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MECHATRONICS ENGINEERING
19/EN906/017

CHM 102
Assignment on Carboxylic acid

1. Give the IUPAC names of the following compounds

HCOOH - Methanoic acid

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

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

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

$\text{HO}_2\text{C}-\text{CO}_2\text{H}$ - Ethanedioic 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 under the following headings

i. 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 (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

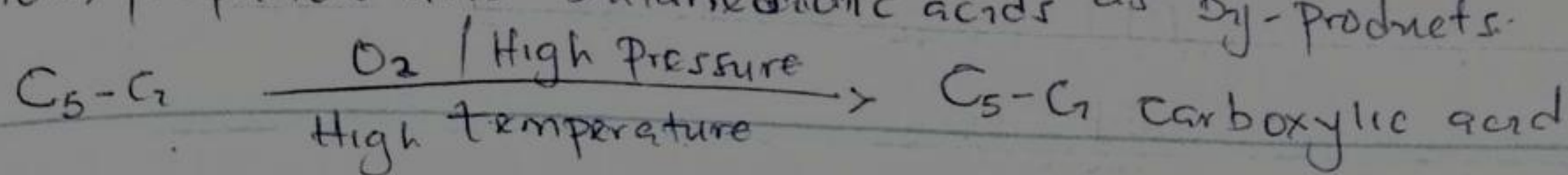
ii. BOILING POINT: Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting point than their aliphatic counterparts of comparable relative molecular mass.

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.

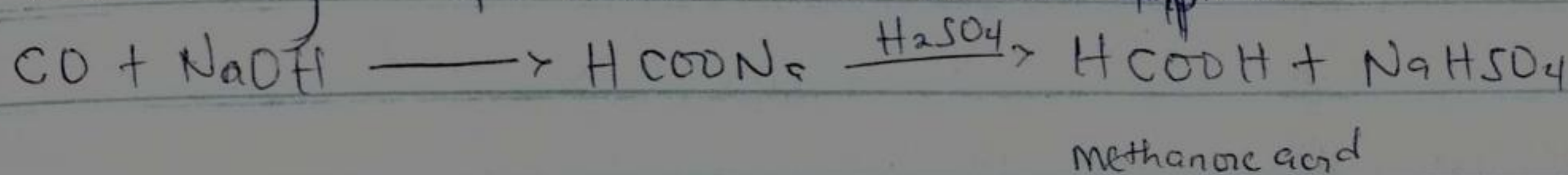
3 Write two industrial preparation of carboxylic acids from Petroleum

1 Liquid phase air oxidation of C₅-C₇ alkanes, obtainable from petroleum at high temperature and pressure will give C₅-C₇ carboxylic acids with methanoic, propanoic and butanedioic acids as by-products.



11 from Carbon(II) oxide

Methanoic acid (formic acid) is manufactured by adding CO₂ under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxo sulphate (VI) acid (H₂SO₄)



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

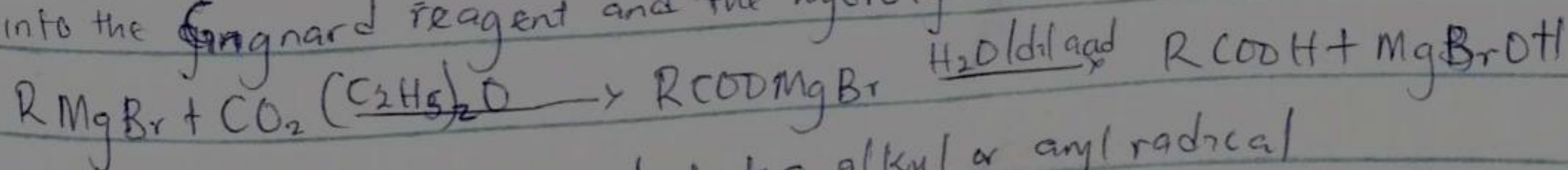
1 Oxidation of primary alcohols and aldehydes

The oxidation can be ^{use to} prepared prepare carboxylic acids using the usual oxidizing agents (i.e. K₂Cr₂O₇ or KMnO₄) in acidic solution



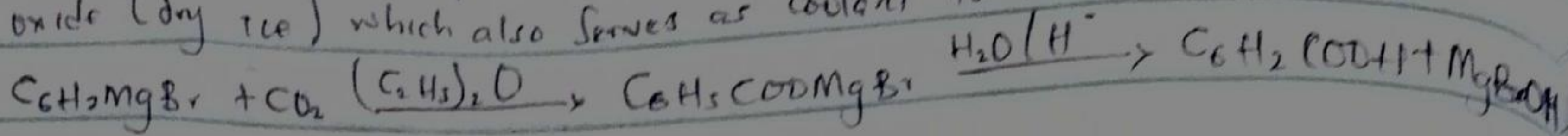
11 Carbonation of Grignard reagent

Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard reagent and the hydrolyzed with dilute acid.

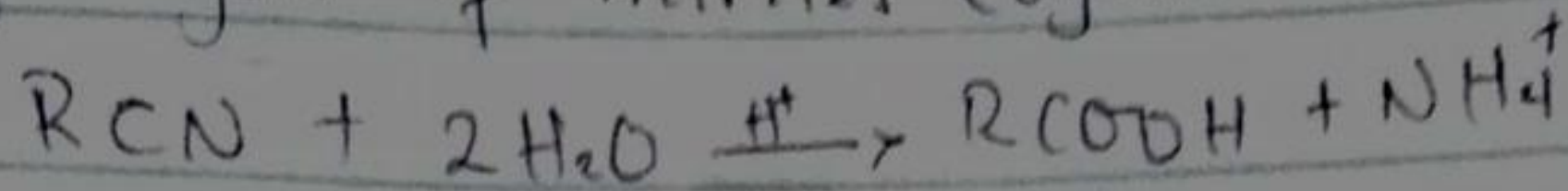


R may be 1°, 2°, 3° aliphatic alkyl or aryl radical

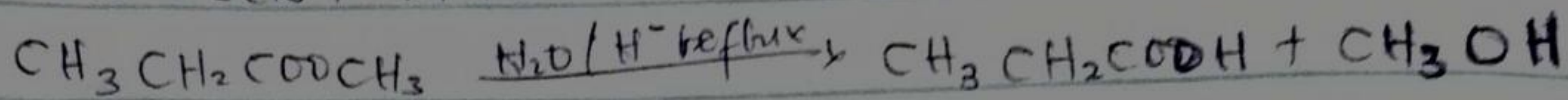
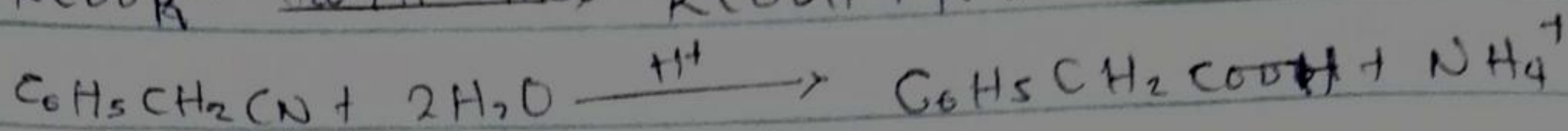
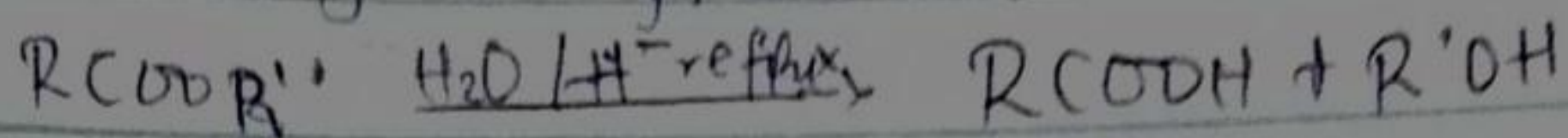
In the preparation of benzoic acid the reagent is added to solid carbon dioxide (dry ice) which also serves as coolant to the reaction mixture.



3. Hydrolysis of nitriles (cyanides) or esters.

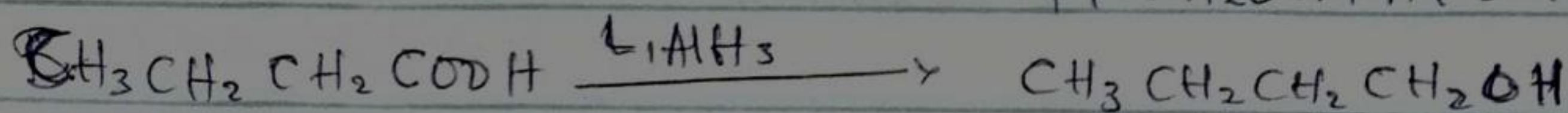
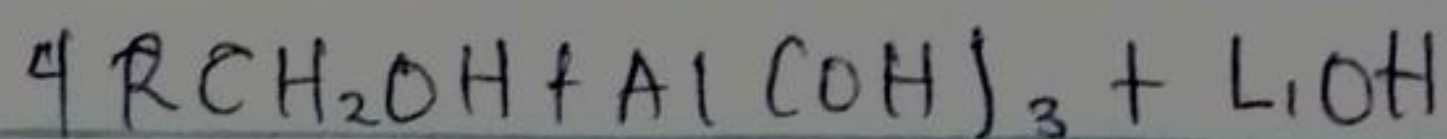
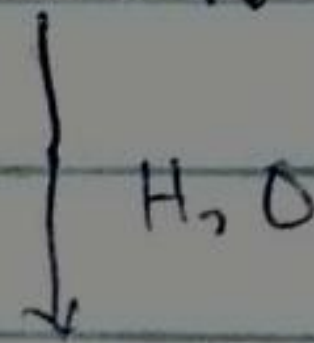
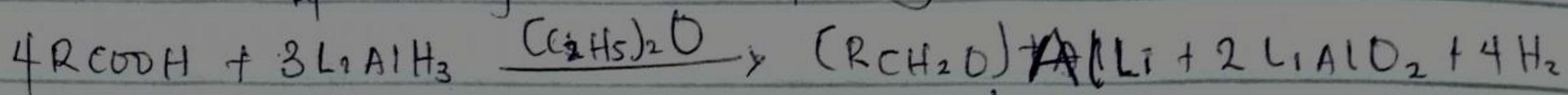


(R = alkyl or aryl radical)



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

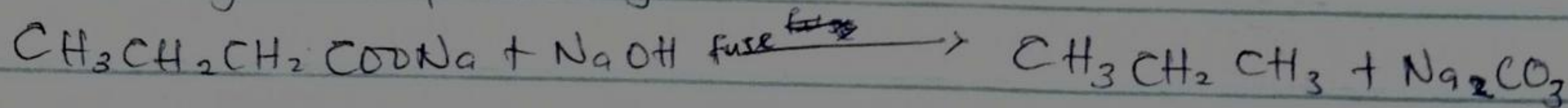
i. Reduction of carboxylic acid to primary alcohol



Butanoic acid

Butanol

ii. Decarboxylation of carboxylic acid

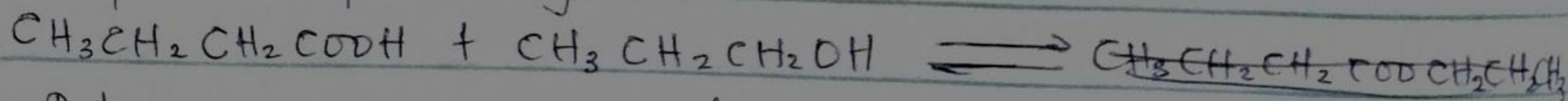


Sodium

hydroxide

Propane

iii. Esterification of carboxylic acid



Butanoic acid

Butanol



Amyl Acetate
+ H₂O