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Dept: Pharmacy  
Course code: CHM 102

Answer

- a)  $\text{HCOOH}$  - Methanoic acid
- b)  $\text{HOOCCH}_2\text{CH}_2\text{COOH}$  → Pentan-1,5-dia acid
- c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$  → Butanoic acid
- d)  $\text{HO}_2\text{C}-\text{CO}_2\text{H}$  → Oxalanoic 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) Physical properties of carboxylic acid

Solubility - lower molecular mass carboxylic acid with up to four carbon atoms in their molecules are soluble in water. Carboxylic acids are soluble in water. Carboxylic acids do not dimerise in water, but forms hydrogen bonds with water. Smaller carboxylic acid (C1 to C5) are soluble in water, whereas larger carboxylic acids (C6 and above) are less soluble due to the increasing hydrophobic nature of the hydrocarbon chains.

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

Appearance: All simple aliphatic carboxylic acids up to C10 are liquids at room temperature. Most other carboxylic acids are solids at room temperature although anhydrous carb...

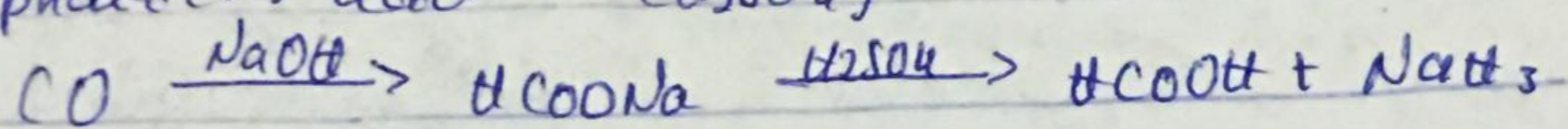
acid (acetic acid) also known as glacial acetic acid  
freezes to an ice-like solid known below room  
temperatures

3) from Petroleum Petroleum  
liquid phase air oxidation of C<sub>5</sub>-C<sub>7</sub> alkanes, obtain  
able from petroleum at high temperatures and pressure will give  
C<sub>5</sub>-C<sub>7</sub> Carboxylic acids with methanoic, propanoic and  
butanoic acid by-products

C<sub>5</sub>-C<sub>7</sub> O<sub>2</sub>/High temperature and Pressure → C<sub>5</sub>-C<sub>7</sub> Carboxylic acid

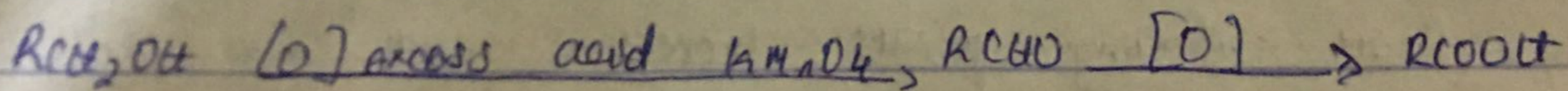
4) From Carbon (II) oxide

Methanoic acid (formic acid) manufactured Carbon (II) oxide  
under pressure to not aqueous occurs of sodium hydroxide  
the free carboxylic acid is by careful reactions with  
tetraoxosulphate (VI) acid (H<sub>2</sub>SO<sub>4</sub>)



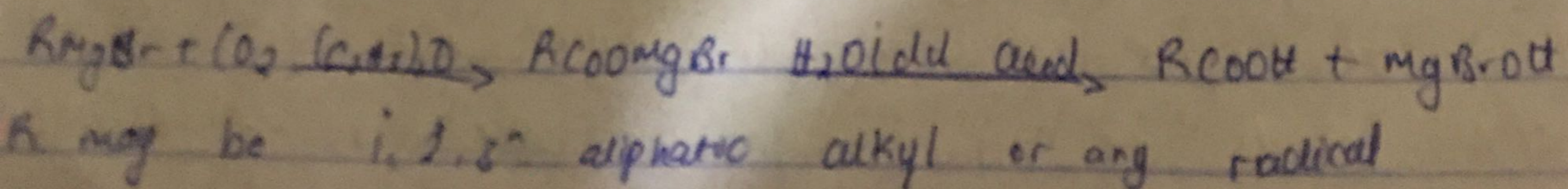
#### 4) Oxidation of primary alcohols and aldehydes

Oxidation of primary alcohols and aldehydes can be  
used to prepare carboxylic acids using the usual oxidizing  
agents (i.e. K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> or KMnO<sub>4</sub>) in acidic solution



#### Carboxylation of the Grignard reagent

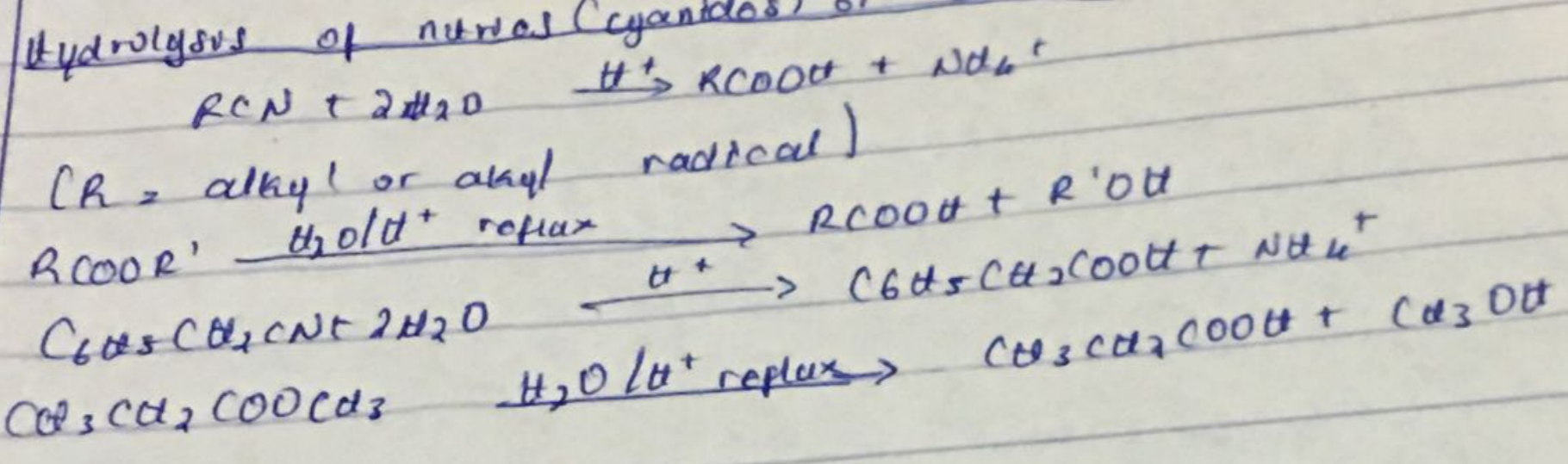
Aliphatic carboxylic acids are obtained by bubbling  
carbon (II) oxide into the Grignard reagent and non hydrolyzed  
in dilute acid



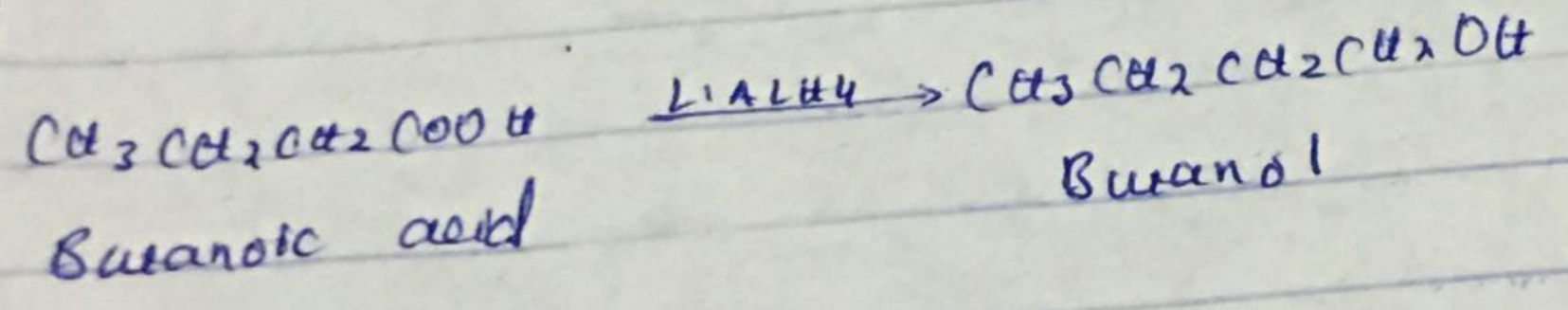
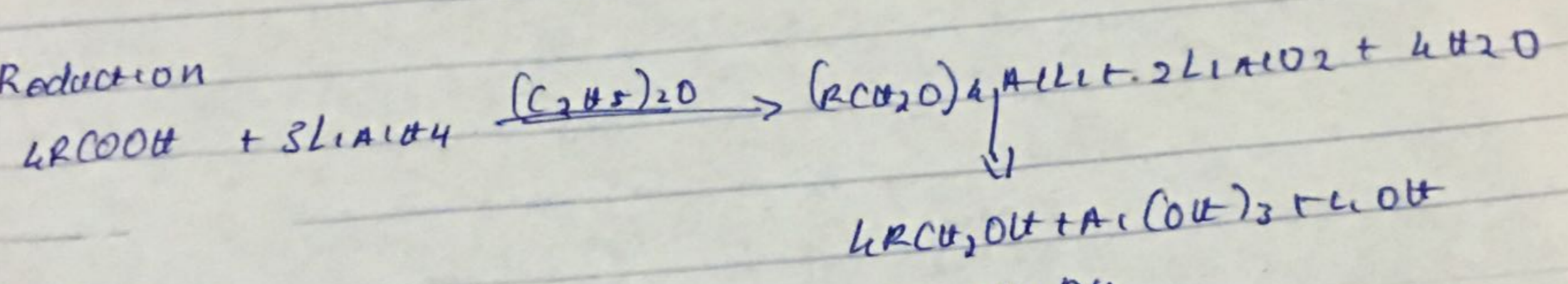
In the preparation of benzoic acid, no reagent is added to solid carbon (iv) oxide (dry ice) which also serves as coolant to the reaction mixture

$$C_6H_5MgBr + CO_2 \xrightarrow{(C_2H_5)_2O} C_6H_5COOMgBr \xrightarrow{H_2O/H^+} C_6H_5COOH + MgBrOH$$

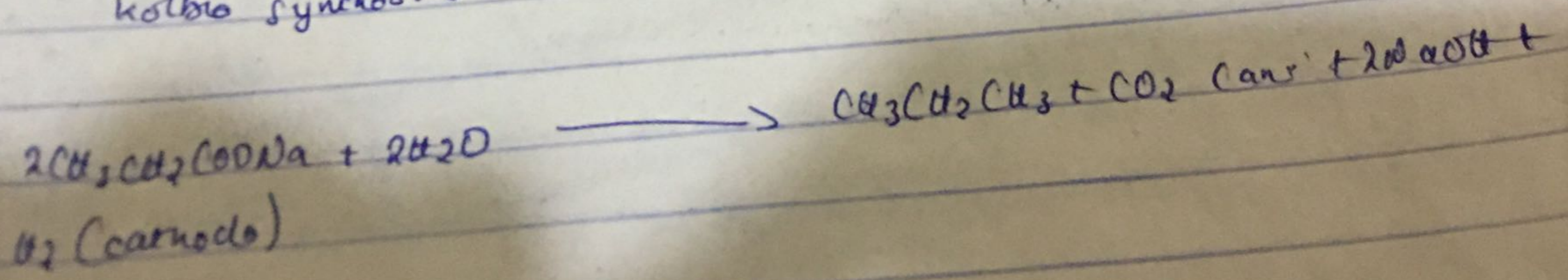
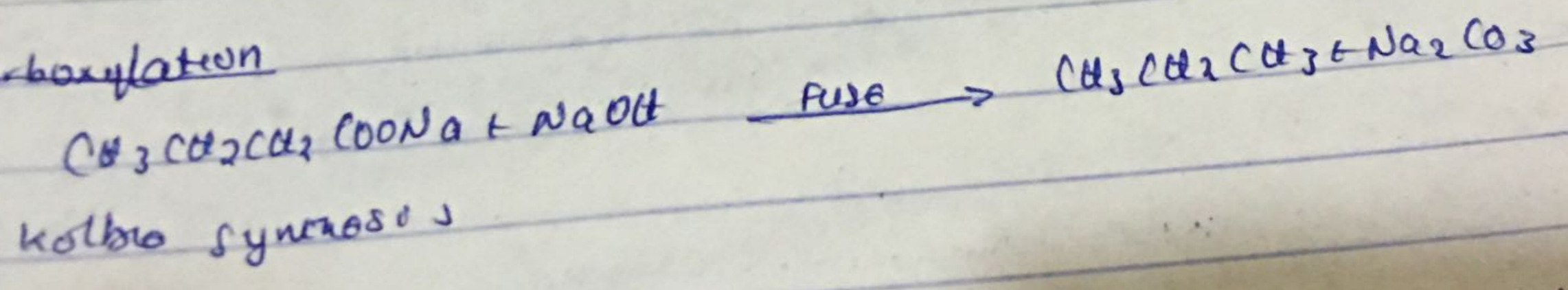
iv Hydrolysis of nitriles (cyanides) or esters



v Reduction



vi Decarboxylation



vii Esterification

