

- 1 a)  $\text{HCOOH}$  — Methanoic acid  
b)  $\text{HOOC(CH}_2\text{CH}_2\text{CH}_2\text{COOH)}$  — Pentan-1,5-dioic acid  
c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$  — Butanoic acid  
d)  $\text{HO}_2\text{C}-\text{CO}_2\text{H}$  — Ethane dioic 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 appearance:

- all simple aliphatic carboxylic acids up to  $\text{C}_{10}$  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 room temperature.

## 1) Boiling Point:

- This 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.

## 1) 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

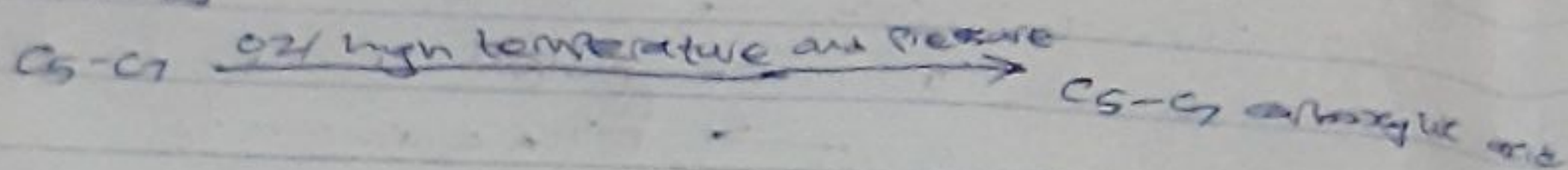
the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble organic solvents.

## 3) Industrial Preparation of carboxylic acid

### ① From Petroleum:

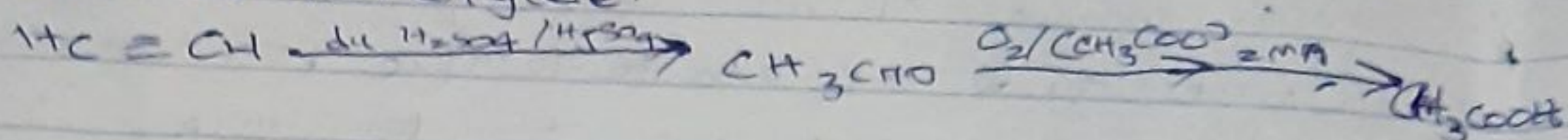
Liquid phase air oxidation of  $\text{C}_5$ - $\text{C}_7$  alkanes obtainable from petroleum at high temperature.

and pressure will give C<sub>6</sub>-C<sub>7</sub> carboxylic acids with  
 methanoic, propanoic and butanoic acids as  
 by products

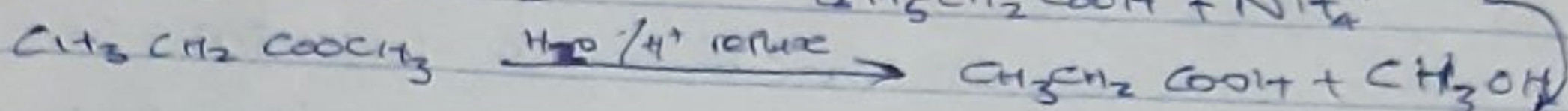
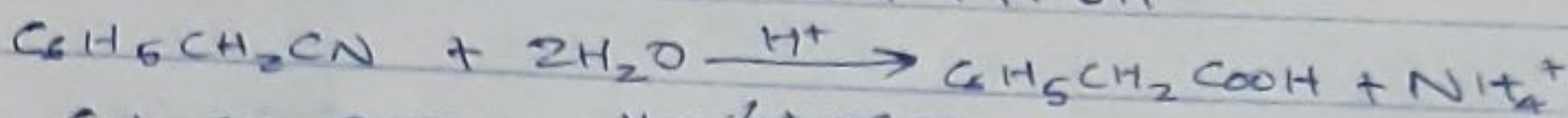
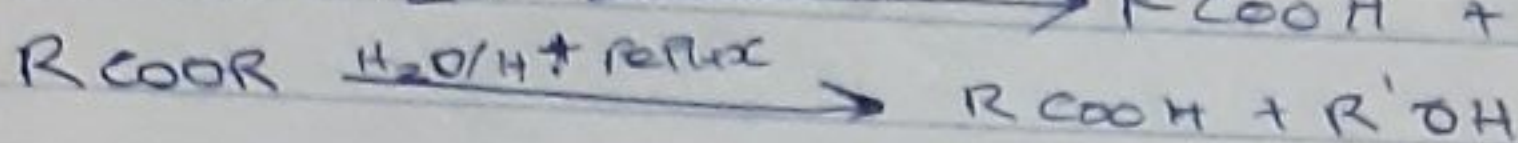
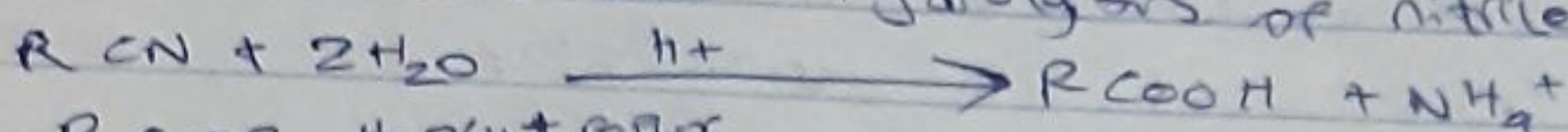


b) From ethanol

ethanoic acid is obtained commercially by the liquid phase  
 air oxidation of 5% solution of ethanol to ethanoic acid  
 using manganese(II) ethanoate catalyst. Ethanol itself is  
 obtained from ethylene:

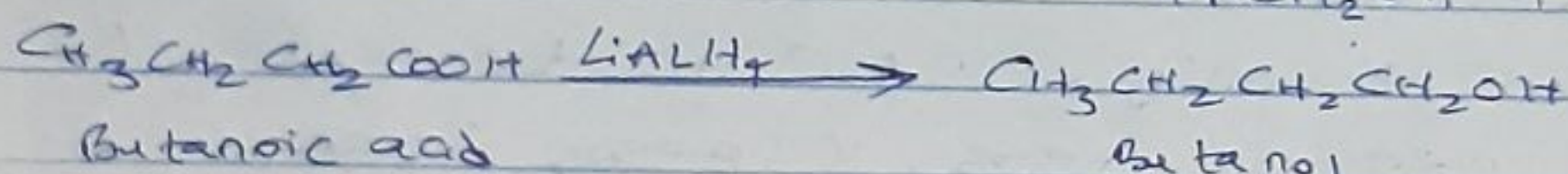
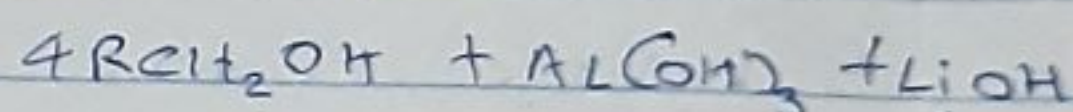
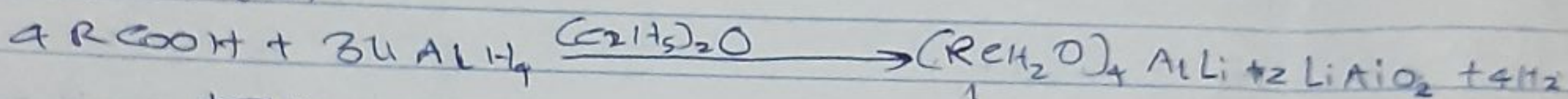


c) ~~Hydrolysis~~ <sup>Hydrolysis</sup> of nitriles (cyanides) or esters



R = alkyl or  
 aryl  
 radical

5) a) reduction



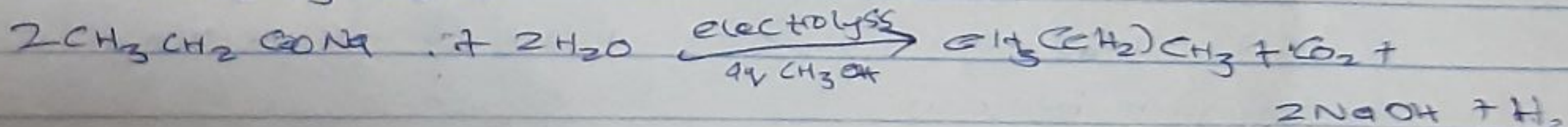
Butanoic acid

butanol

10) Decarboxylation



Kolbe synthesis



c) Esterification

