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ELECT / ELECT ENGINEERING

19 / ENG 504 / 055

CHM 102 ASSIGNMENT

(i) HCOOH - Methanoic acid

(ii) $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - Pent-1,5-dioic acid

(iii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid

(iv) $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - Ethanedioic acid

(v) $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid

(vi) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enoic acid

2 Physical Appearance

All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most ~~are~~ other carboxylic acids are solid at room temperature although acetic acid or glacial ethanoic acid freezes to an ice-like solid below room temperature.

(ii) Boiling Point

Boiling point increases with relative molecular mass.

Aromatic carboxylic acids have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

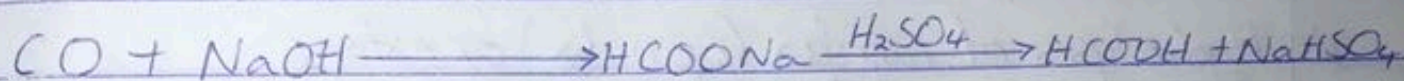
(iii) Solubility

Carboxylic acids with up to four carbon atoms are soluble in water due to ~~the~~ their ability to form hydrogen bonds with water molecules. Their water solubility decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence

~~are~~ covalent. All carboxylic acids are soluble in organic solvents.

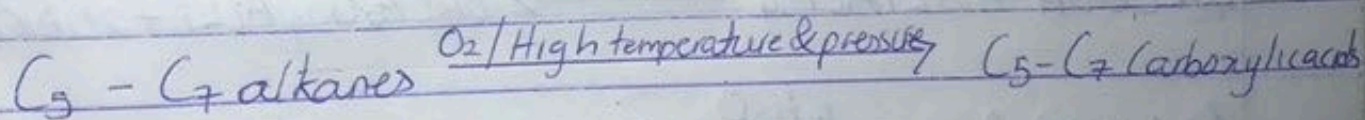
3(i) From Carbon (II) oxide

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 with tetraoxosulphate (VI) acid (H_2SO_4)



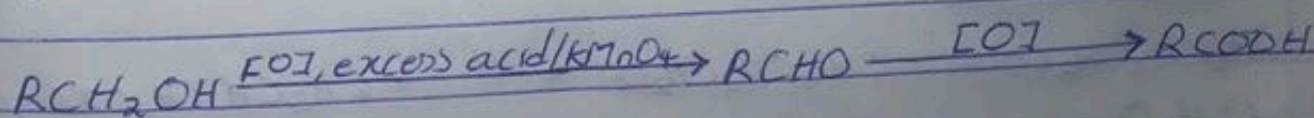
(ii) From petroleum

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 butanedioic acids as by-products



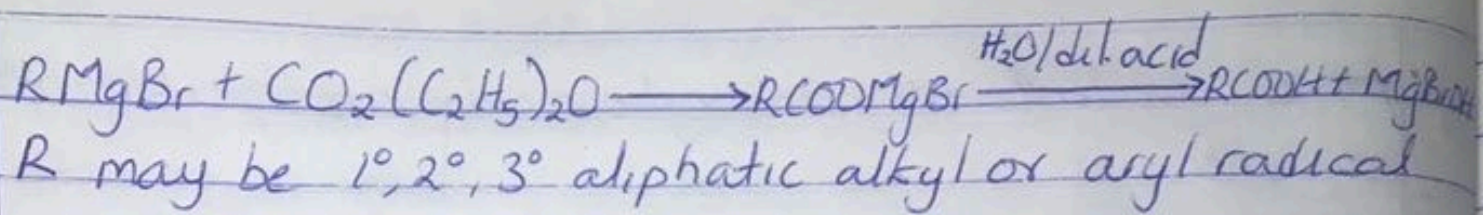
4 Oxidation of primary alcohols and aldehydes

Carboxylic acids can be prepared by oxidation of primary alcohols and aldehydes using usual oxidizing agents ($K_2Cr_2O_7$ or $KMnO_4$) in acidic solution

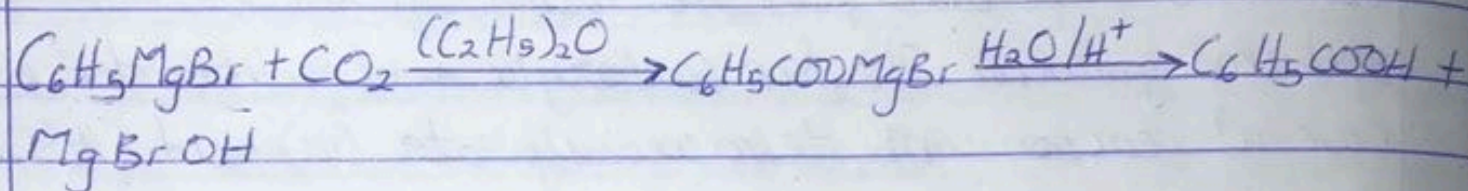


(ii) Carbonation of Grignard reagent

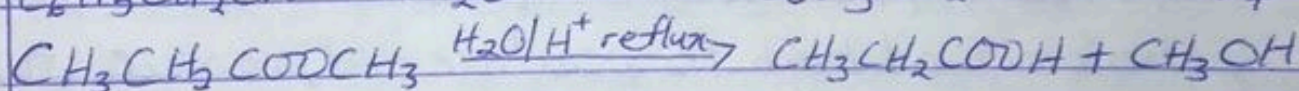
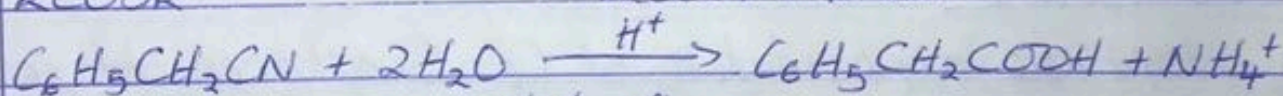
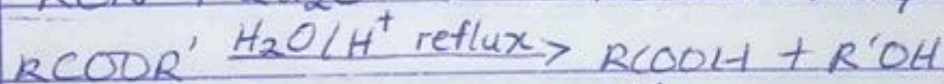
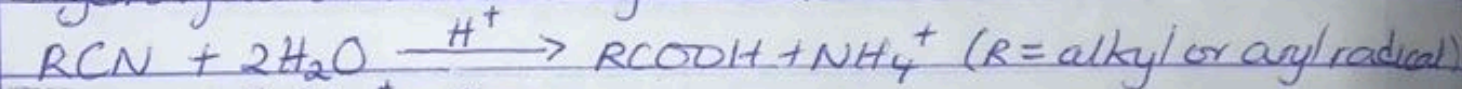
Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into grignard reagent and then hydrolyzed with dilute acid



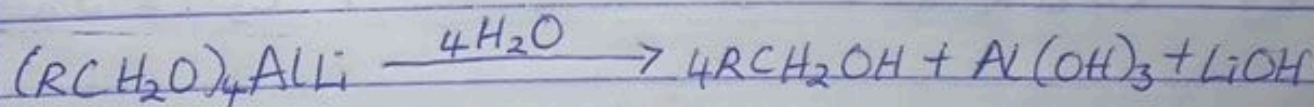
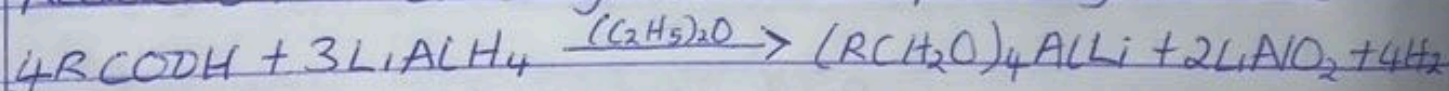
In preparing benzoic acid, the reagent is added to solid carbon(IV) oxide also serving as a coolant



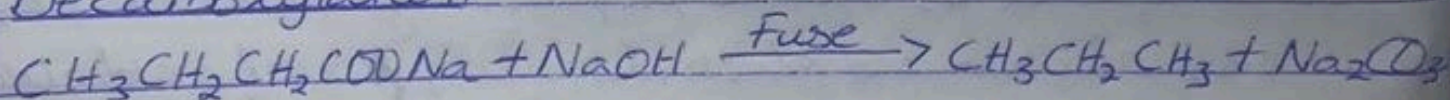
(iii) Hydrolysis of nitriles (cyanides) or esters



5 Reduction of Carboxylic acid to primary alcohol



(ii) Decarboxylation



(iii) Esterification

