

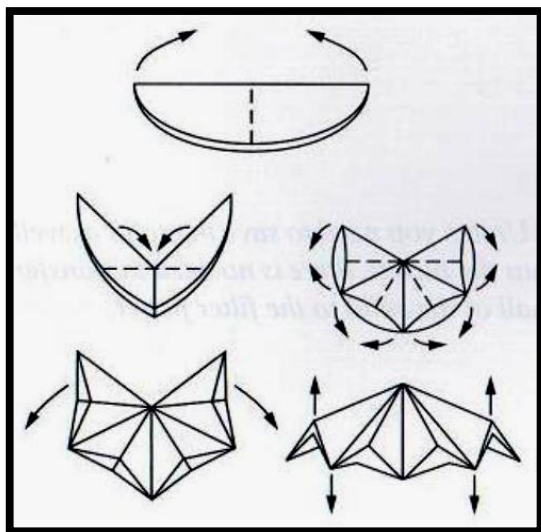


Figure 1: Making a fluted filter paper

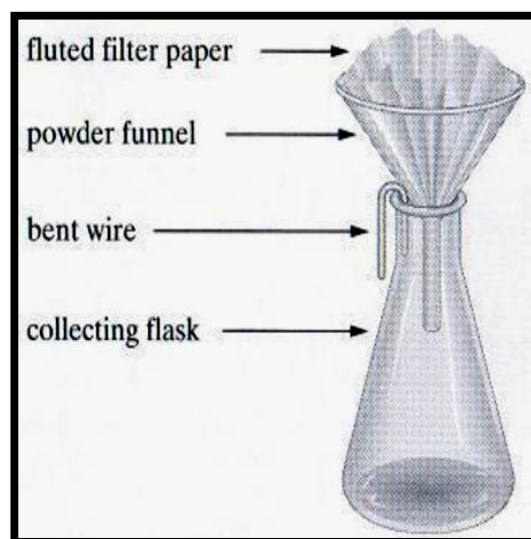


Figure 2: Apparatus for gravity filtration

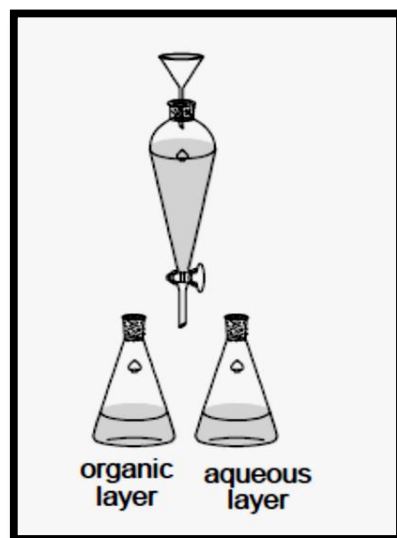
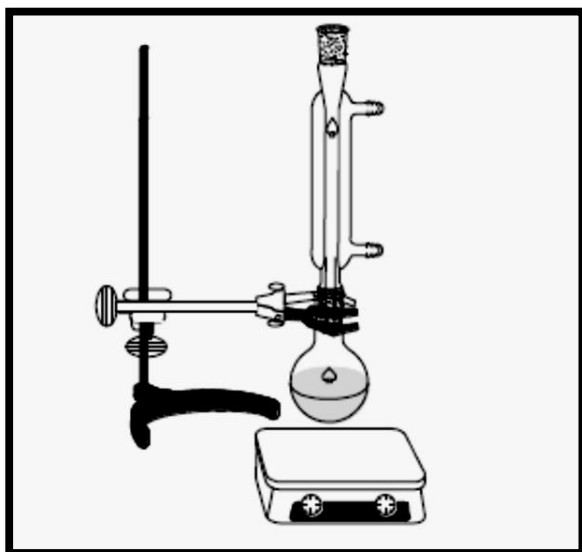
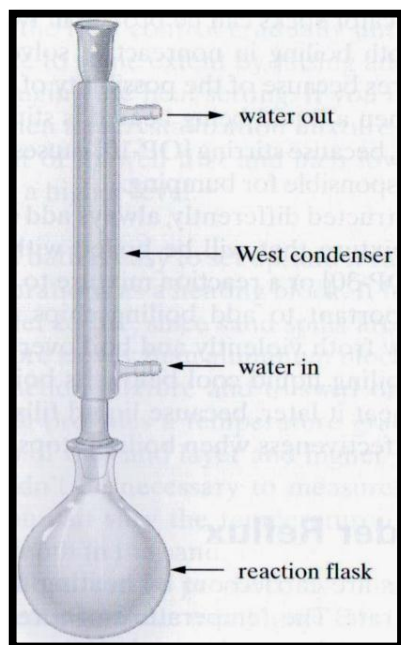


Figure 3: reflux appliance

Figure 4: Apparatus for heating under reflux

Figure 5: separating funnel

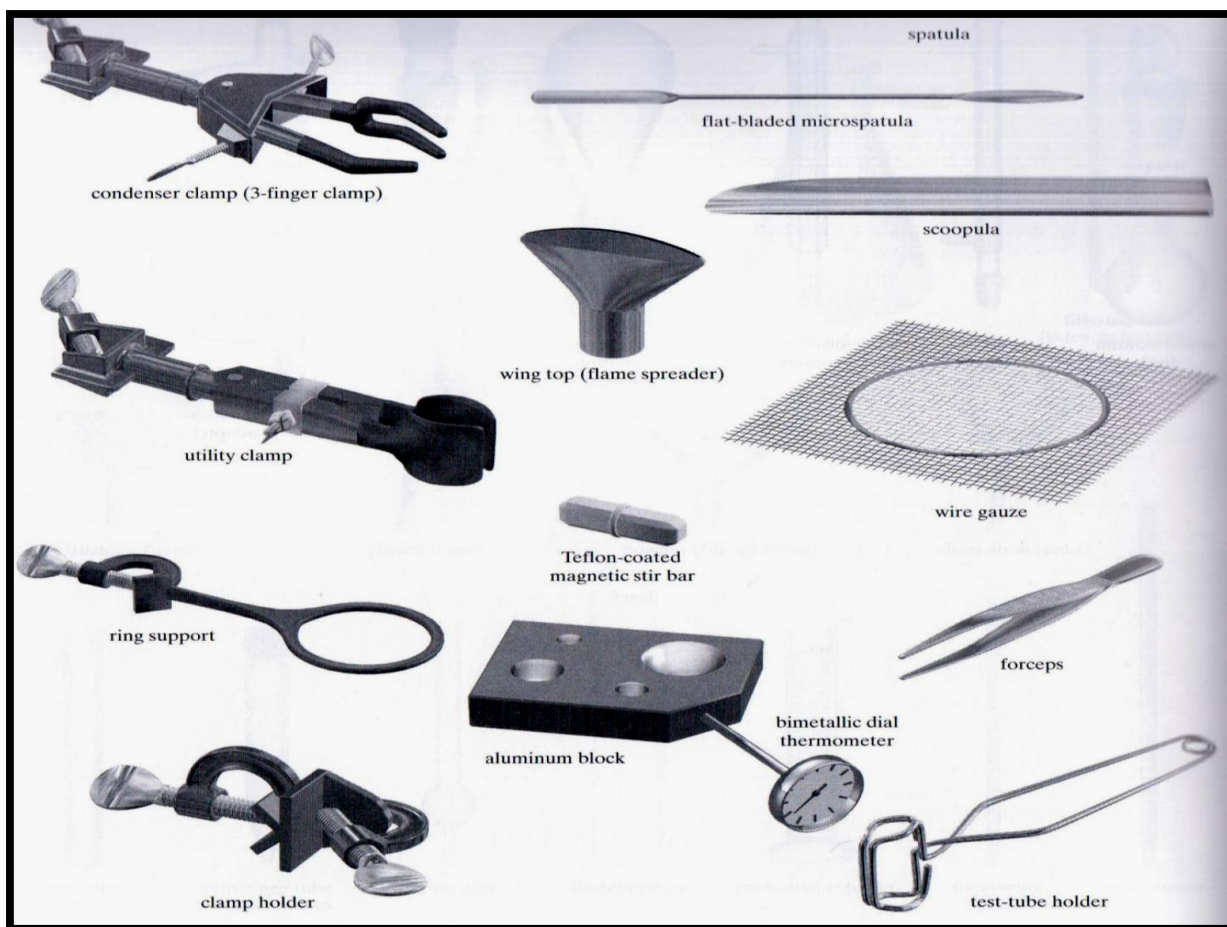


Figure 6: Hardware

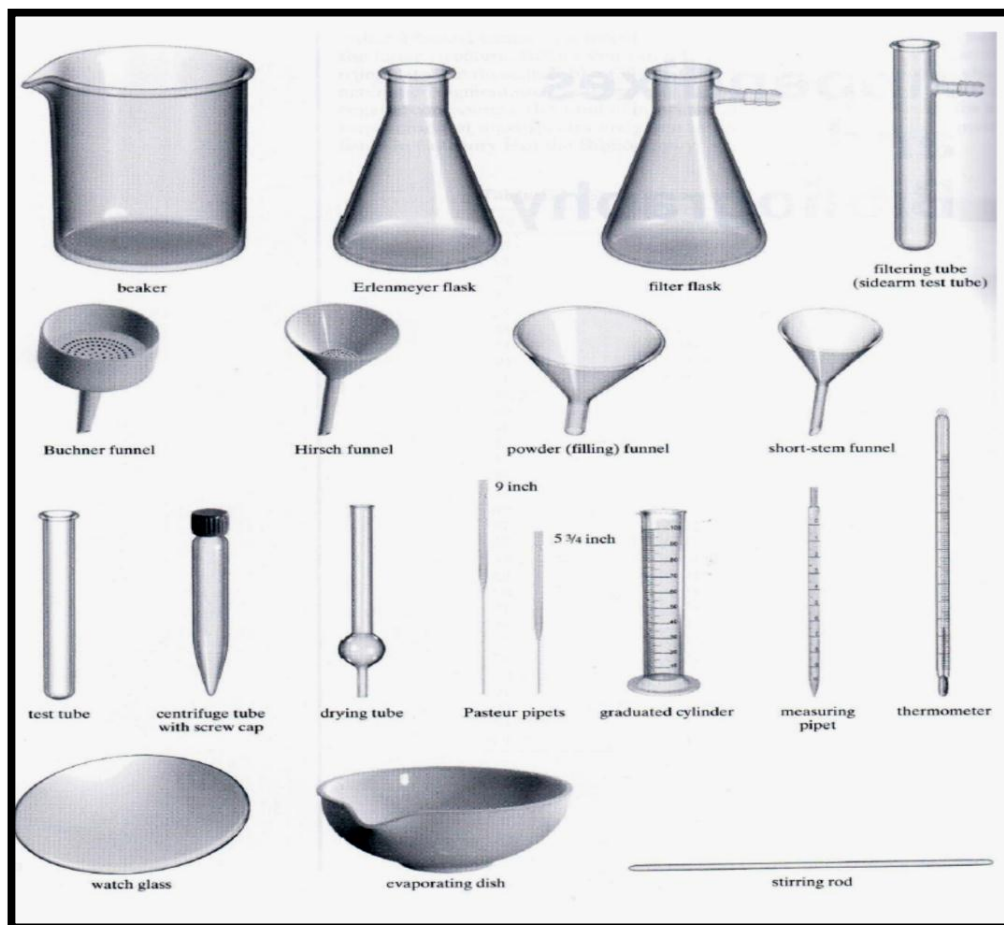


Figure 7 :Chemical glassware

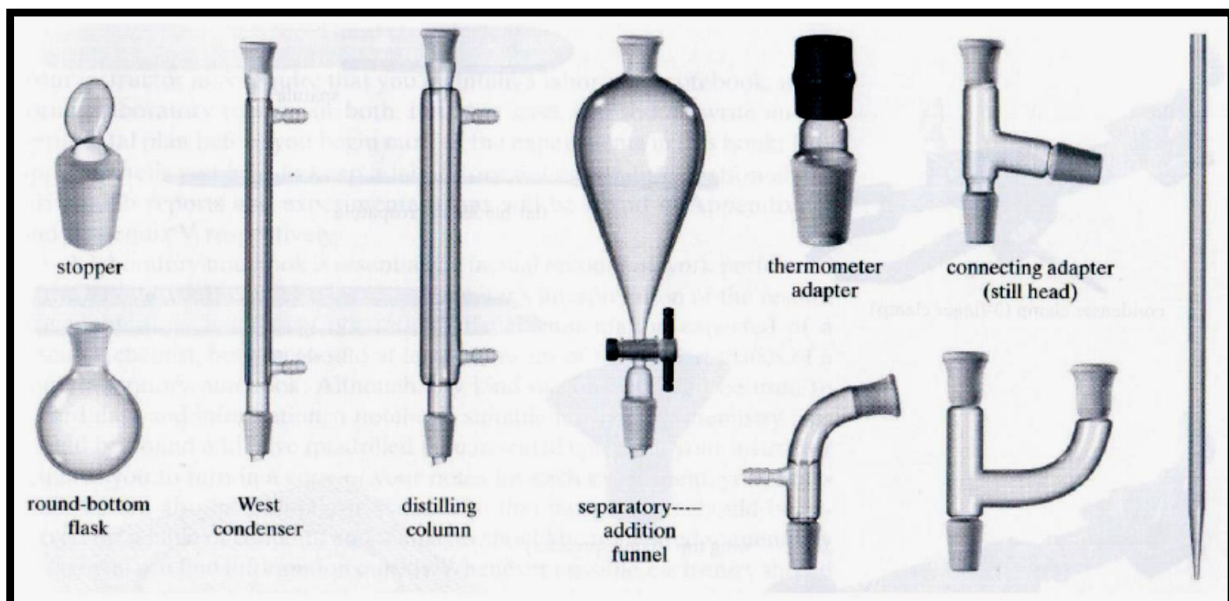


Figure 8 :Lab kit component

Calculations :

Mass of product expected: _____ g

Mass of product obtained: _____ g

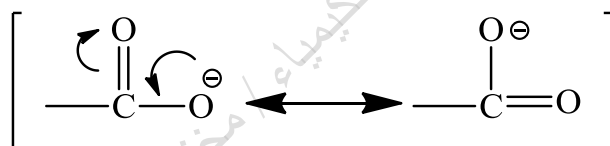
$$\text{Percent chemical yield} = \frac{\text{Mass of product obtained}}{\text{Mass of product expected}} \times 100$$

Experiment 1

Preparation carboxylic acid by cannizzaro reaction

Theoretical part:

Carboxylic acid : is an organic compound that contains a carboxyl group, and show appreciable acidity . The general formula of a carboxylic acid is $R-COOH$, with R referring to an alkyl group or to an aryl group. The acidity of a carboxylic acid is thus due to the powerful resonance stabilization of its anions . This stabilization and the resulting acidity are possible only because of the presence of the carbonyl group. According to the resonance theory , then, a carboxylate ion is a hybrid of two structures which , being of equal stability , contribute equally. Carbon is joined to each oxygen by “one-and-a-half” bond. The negative charge is evenly distributed over both oxygen atoms.



Names of carboxylic acids:

- 1- **The common names:** That refer to their sources rather than to their chemical structure , such as formic acid, adds the sting to the bite of an ant (Latin: *formica*, *ant*) ,Butyric acid gives rancid butter its typical smell (Latin: *butyrum*,*butter*).

2- The International Union of Pure and Applied Chemistry (IUPAC) system :

Follow the usual pattern. The longest chain carrying the carboxyl group is considered the parent structure , and is named by replacing the $-e$ of corresponding alkane with ***-oic acid***.

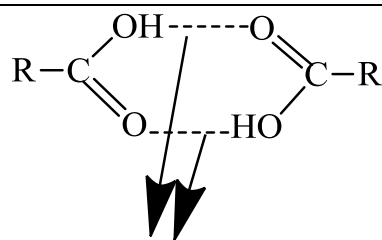
Examples:

Alkane $\longrightarrow$ Alkan**oic acid**

Compound formula	Opposite alkane name	Acids name (IUPAC) system	Acids name common names
CH ₃ COOH	Ethane	Ethan oic acid	Acetic acid
CH ₃ CH ₂ COOH	Propane	Propan oic acid	Propionic acid

Physical Properties of carboxylic acids :

- 1- As we would expect from their structure , carboxylic acid molecules are polar , and like alcohol molecules can form hydrogen bonds with each other and with other kinds of molecules. The aliphatic acid therefor show very much the same solubility behavior as the alcohol :the first four are miscible with water , the five –carbon acid is partly soluble , and the higher acids are virtually insoluble . Water solubility undoubtedly arises from hydrogen bonding between the carboxylic acid and water .The simplest aromatic acid ,benzoic acid ,contains too many carbon atoms to show appreciable solubility in water.
- 2- The carboxylic acid are even higher boiling than alcohols, this very high boiling points are due to the fact that a pair of carboxylic acid molecules are held together not by one but two hydrogen bonds.

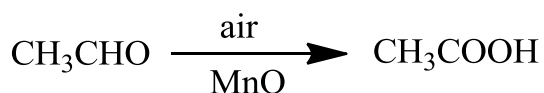
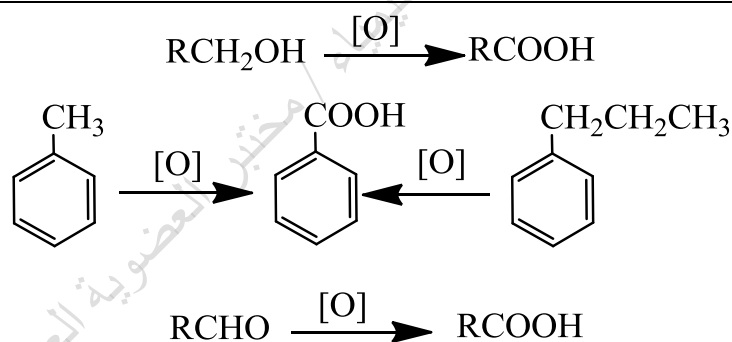


Hydrogen Bond

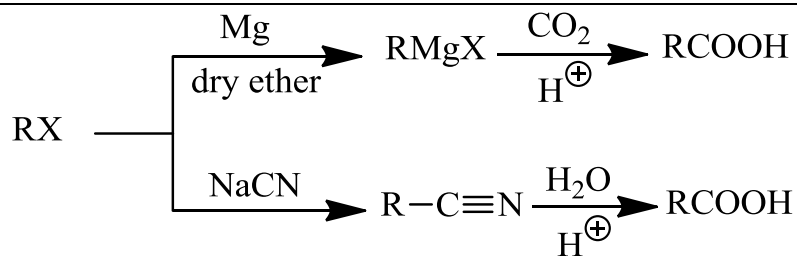
3- The odors of the lower aliphatic acid progress from the sharp , irritating odors of formic and acetic acids to the distinctly unpleasant odors of butyric , valeric and caporic acids : the higher acids have little odor because of their low volatility .

Preparation of carboxylic acids :

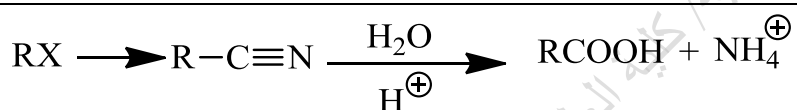
1- Oxidation:.



2- The carbonation of Grignard reagents:

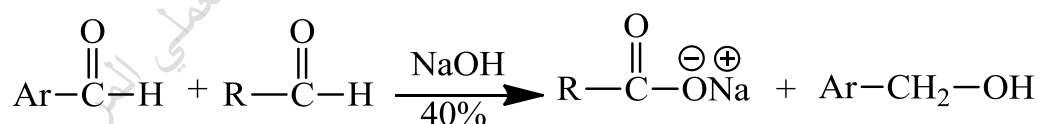


3- Hydrolysis of nitriles:

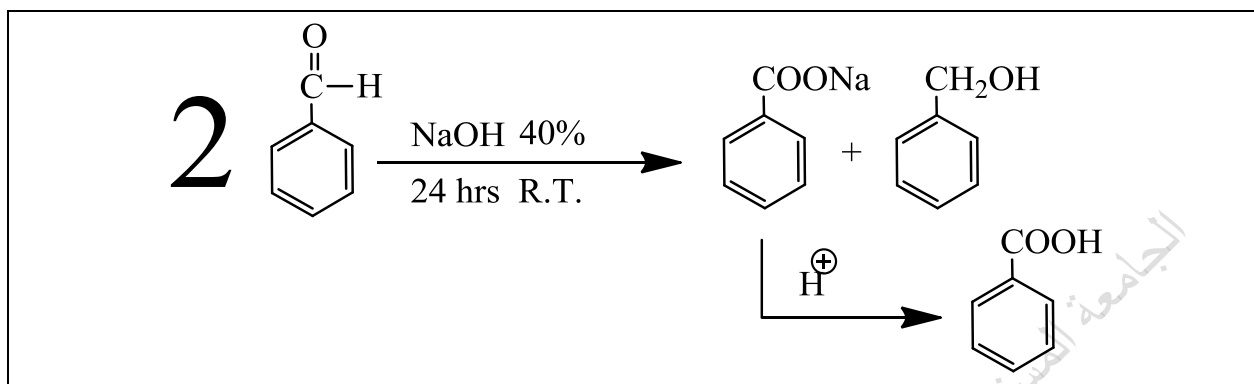


4- Cannizzaro reaction:

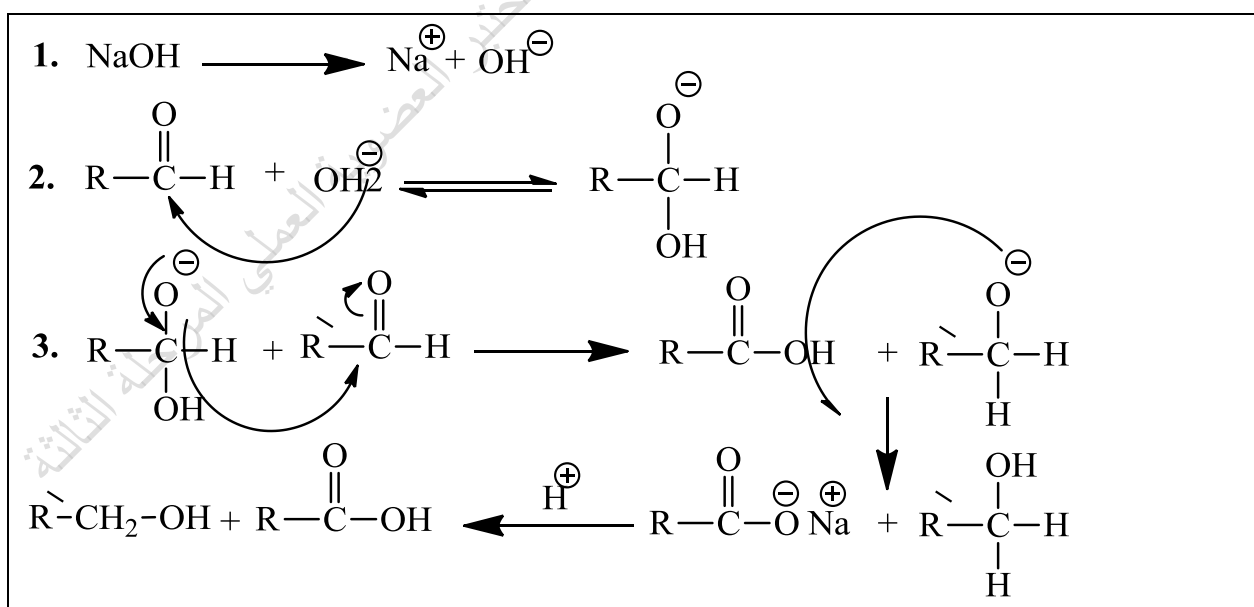
Aromatic aldehyde (and other aldehydes in which α -hydrogen atoms are absent, e.g. formaldehyde and trimethylacetaldehyde) under the influence of strong aqueous or alcoholic alkali undergo simultaneous oxidation and reduction yielding the alcohol and corresponding carboxylate salt. Thus:



E.G. : preparation benzoic acid:



The mechanism for the reaction involves the production of anion which may transfer a hydride ion to a carbonyl carbon atom in another aldehyde molecule. The reaction sequence is completed by a proton transfer to yield the carboxylate anion and the alcohol.:



Uses of benzoic acids:

- 1- dye intermediates, installation of paint, antiseptic steel and plastic intense.
- 2- Benzoic acid pharmaceutical grade: used as preservatives, antimicrobial agent. It is found in toothpastes and mouthwashes.

Experiment :

- 1- Pour 3 ml pure Benzaldehyde and 9 ml of sodium hydroxide (40%) into 250-ml conical flask and cork the conical securely with rubbery stopper.
- 2- Shake the mixture vigorously until it has been converted into a thick emulsion .
- 3- Allow the mixture to stand overnight or for 24 hrs. in the stoppered conical .
- 4- Add just 10 ml water to the mixture and pour the liquid into separator funnel .
- 5- Rinse out the bottle with about few milliliters of ether and add this ether to the solution in the funnel .
- 6- Shake the solution with 10 ml of ether several times .
- 7- Separate the lower aqueous solution and save it.
- 8- Pour the aqueous solution remaining with stirring into a mixture of 8 ml of concentrated hydrochloric acid , 8 ml of water and about 10 gm. of crushed ice.
- 9- Filter the precipitated benzoic acid , wash it with a little cold water , drain and recrystallize from boiling water. (m.p.=120-121).
- 10- Weigh the product and calculate the percentage range.

Experiment 2