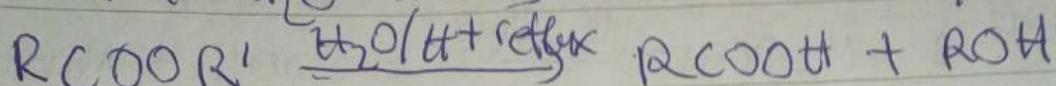
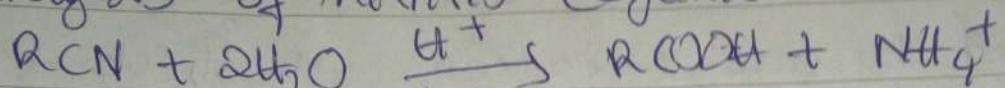


(2) (3)

R may be $1^\circ, 2^\circ, 3^\circ$ aliphatic alkyl or aryl radicals.

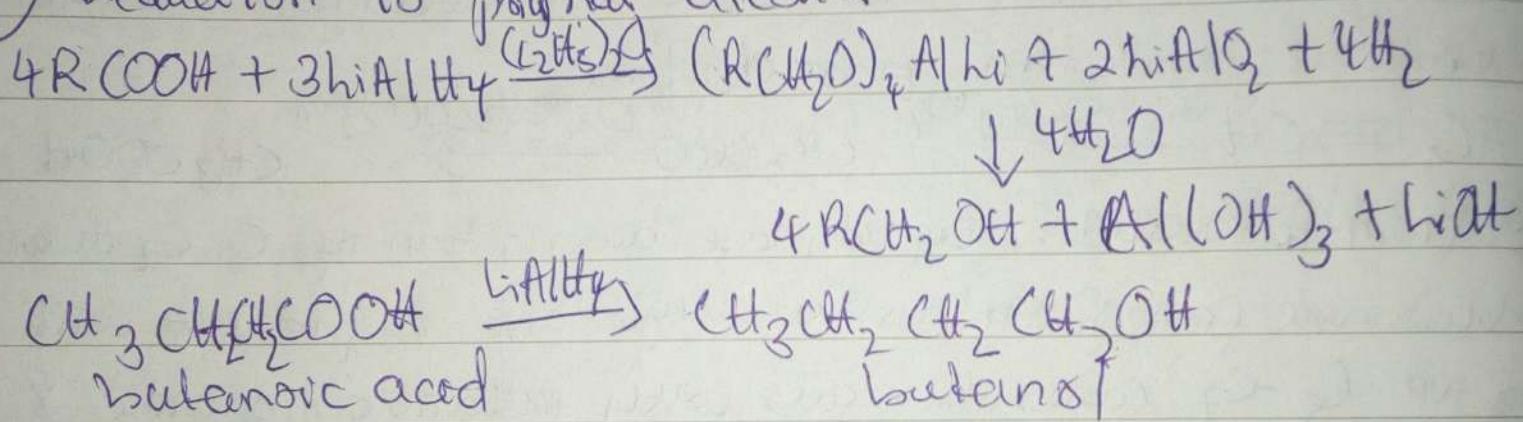
$$R\text{MgBr} + \text{CO}_2 \xrightarrow{(\text{C}_2\text{H}_5)_2\text{O}} R\text{COOMgBr} \xrightarrow{\text{H}_2\text{O/dil. acid}} R\text{COOH} + \text{MgBr}_2$$

(c) Hydrolysis of nitriles (cyanides) or esters:

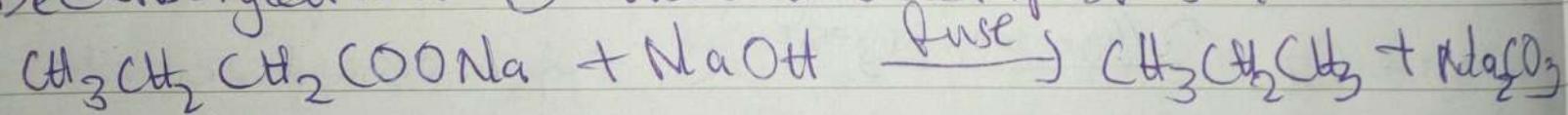


(R = alkyl or aryl radical)

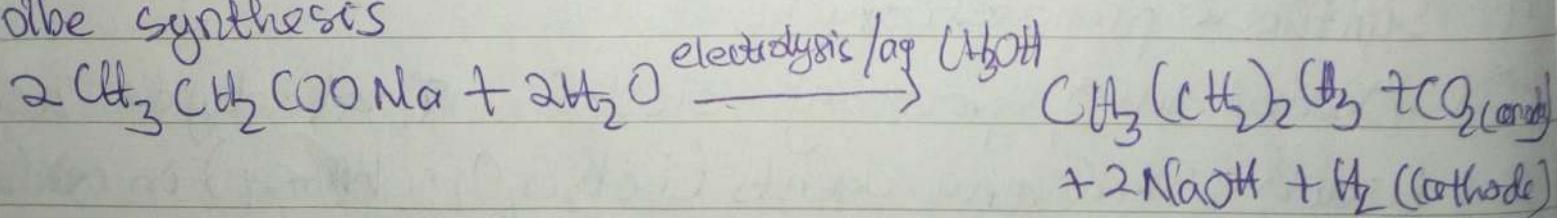
5) Reduction to primary alcohol



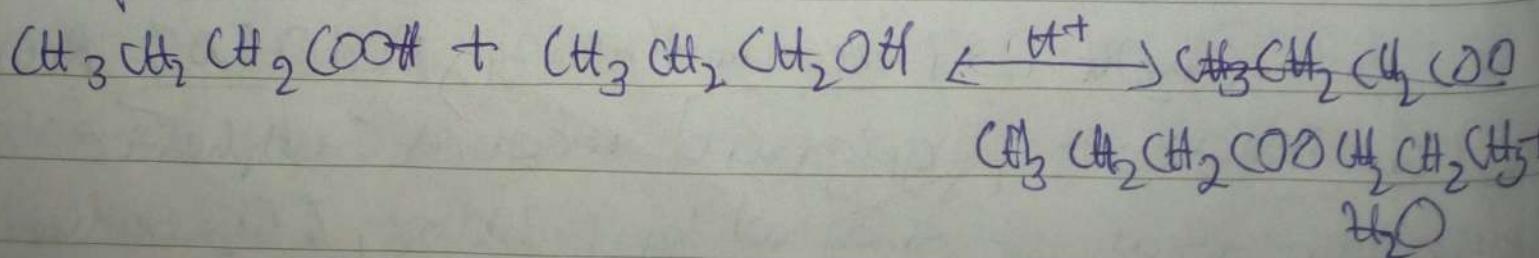
Decarbonylation:- (a) Thermal decomposition:-



Kolbe Synthesis



Esterification



(2)

③ Industrial preparations:

a) from carbon (ii) oxide :- methanoic acid (formic acid) is manufactured by adding carbon (ii) oxide under pressure to hot aqueous solution of NaOH. The free carboxylic acid is liberated by careful reaction with H_2SO_4

$$CO \xrightarrow{NaOH} HCOONa \xrightarrow{H_2SO_4} HCOOH + NaHSO_4$$

b) from ethanol : ethanoic acid is obtained by the liquid phase air-oxidation of 5% solution of ethanal to ethanoic acid using manganese (ii) ethanoate catalyst. Ethanol is obtained from ethylene

$$HC=CH \xrightarrow{\text{dil } H_2SO_4 / HgSO_4} CH_3CHO \xrightarrow{O_2 / (CH_3COO)_2Mn} CH_3COOH$$

c) From Petroleum : Liquid phase air oxidation of C₅-C₇ alkenes, obtainable from Petroleum at high temp & pressure will give C₅-C₇ carboxylic acids with methanoic, propanoic & butanoic acids as by products

$$C_5-C_7 \xrightarrow{\alpha / \text{high temp \& pressure}} C_5-C_7 \text{ carboxylic acids}$$

④ Synthetic preparations:

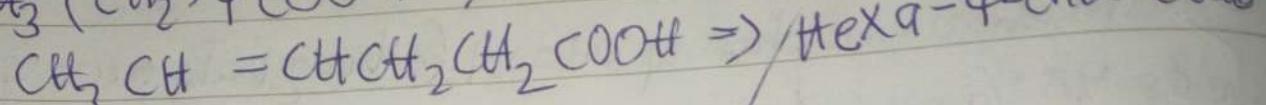
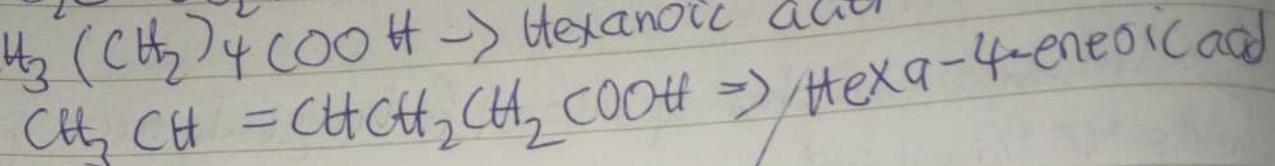
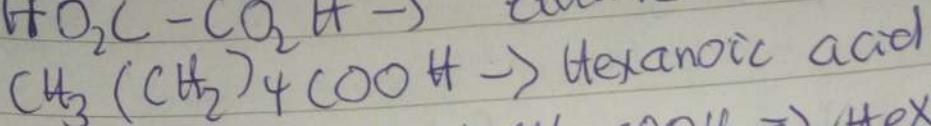
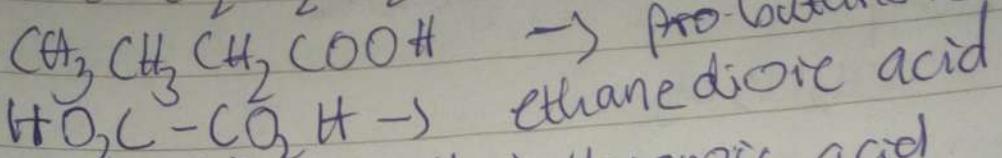
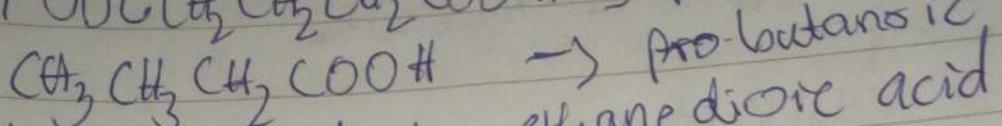
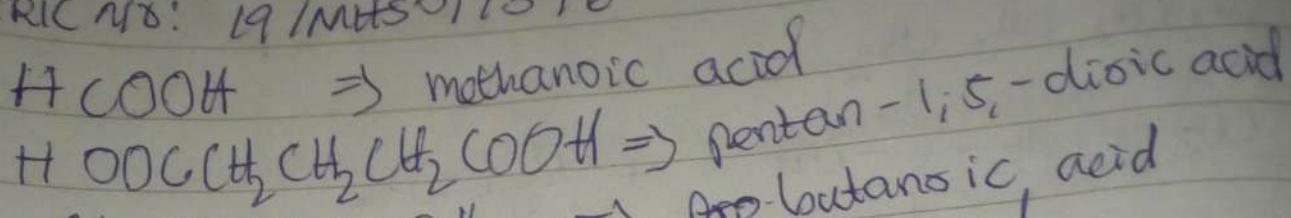
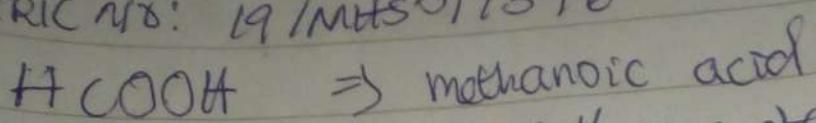
a) Oxidation of primary alcohols & aldehydes using the usual oxidizing agents (i.e. $K_2Cr_2O_7$ or $KMnO_4$) in acidic solution gives carboxylic acids

$$RCH_2OH \xrightarrow{[O] \text{ excess acid } KMnO_4} RCHO \xrightarrow{[O]} RCOO^-$$

b) Carbonylation of Grignard reagent : Aliphatic carboxylic acids are obtained by bubbling CO_2 in the Grignard reagent & then hydrolyzed with dil. acid.

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①



② (a) Physical appearance:

all simple aliphatic carboxylic acids up to C_6 are liquids at room temperature. most other carboxylic acids are solid at room temp, although anhydrous carboxylic acid also known as glacial ethanoic acid freezes to an ice-like solid below room temp.

③ Boiling points: boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids & have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

④ Solubility: lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water. all carboxylic acids are soluble in organic solvents. water solubility of acids decreases as the relative molecular mass increases.