

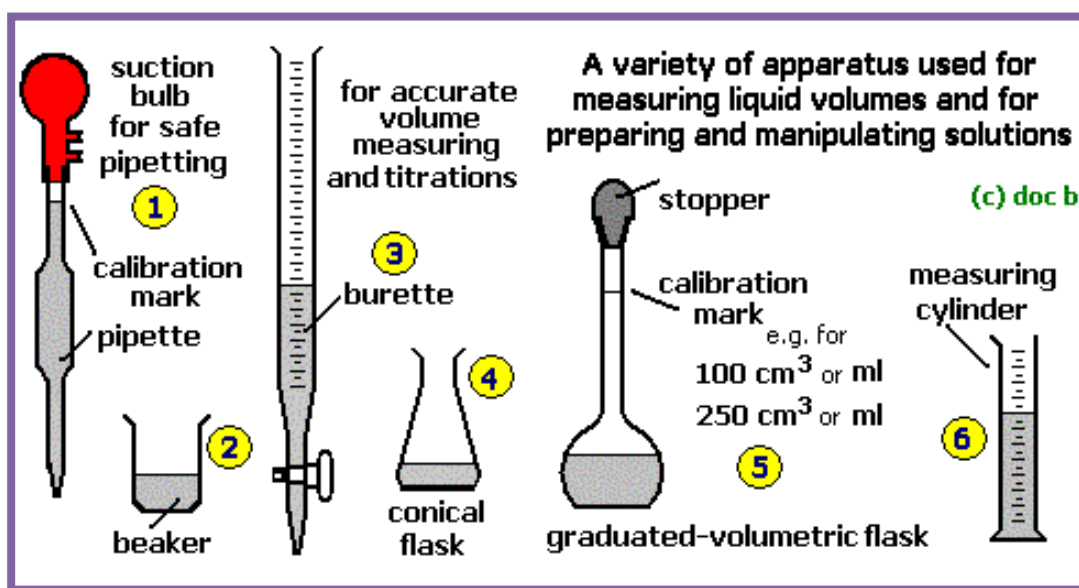


University of Technology  
Petroleum Technology Department



## Chemistry Lab Guide

### For: First Stage



### Laboratory staff

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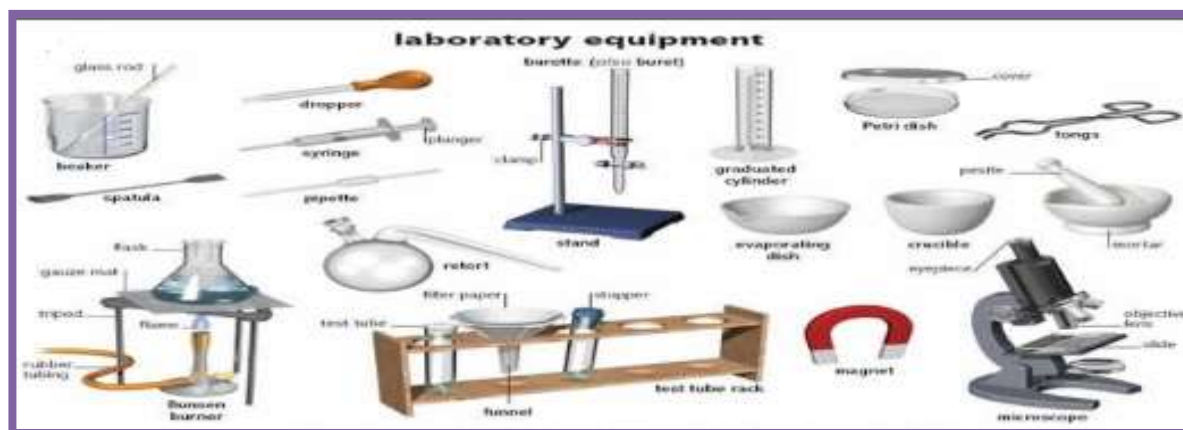
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# A List of Chemistry Laboratory Tools and Apparatus



### Name of device: PH meter

#### **Description the device :**

- 1- pH electrode.
- 2- Temperature prod.
- 3- Reference electrode.
- 4- Plug in power supply.



### Name of device: Fume Hood

#### **Description the device:**

Fume cub board is a type of local ventilation device that is designed to limit exposure to hazardous or taxis fumes , vapor ,or dust.



### Name of device: Heating mentle

#### **Description the device :**

- 1-Temp operation up to 45c.
- 2-Flask vol. upto 20L.
- 3-Flexible glass jar heating mental
- 4- Plastic content metal housing
- 5-High quality design
- 6- Thermally insulated and earth
- 7-Residual current detection



### Name of device: Termax drying oven

#### **Description the device:**

- 1-Temp range up to 250c
- 2-PID temp control
- 3-Digital calibration
- 4-Alarm
- 5-Timer
- 6-Data logging
- 7-Safety thermostat
- 8-Four speed fan



### Name of device: Water distillation

#### **Description the device :**

The distillation apparatus, commonly called a 'still', consists of a vessel for plant material and water, a condenser to cool and condense the vapor produced and a method of collection, or 'receiver'



### Name of device: Electronic balance

#### **Description the device :**

Capacity 200gm

Accuracy 0.01 gm , Ac power four batteries balance has an external calibration system include a 100gm calibration weight

The allow the used to quickly and accurately measure the mass of a substances level of accuracy impossible for traditional balance to a chive.



**Name of device: Sensitive balance**

**Description the device :**

- 1-Operating temp :10 to 30c , 50 to 86F
- 2-Automatic calibration with external weight
- 3- Auto shut off battery mode low battery indication .



**Name of device: Magnatic stirrer**

**Description the device :**

The unit design for operation with magnetic stirrer element of length 20-30 mm .the device is operated with the help of controls situated on the front peal the initial heating of the hot



**Name of device: Water bath**

**Description the device :**

- 1-cover frame and lid have mirror finish .lift up ,insult lid with liner chamber ,no dripping back of condensate into the tubes
- 2- corrosion resistance outer housing made of electrolyte galvanized sheet steel powder coat



## Name of device: Refractive meter

### Description the device :

- 1-dual level LCD
- 2- Automatic temperature control ATC
- 3-Easy setup and storage
- 4- Battery operation with low power indicator (BEPS)
- 5- Auto turns off after 3 min



## First semester

For the first semester, first-year petroleum technology students study laboratory analytical chemistry .

## Analytical chemistry

Analytical chemistry is often described as the area of chemistry responsible for characterizing the composition of matter, both qualitatively (Is there any lead in this sample) and quantitatively (How much lead is in this sample). As we shall see, this description is misleading. Analytical chemistry is the study of the separation, identification, and quantification of the chemical components of natural and artificial materials.

*1-Qualitative analysis*

*2- Instrumental methods.*

**3-Quantitative analysis are classified to:**

**1-Gravimetric analysis    2-Volumetric analysis**

**A Titration** is a method of analysis that will allow you to determine the precise endpoint of a reaction and therefore the precise quantity of reactant in the titration flask. A burette is used to deliver the second reactant to the flask and an indicator or pH Meter is used to detect the endpoint of the reaction.

## List of laboratory experiments of Analytical Chemistry course

### **Experiment No.(1) : preparation of standard**

#### **Primary Standard Solution:**

The primary standard is a highly purified compound that serves as a reference material in volumetric and mass titrimetric methods. The accuracy of a method is critically dependent on the properties of this compound. Important requirements for primary standard are the following

Standard materials are classified into:-

- 1- Standard materials primary
- 2- Standard materials secondary

### **Experiment No.(2) : preparation of standard and secondary solution**

Some compounds consider as secondary standard solution due missing one of the important requirements for primary standard. For that can prepare as an approximate normal solution and then calibrate with a known standard

chemical solution by volumetric analysis. Such as: hydrochloric acid HCL, sodium hydroxide NaOH .

### Materials and chemicals

- 1- Balance
- 2- Beaker
- 3- Washing bottle
- 4- Volumetric flask
- 5- Glass rod
- 6- Sodium Carbonate
- 7- Hydrochloric acid

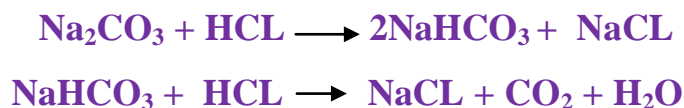


### Experiment No.(3) : Titration of Hydrochloric acid with Sodium Carbonate

Accurate normality of sodium carbonate to standardize the hydrochloric acid solution as the following reaction :



You can continue to interact using methyl orange as evidence that the first unreacted needs mole is one of hydrochloric acid to convert sodium carbonate into sodium bicarbonate And that the second mole of hydrochloric acid, sodium bicarbonate converts to dual-dioxide and water as in the following interaction





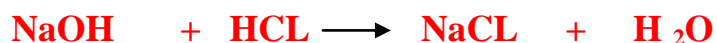
## Materials and chemicals

- 1- Pipet
- 2- Conceal flask
- 3- Buret
- 4- Sodium Carbonate
- 5- Hydrochloric acid
- 6- Methyl orange(M.O)



## **Experiment No.(4) : Titration of Hydrochloric acid with Sodium Hydroxide**

The sodium hydroxide is a white crystals quickly dissolve after exposure to the atmosphere, and even during weight so it cannot be used as a solution first record with a secondary standard solution of diluted hydrochloric acid and sodium hydroxide can be standardized calculation according to the following equation



## Materials and chemicals

- 1- Pipet
- 2- Conceal flask
- 3- Buret
- 4- Sodium Hydroxide
- 5- Hydrochloric acid
- 6- Phenol naphthalene (Ph.Ph)



### **Experiment No.(5) : Reaction of Mixture (base strong and base weak)with acid strong**

that to determine the quantities of the carbonate and hydroxide in mixture, we will use volumetric titration with two different acid-base indicators in the same solution.

- Sodium hydroxide is strong base in will be the first react with HCl with ph.ph as indicator worked pH (10.0-8.3), then sodium carbonate reacts with HCl according to the following equation:



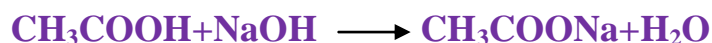
#### **Materials and chemicals**

- 1- Pipet
- 2- Conceal flask
- 3- Buret
- 4- Sodium Hydroxide
- 5- Hydrochloric acid
- 6- Phenol naphthalene (Ph.Ph)
- 7- Methyl orange(M.O)



### **Experiment No.(6) : Acidity of Vinegar**

Vinegar contains about 5%by volume acetic acid  $\text{CH}_3\text{COOH}$  most of the remaining 95%is water plus small quantities of ethyl alcohol and other carboxylic acid. The acid contents or vinegar may determine quantitatively by volumetric titration with standard solution of sodium hydroxide solution using phenolphthalein indicator.



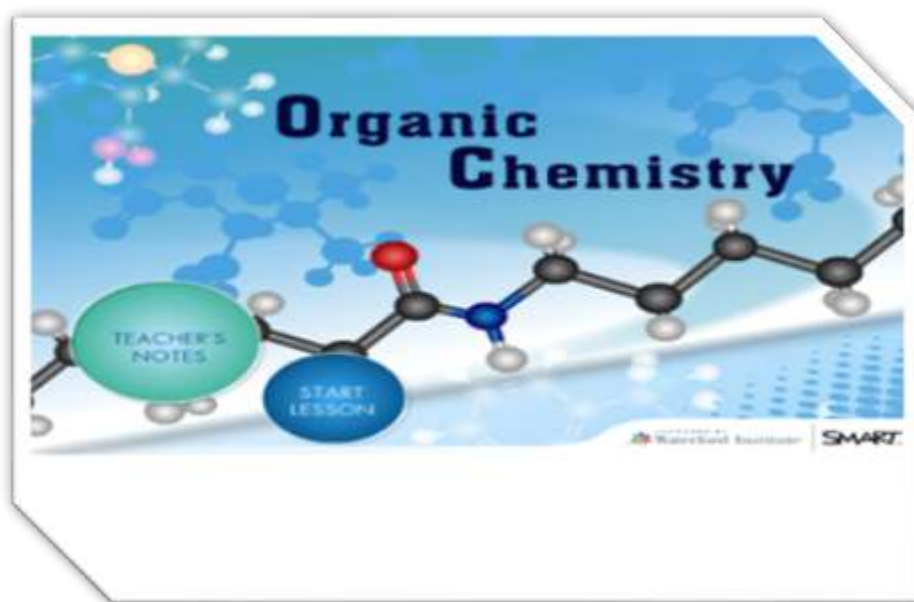
## Materials and chemicals

- 1- Buret
- 2- Conceal flask
- 3- Pipet
- 4- Phenol naphthalene (Ph.Ph)



## Second semester

For the second semester, first-year petroleum technology students study laboratory organic chemistry.



# Organic Chemistry

is the study of the compounds of carbon structure, properties, composition, Reactions and preparation. Hydrocarbons, and their derivatives. These compounds may contain any number of other elements, including Hydrogen, Nitrogen, Oxygen, the Halogens as well as Phosphorus, Silicon, and Sulfur

List of laboratory experiments with procedure and calculations for each experiment of Organic Chemistry

## Experiment no. (1): Melting point determination

**The melting point of crystal solid** is the temperature at which the solid begins to change into liquid under atmospheric pressure. For powder substance, the change from the solid to the liquid state is quite sharp (within  $0.5^{\circ}\text{C}$ ). Hence the temperature is a valuable mean for identification purposes and an important criterion of purity.

### Materials and chemicals

- 1 - capillary tube.
- 2- Bunsen burner.
- 3- thermometer.
- 5- Oil bath
- 6- sample



## Experiment no. (2): Boiling point

**The boiling point of liquid** is a temperature at which the vapor pressure of the liquid is equal to the external pressure exerted at any point upon the liquid surface

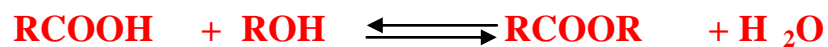
### Materials and chemicals:

- 1- Capillary tube
- 2- Bunsen burner
- 3- Thermometer
- 4- Oil bath



## Experiment no.(3): Preparation of Ester

Many of the Esters type  $\text{RCOOR}$  have pleasant odors, and are produced by the reaction of alcohol and carboxylic acids with the loss of water, according to the following equation:



### Materials and chemicals:

1-Pipet

4- Sulfuric acid

7- Boiling chips.

2-Round bottom flask

5- Heating mantel

3- Ethanol

6- Acetic acid

### Experiment no. (4): Simple Distillation

The purpose of the experiment is to separate a volatile liquid from a non-volatile substance or, more usually the separation of two or more liquids of different boiling points . This is usually called fractional distillation .

### Materials and chemicals:

1-Boiling chips

2- Thermometer

3- Heating mantel

4- Cylinder.

5- Round bottom flask.

6- Condenser.

7-Joins.



## **Experiment no. (5): Identification of functional Organic groups**

Several organic functional groups such as alcohols, Aldehydes, Ketones and esters exhibit particular specific chemical reaction which is used to test for the presence of the group, or better known as identification of organic compounds. When these groups are reacted with a specific chemical reagent, either a colored or colorless solution is formed.

### **Materials and chemicals:**

1-Test tube + Test- tube rack

2- Pipet



## **Experiment no. (6): Extraction**

Extraction one ways of purifying organic compounds, liquid, if put in contact with the solvent for tangency with a solution, the solute spreads between two layers. The solution should be shaken to increase the surface area between the two layers.

-To Calculate the concentration of organic compound( carboxy acid) in water layer and in organic solvent. So. the concentration of acid in organic layer divided to the concentration in water layer is called diffusion coefficient Symbolized by the  $k$  , As in the following equation

$$K = C_2 / C_1$$

**K = diffusion coefficient**

**C<sub>2</sub> = Solute concentration in organic layer**

**C<sub>1</sub> = Solute concentration in water layer**



### Materials and chemicals:

**1-Separating funnel.**

**2-Acetic acid**

**3-Bunsen**

**4- Conceal flask**

**5- Burette**

**6- Ph.Ph**

**7-Sodium hydroxide**