

BILIAMEN ADEDOLAPO ABDULFATTAH
MECHATRONICS ENGINEERING
19/ENG051019
CHEM 102

- 1 HCOOH - Methanoic acid.
 $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - 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 Physical properties:

i) Physical appearances: All simple aliphatic carboxylic acids up to C_{10} are liquids at room-temperatures. Most other carboxylic acids are solids 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 Points: Boiling points increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

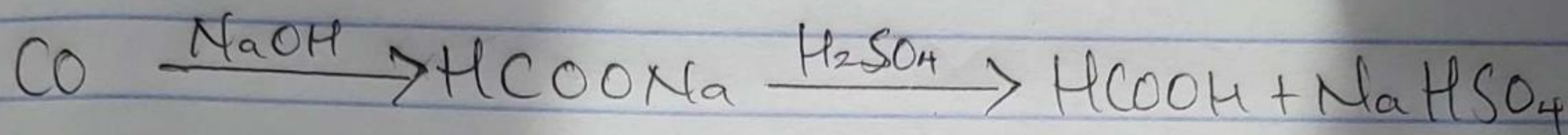
iii) Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water. This is largely due to their ability to form hydrogen bonds with water molecules.

The 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 solvent.

3 Industrial Preparations of Carboxylic acids.

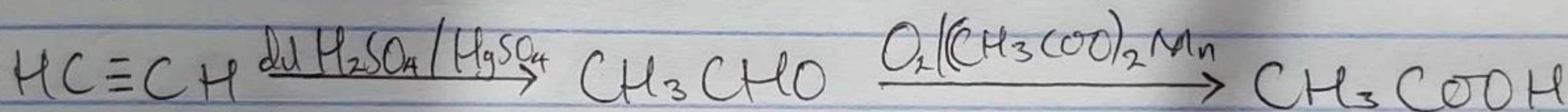
a) From Carbon (II) Oxide.

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 tetraoxo sulphate (VI) acid (H_2SO_4)



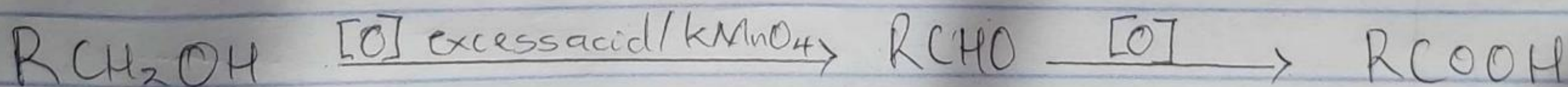
b) From ethanal

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.

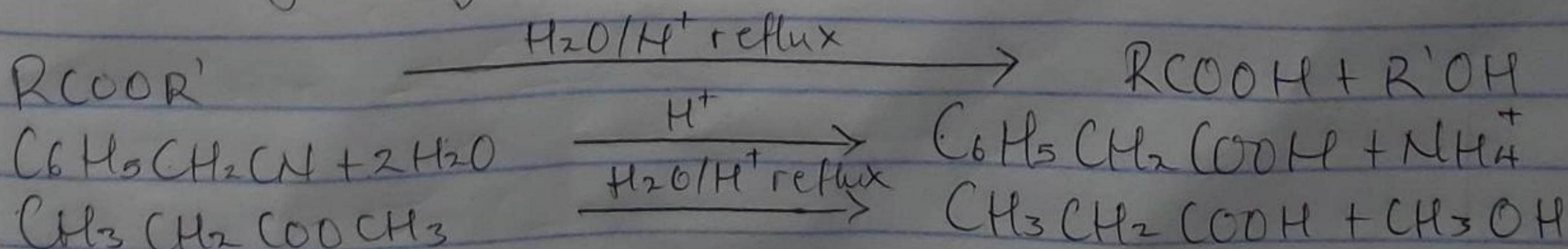
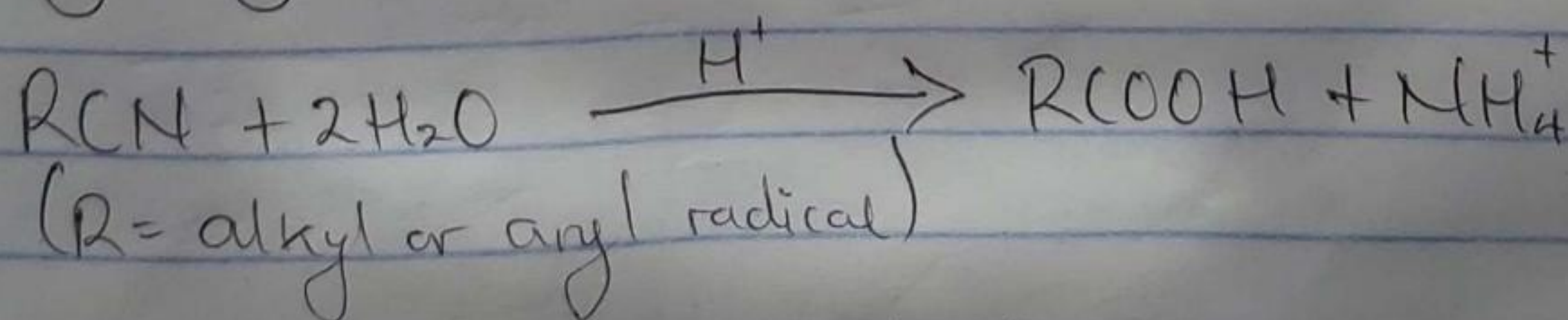


4 Synthetic Preparations of Carboxylic acids

A) The oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidising agents which are $K_2Cr_2O_7$ or $KMnO_4$ in acidic solution

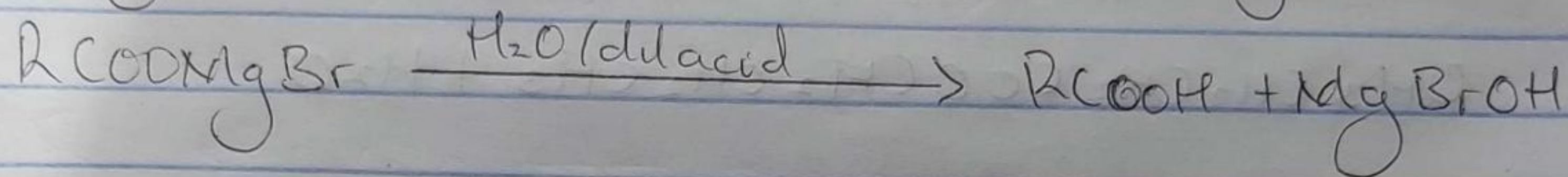
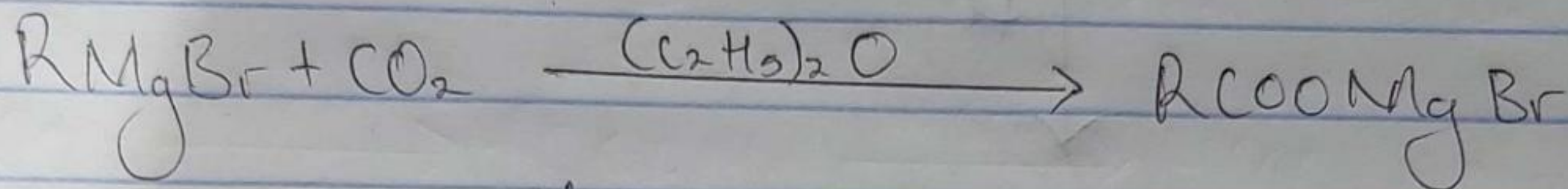


B) Hydrolysis of nitriles (cyanides) or esters.



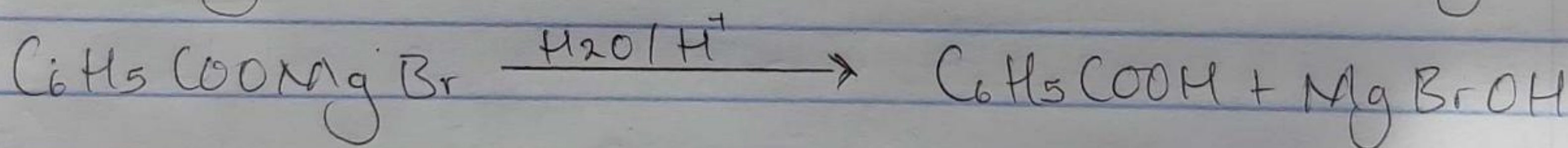
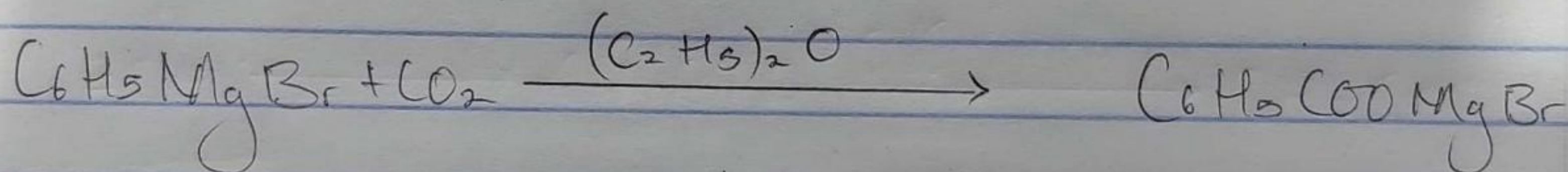
c) Carbonation of Grignard reagent

Bubbling carbon (IV) oxide into Grignard reagent and then hydrolyzing the intermediate with dilute acid produces aliphatic carboxylic acids.

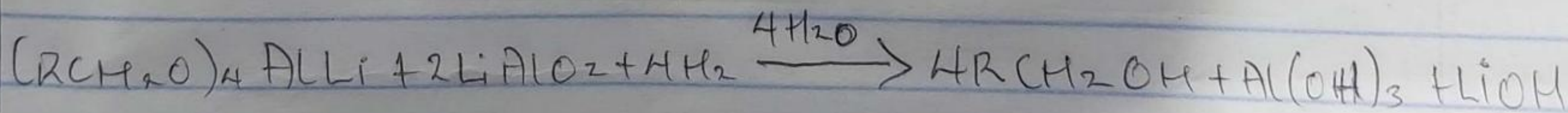
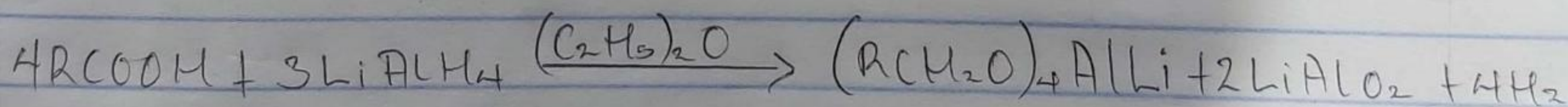


R may be 1° 2° 3° aliphatic alkyl or aryl radical

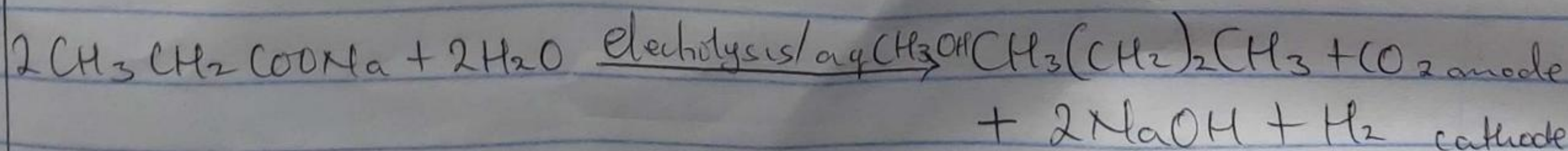
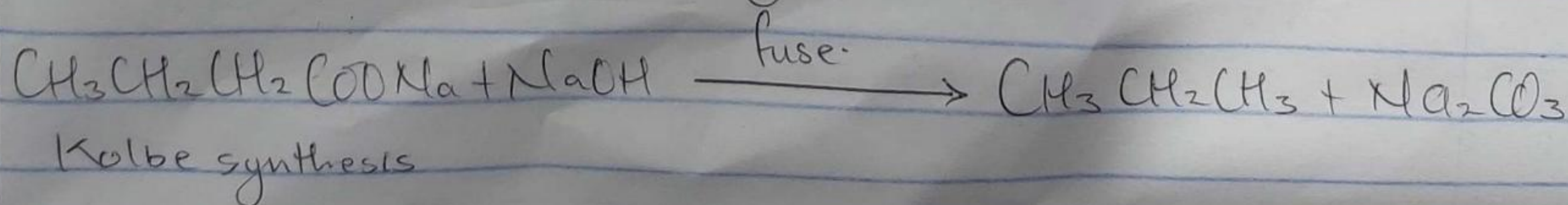
For benzoic acid the reagent added to solid carbon (IV) oxide (dry ice) which also serves as a coolant to the mixture.



5 A) Reduction of Carboxylic acid.



B) Decarboxylation of Carboxylic acid.



C) Esterification of Carboxylic acids.

