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1. Give the IUPAC Name of the following Compounds.

a. HCOOH - Methanoic Acid.

b. $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ - Pentan-1,5-dioic acid.

c. $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid.

d. $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - ~~Ethanoic~~ Ethanedioic acid.

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

f. $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enoic acid.

2. Discuss Briefly the Physical properties of Carboxylic acid under the following heading:

a. Physical Appearance: All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxylic acids are solid at room temperature although anhydrous carboxylic acid also known as glacial ethanoic acid freezes to an ice like solid below the room temperature.

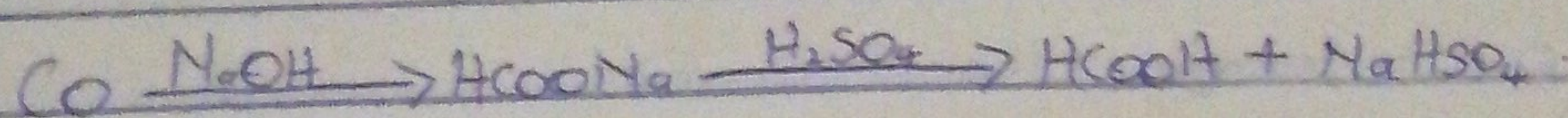
b. Boiling Points: Boiling points increase with increasing ~~molecular~~ molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

c. Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water, this largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decrease 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. Note two industrial preparation of carboxylic acids.

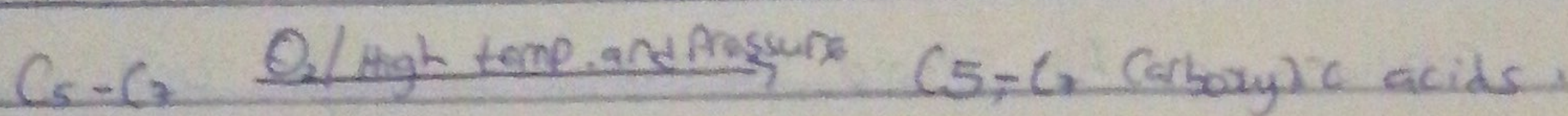
a. From carbon(II) oxide.

Methanoic 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)



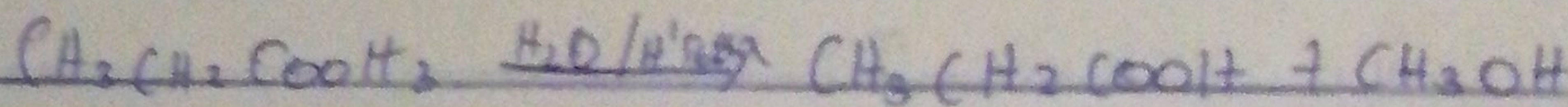
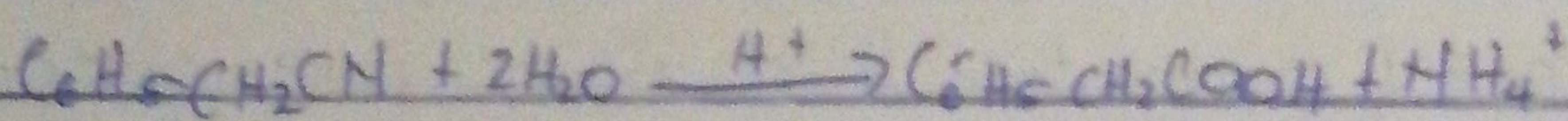
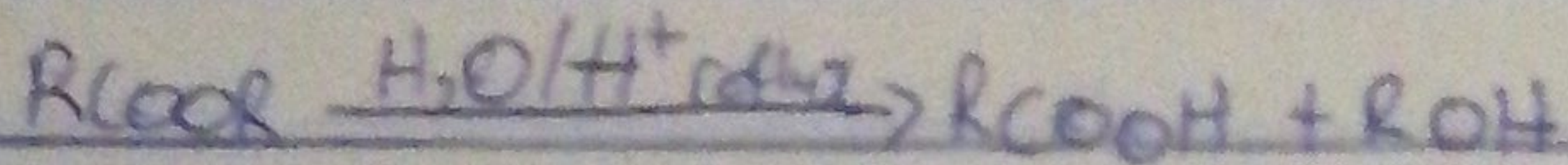
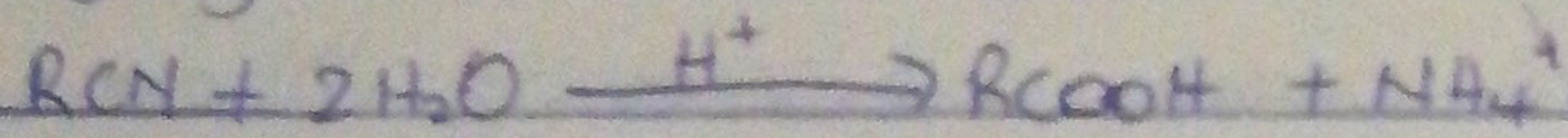
b. From Petroleum.

Liquid phase air oxidation of C_5-C_7 alkanes, obtainable from petroleum at high temperature and pressure will C_5-C_7 carboxylic acids with methanoic, propanoic, butanoic acids as by-products.



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

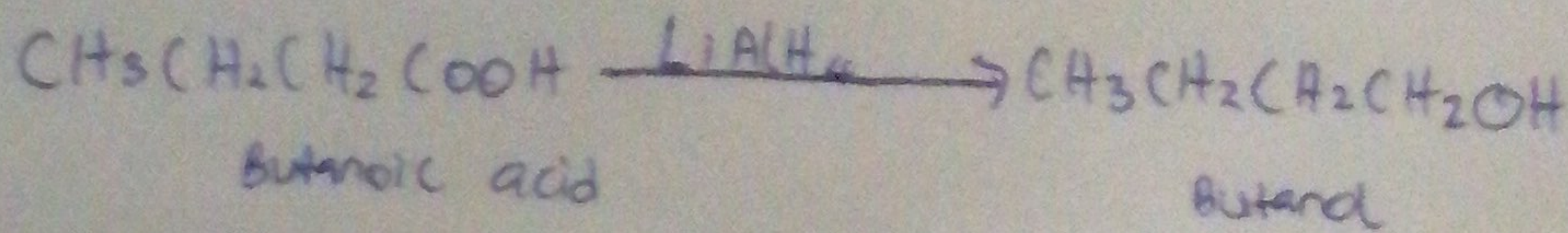
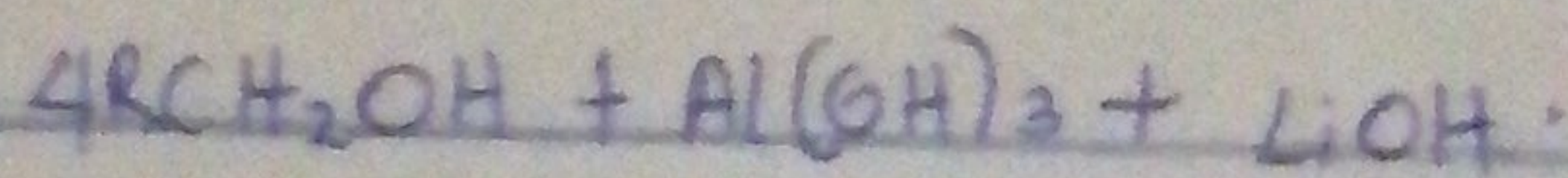
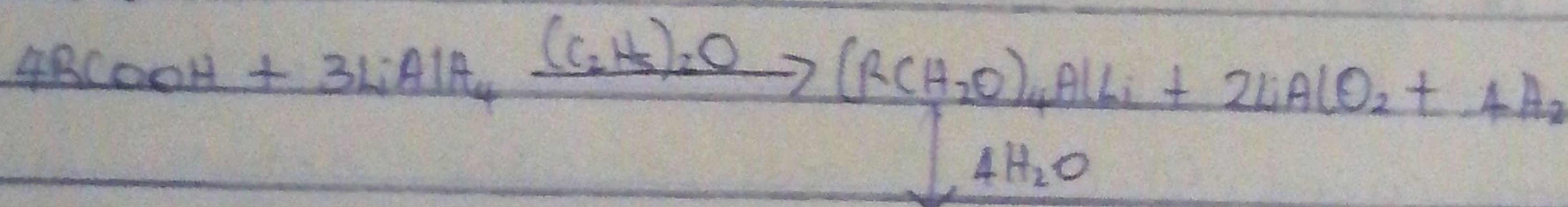
Hydrolysis of nitrates or esters.



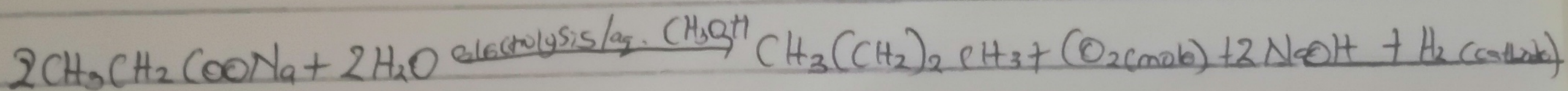
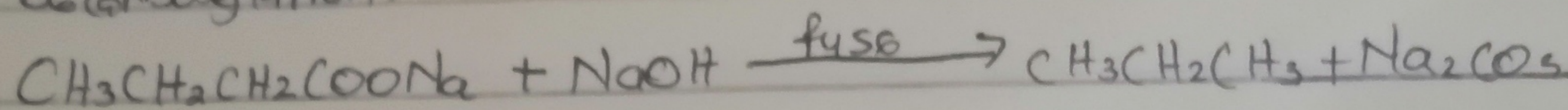
R = alkyl or aryl radical.

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

Reduction



b. Decarboxylation.



c. Esterification

