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COLLEGE MEDICINE AND HEALTH SCIENCES

DEPARTMENT MEDICINE AND SURGERY

MATRIC NO. 19/MHS01/400

COURSE: CHM 102

- 1 i HCOOH - Methanoic acid
- ii $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - Pentan-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-eneoic acid

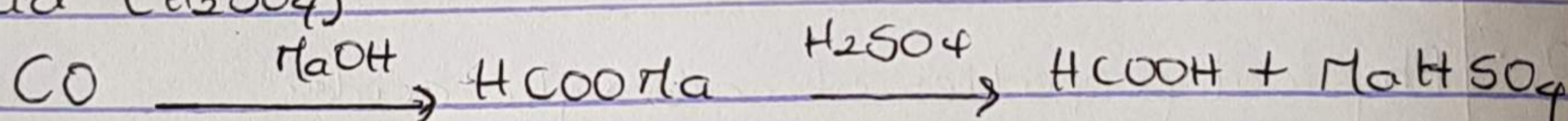
2 Physical properties of carboxylic acids:

- i Physical appearance: All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. 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;

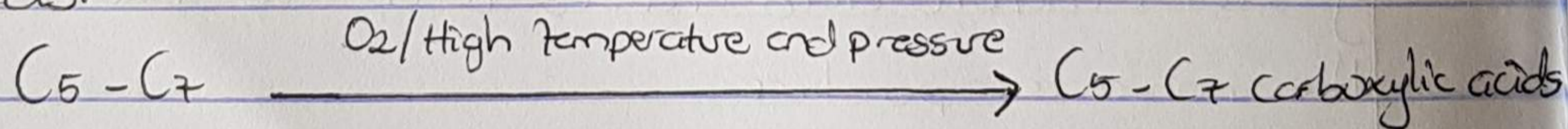
this is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

3. Industrial preparations of carboxylic acids are:

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)

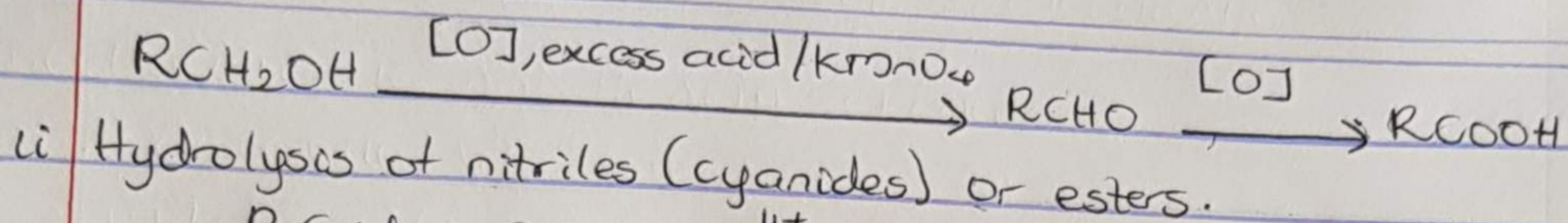


ii From petroleum: Liquid phase air oxidation of $C_5 - C_7$ alkenes, obtainable from petroleum at high temperature and pressure will give $C_5 - C_7$ carboxylic acids with methanoic, propanoic and butanedioic acids as by-products.

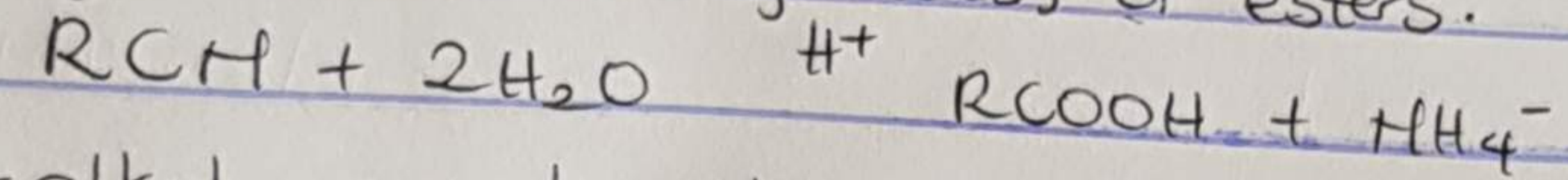


4. Synthetic preparation of carboxylic acid:

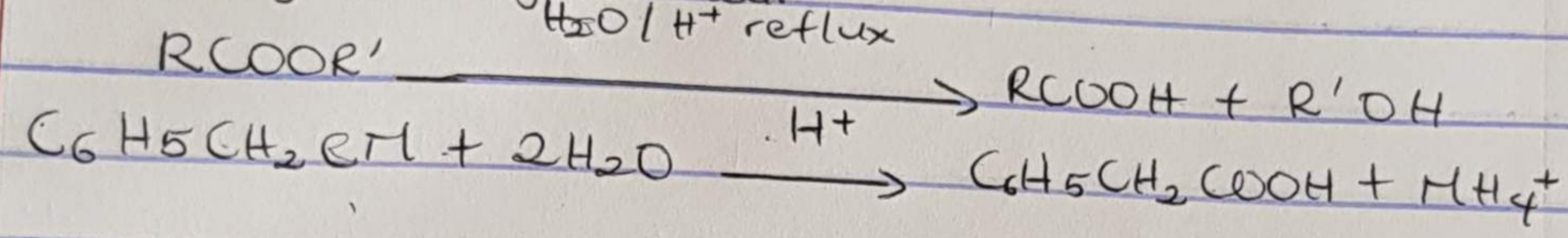
i Oxidation of primary alcohols and aldehydes: This can be used to prepare carboxylic acid using the usual oxidizing agents (i.e. $K_2Cr_2O_7$, $K_2Cr_2O_7$ or $KMnO_4$) in acidic solution



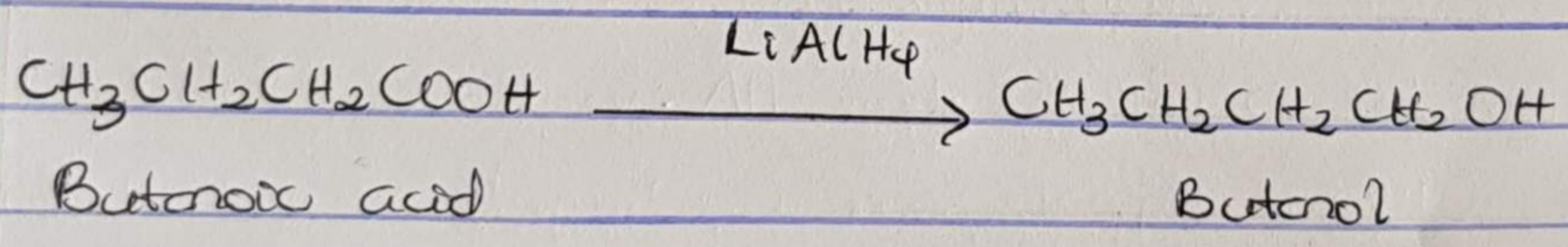
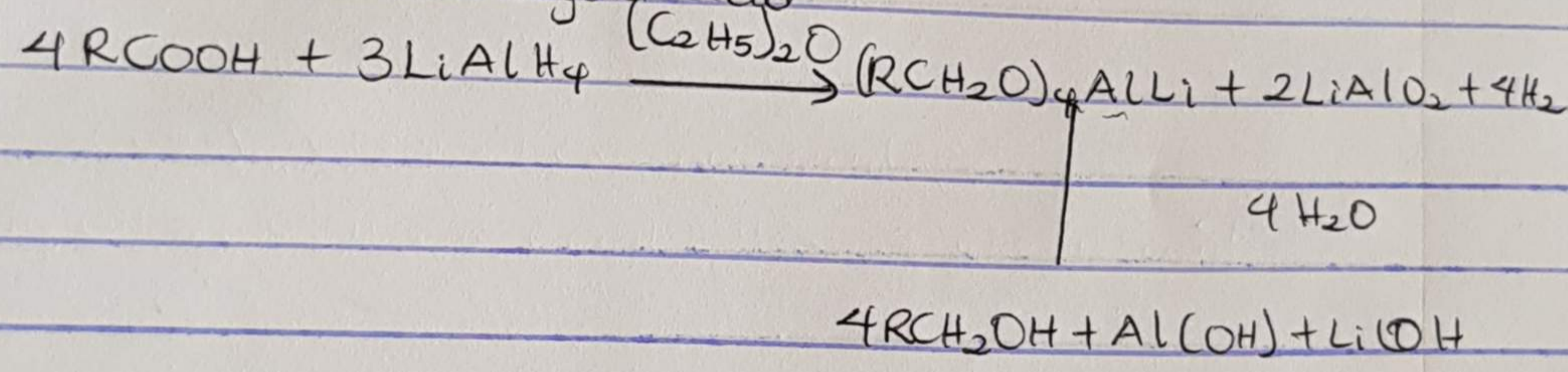
ii Hydrolysis of nitriles (cyanides) or esters.



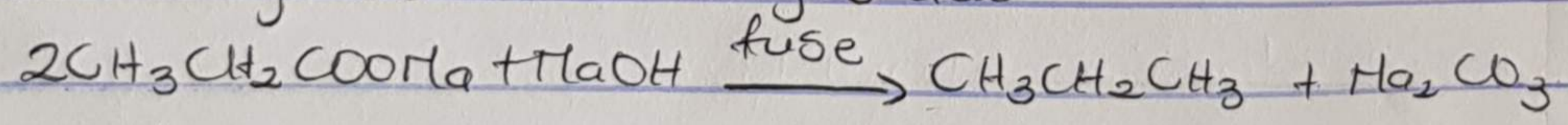
R = alkyl or aryl radical



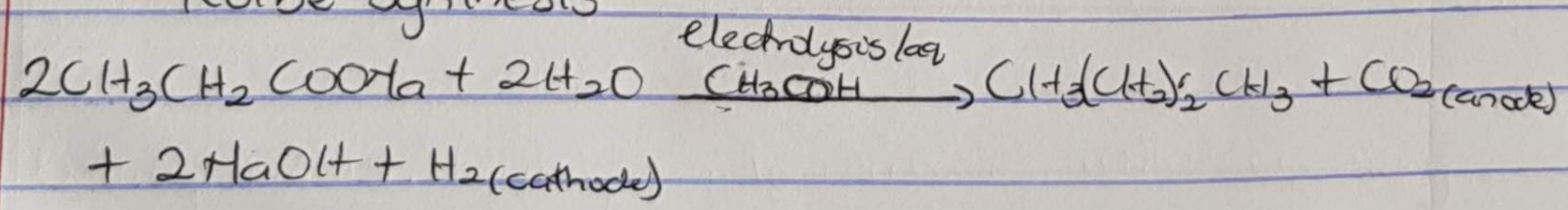
5. Reduction of carboxylic acid



ii Decarboxylation of carboxylic acid.



Kolbe synthesis



iii Esterification of carboxylic acid

