⇒ From carbon(II) oxide: Methanoic acid (formic acid) is manufactured by adding carbon(II) oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction ~~of~~ with tetraoxosulphate (vi) acid ( $H_2SO_4$ ).

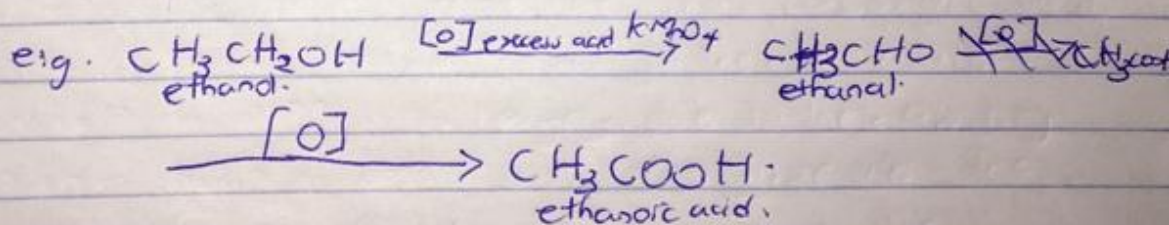
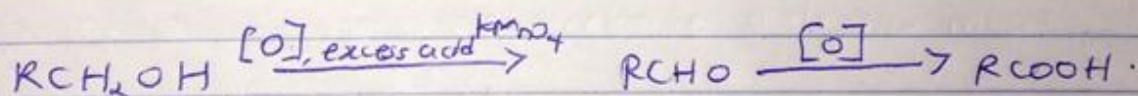


⇒ From petroleum: Liquid phase air oxidation of  $C_5-C_7$  alkanes, obtainable from petroleum at high temperature and pressure will give  $C_5-C_7$  carboxylic acids with methanoic, propanoic and ~~butanoic~~ butanedioic acids as by products.

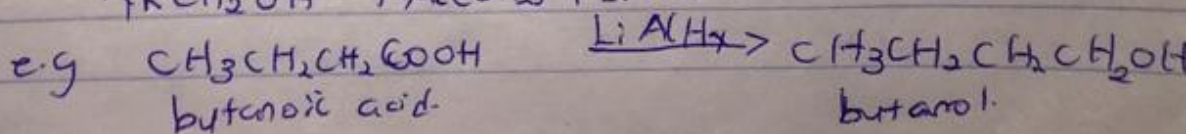
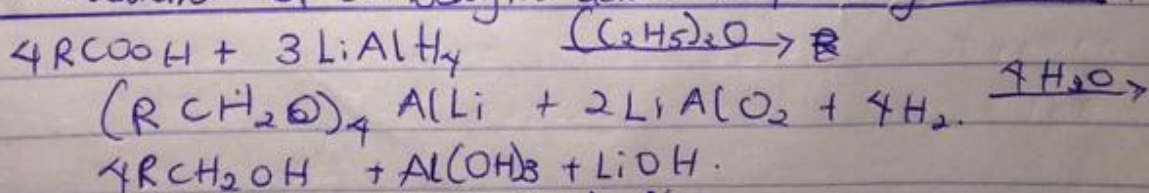


### 4. Synthetic preparation of carboxylic acids.

⇒ Oxidation of primary alcohols and aldehydes: Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidising agents i.e.  $K_2Cr_2O_7$  or  $KMnO_4$  in acidic solution.

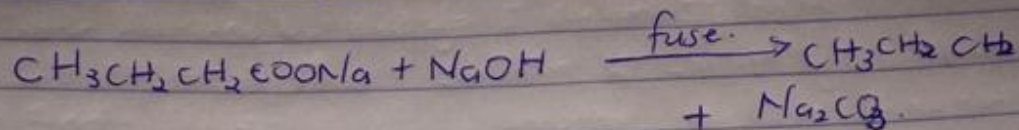


### 5. ⇒ Reduction of carboxylic acid to primary alcohol.

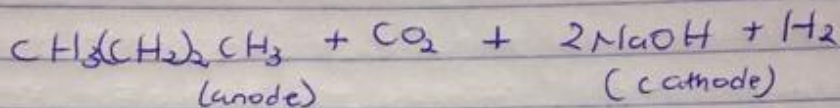
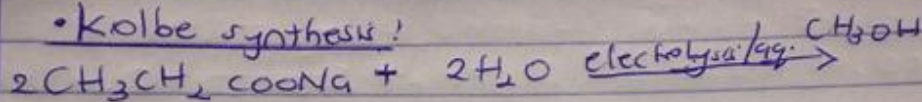


⇒ Decarboxylation of carboxylic acid.

• Thermal decarboxylation:



• Kolbe synthesis:



⇒ Esterification of carboxylic acid.

