

ME
TRIC
D: 19/ENG07/D16
PT: PETROLEUM ENGINEERING
URSE
DE: CH11D2

- Give the IUPAC names of the following compounds.
- HCOOH - Methanoic acid.
- $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - ~~Methanoic acid~~ Pentan-1,5-dioic acid
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid
- $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - Ethanedioic acid
- $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid
- $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enoic acid.

2. Discuss briefly the physical properties of carboxylic acid under the following headings.

i. Physical appearance: All simple aliphatic carboxylic acids up to C_6 are liquids at 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.

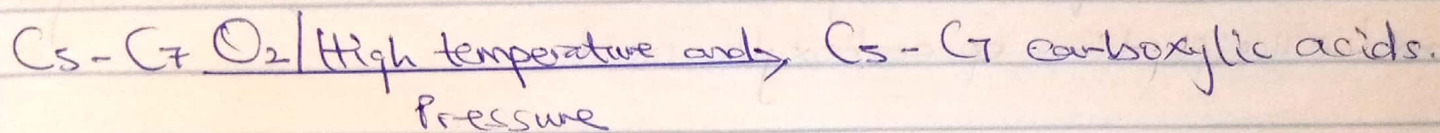
ii. Boiling point: It increases with increasing relative molecular mass. Aromatic carboxylic acid are crystalline solid and have higher melting point than their aliphatic counterparts of comparable relative molecular mass.

iii. Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases as the 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. Write two industrial preparations of carboxylic acids.

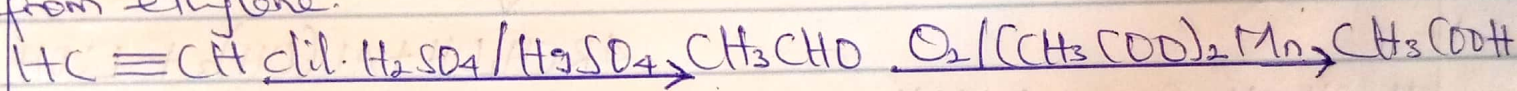
i. From Petroleum.

Liquid phase air oxidation of C₅-C₇ alkanes, obtainable from petroleum at high temperature and pressure will give C₅-C₇ carboxylic acids with methanoic, propanoic and butanedioic acid as by-products:



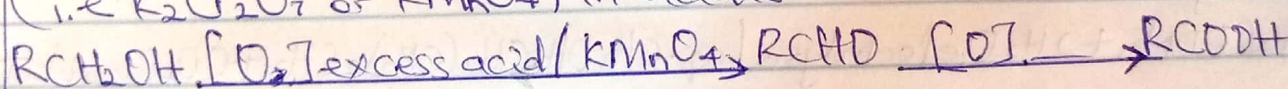
ii. From Ethanol:

Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanal to ethanoic acid using manganite (II) ethanoate catalyst. Ethanal itself is obtained from ethylene.



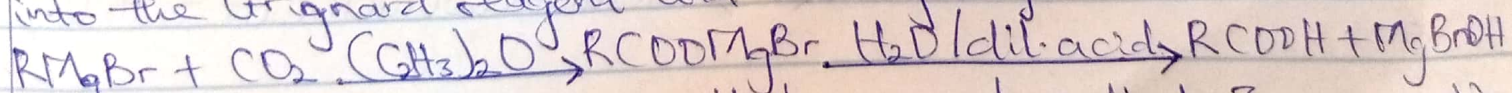
4. With equations and brief explanation discuss the synthetic preparation of carboxylic acid.

i. Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (i.e. K₂Cr₂O₇ or KMnO₄) in acidic solution.

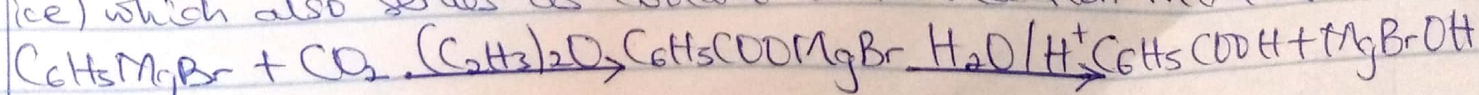


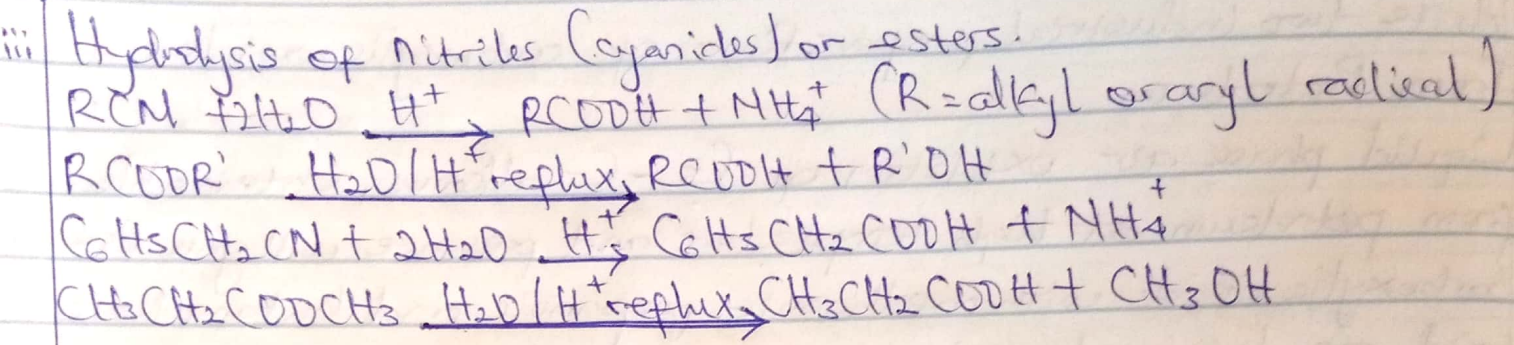
ii. Carbonation of Grignard reagent.

Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid



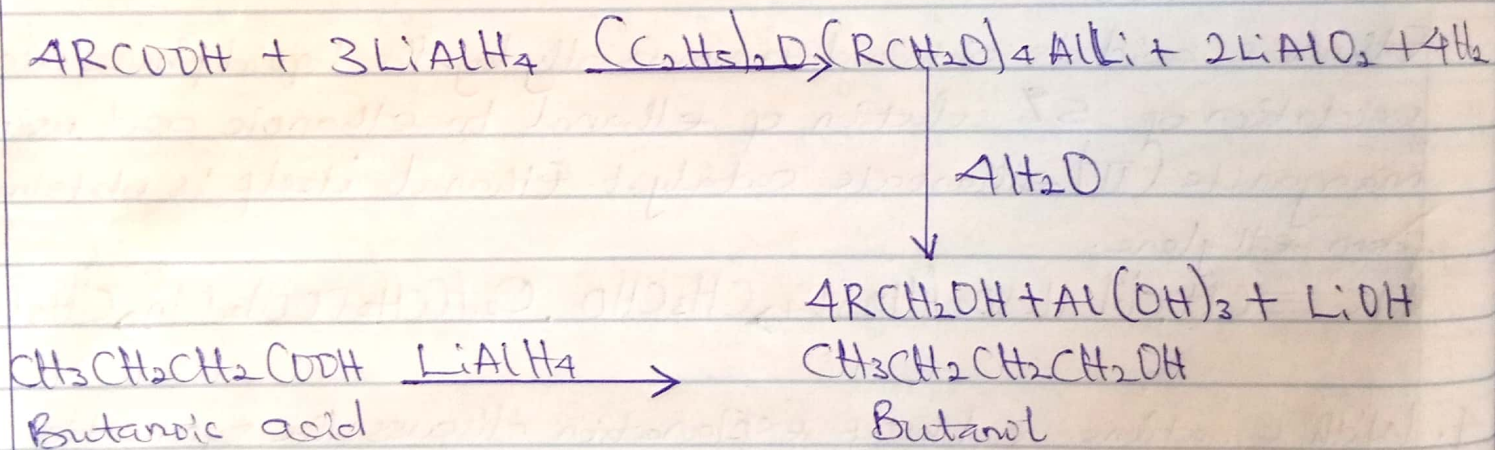
R maybe 1°, 2°, 3° aliphatic alkyl or aryl radical; In preparation of benzoic acid the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to the reaction mixture



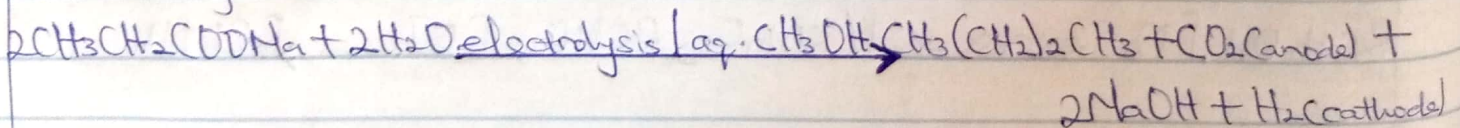
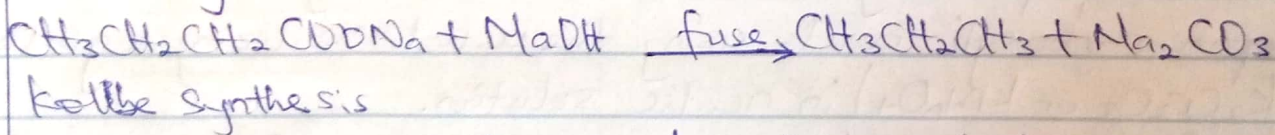


5. With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

i. Reduction to primary alcohol.



ii. Decarboxylation.



iii. Esterification

