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DEPT: MBBS  
MATRIC NO: 19/MHS01/120

1) Give IUPAC names of the following compounds  
 $\text{HCOOH}$  - 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) Discuss briefly the physical properties of carboxylic acids

i) Physical appearances - All simple aliphatic carboxylic acids up to  $\text{C}_{10}$  are liquids at room temperature. Most other carboxylic acids are solid at room temperature.

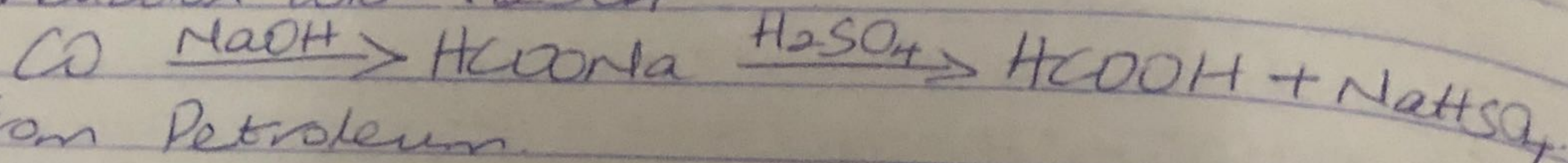
ii) Boiling point - Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

iii) Solubility - The water solubility of acids decrease as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent.

3) Write two industrial preparations of carboxylic acids

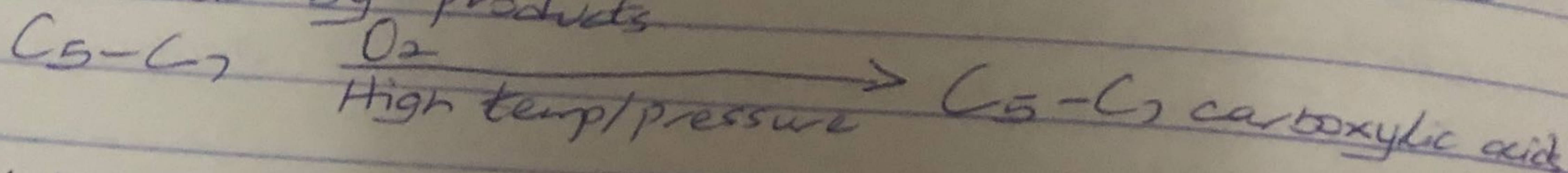
i) From carbon dioxide

Methanoic acid (formic acid) is manufactured by adding carbon dioxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with  $H_2SO_4$



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

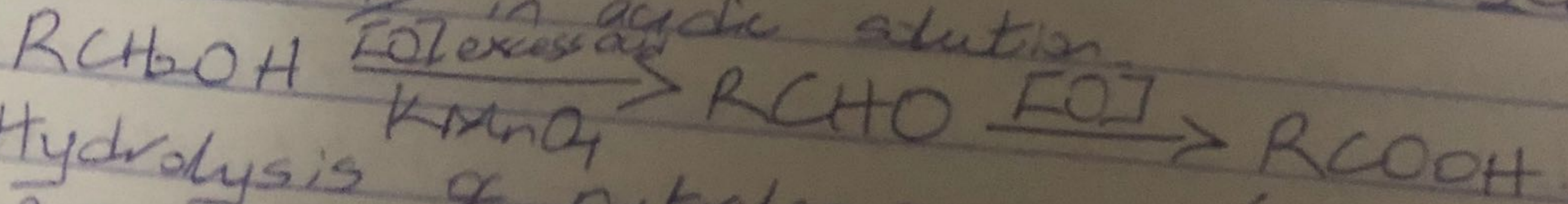


4) With equations and brief explanation discuss the synthetic preparation of carboxylic acid.

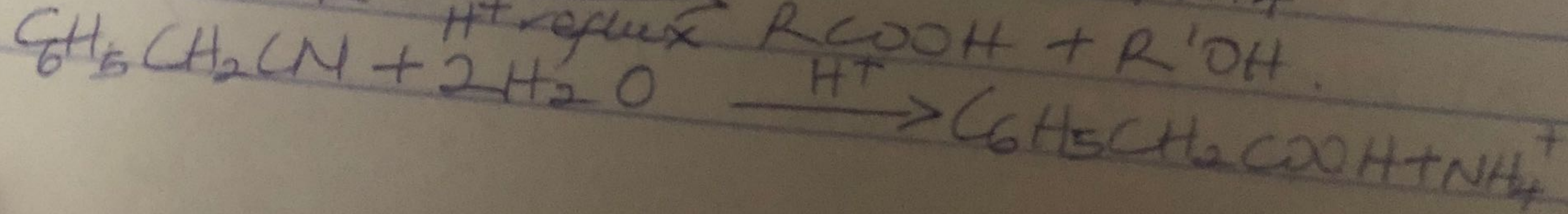
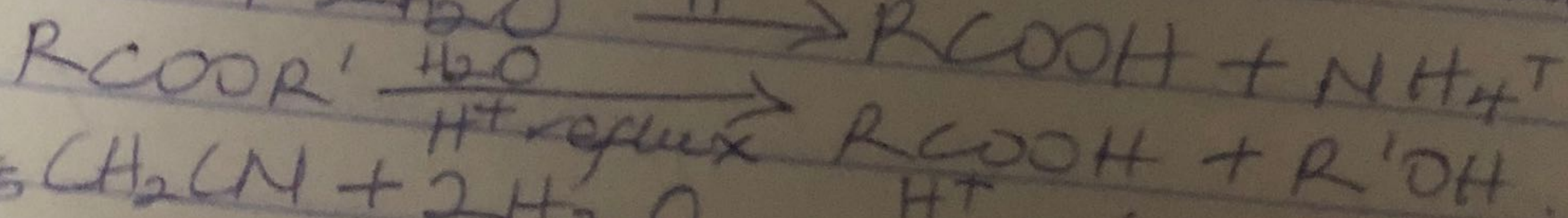
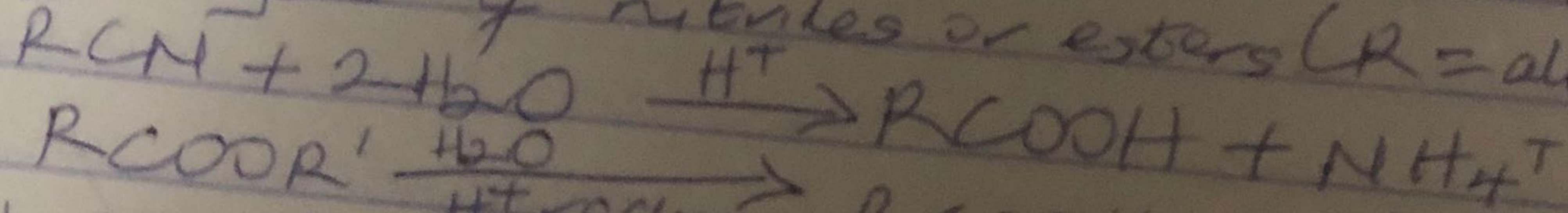
i) Oxidation of primary alcohols and aldehydes

It can be used to prepare carboxylic acids using the usual oxidizing agents (ie  $K_2Cr_2O_7$

~~or~~  $KMnO_4$ ) in acidic solution.

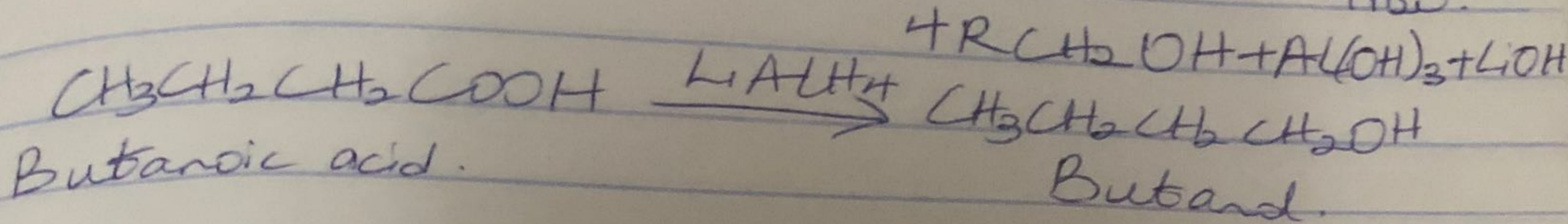
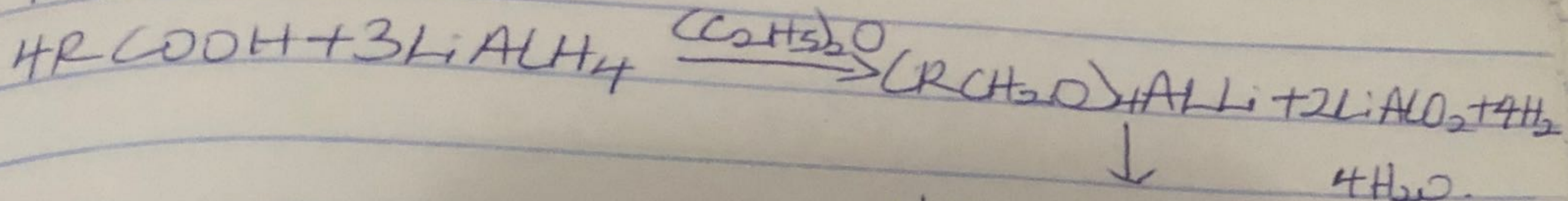


ii) Hydrolysis of nitriles or esters ( $R = \text{alkyl radical}$ )

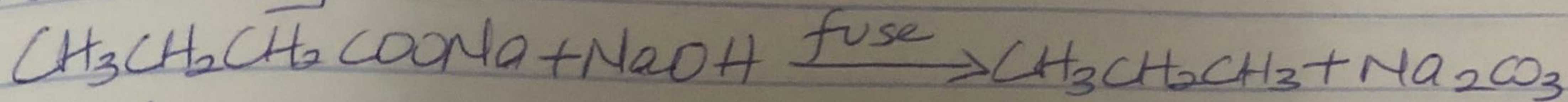


5) With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

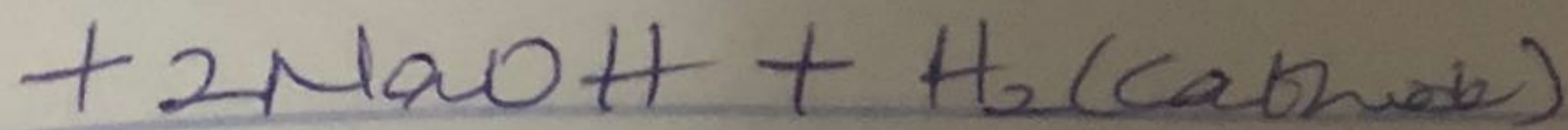
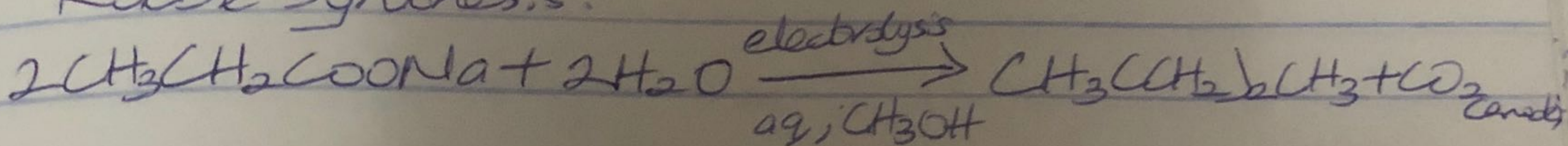
1) Reduction.



2) Decarboxylation.



Kolbe synthesis.



3) Esterification

