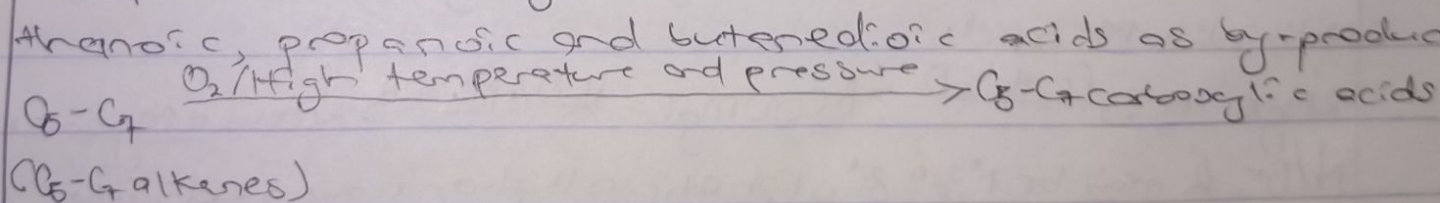


b Boiling Point: Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher boiling points than their aliphatic counterparts of comparable relative molecular mass.

c Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water; this 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 water.

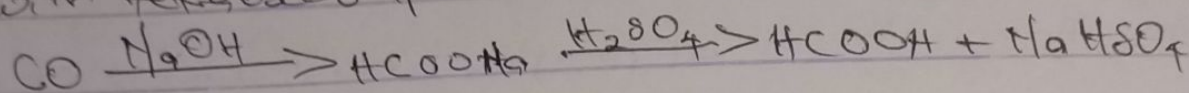
3) Industrial Preparations of Carboxylic Acids

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



b From Carbon(II) oxide: Methanoic acid (formic 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)



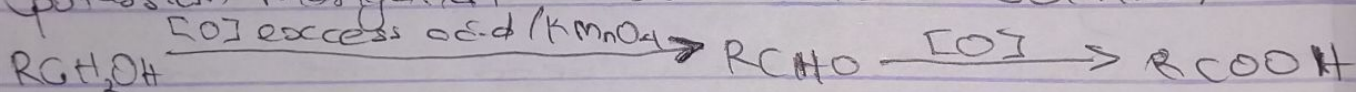
4) Synthetic Preparations of Carboxylic Acid

a) Oxidation of Primary Alcohols and Aldehydes

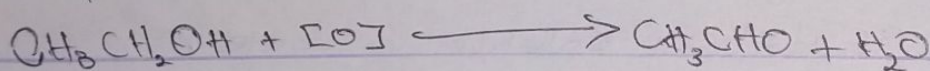
Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents

(i.e. $K_2Cr_2O_7$ (potassium dichromate (vi)) or $KMnO_4$

(potassium manganate (vii)) in acidic solution.

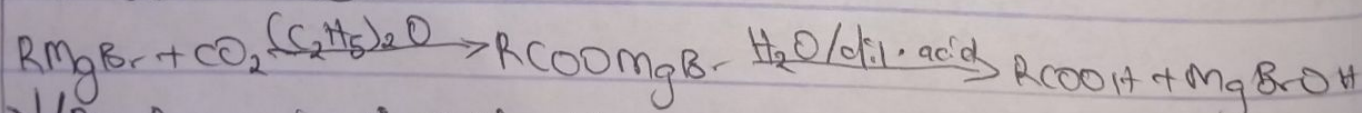


Example: oxidation of ethanol to ethanoic acid



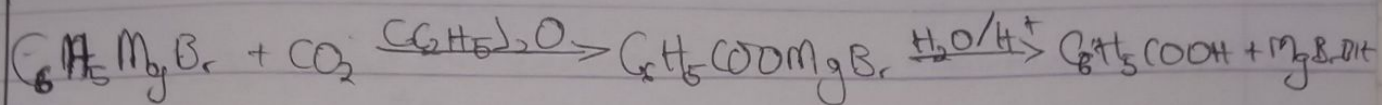
b) Carbonation of Grignard Reagent

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



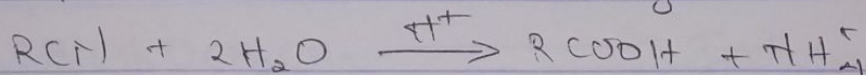
N/B: R may be 1°, 2°, 3° aliphatic alkyl or aryl radicals.

In the preparation of benzoic acid, the reagent is added to the solid carbon(IV)oxide (dry: e) which also serves as coolant to the reaction mixture.

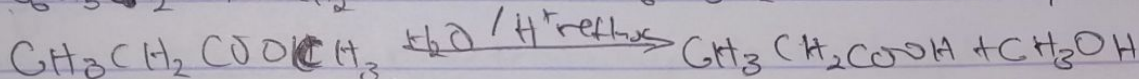
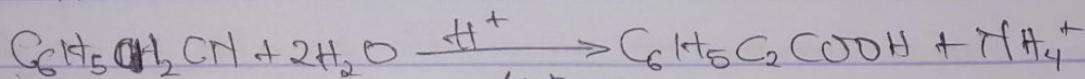
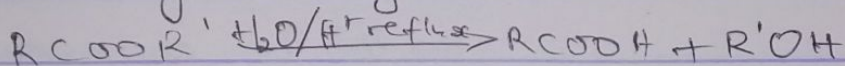


c Hydrolysis of Nitriles (or amides) or Esters:

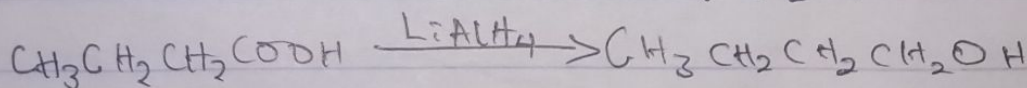
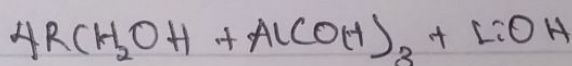
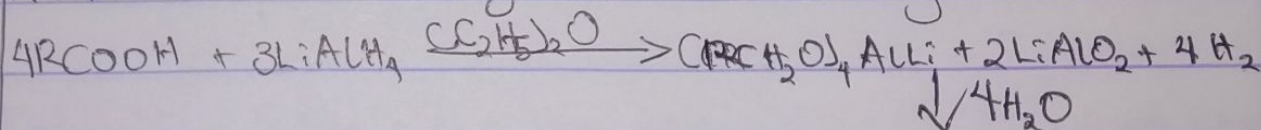
Nitriles undergo hydrolysis to form amides. The amides further undergo reaction in the presence of a catalyst when they form carboxylic acids. The catalyst for this reaction is H^+ or OH^- . Further more, application of mild reaction condition helps in ceasing the reaction in the amide stage.



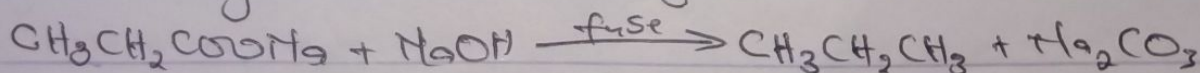
(R = alkyl or aryl radical)



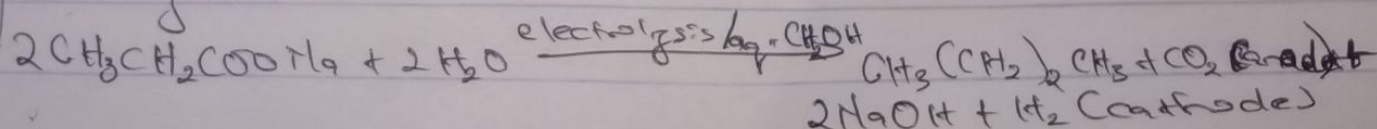
5) Reduction of Carboxylic Acid to Primary Alcohol



b Decarboxylation of Carboxylic Acid



Kolbe synthesis



c Esterification

