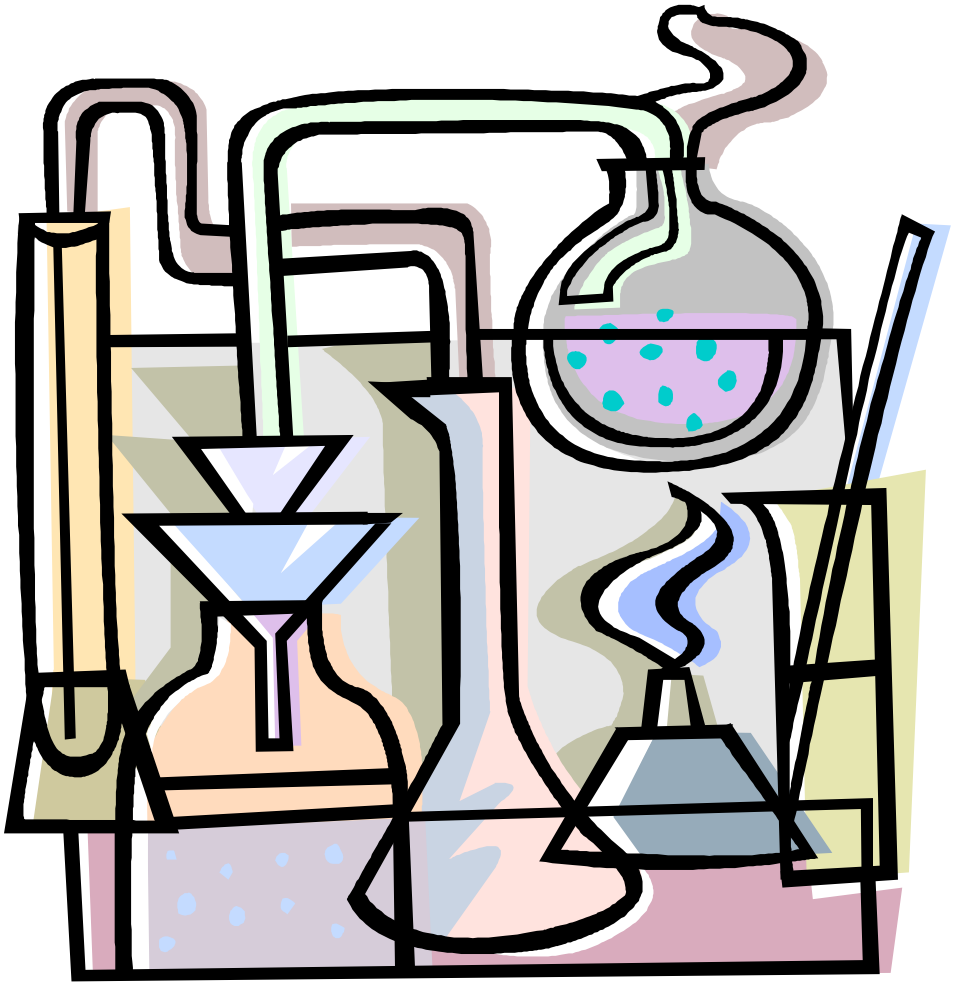
LABORATORY TOOLS & EQUIPMENT AND THEIR USES



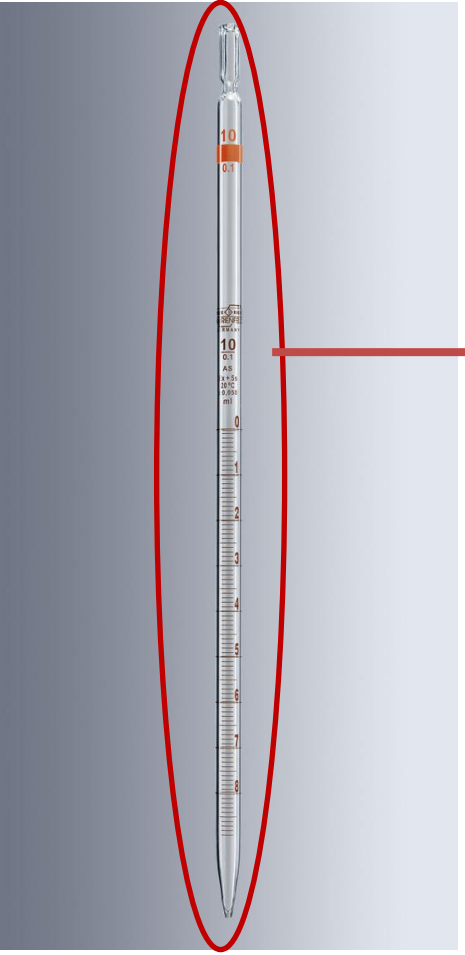
Test Tube

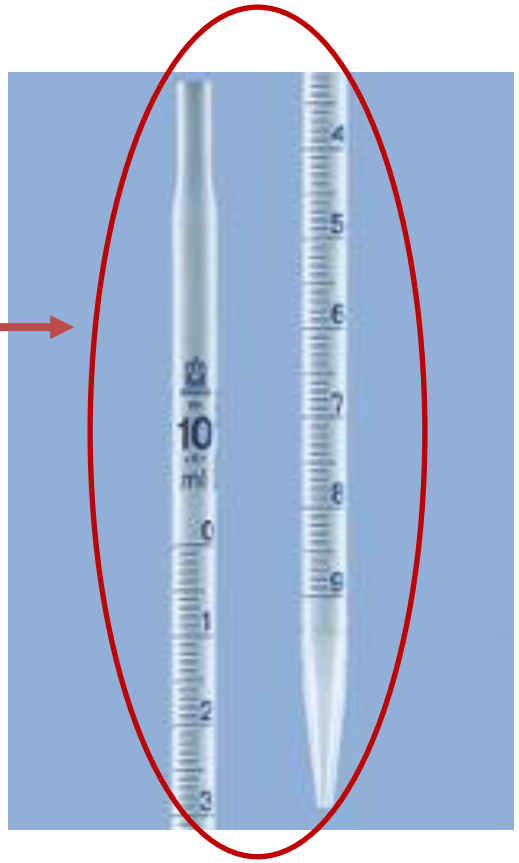
EDTA Tube

Gel Tube

Test Tube Holder (Rack)

Capillary Tube

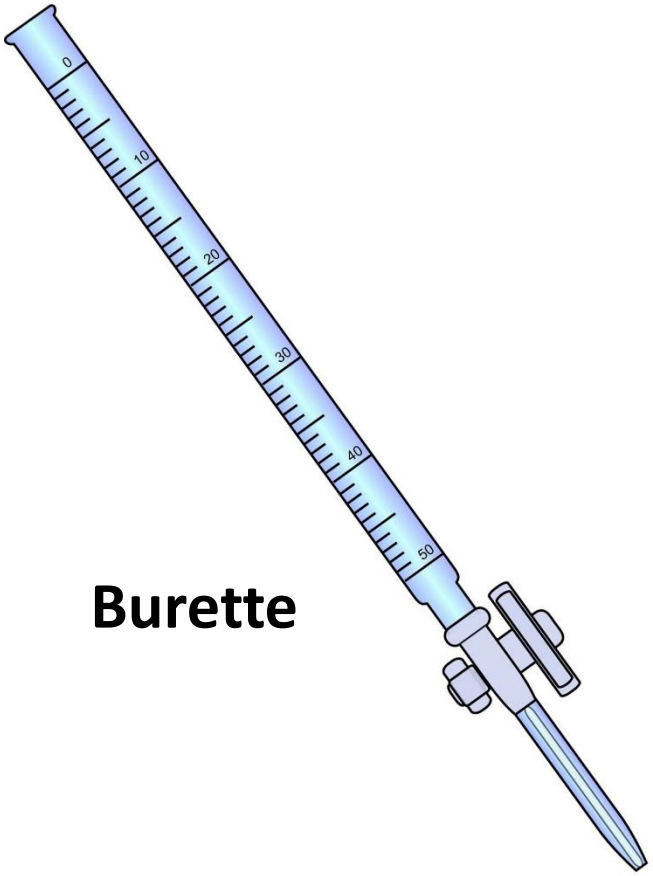




Graduated Pipette

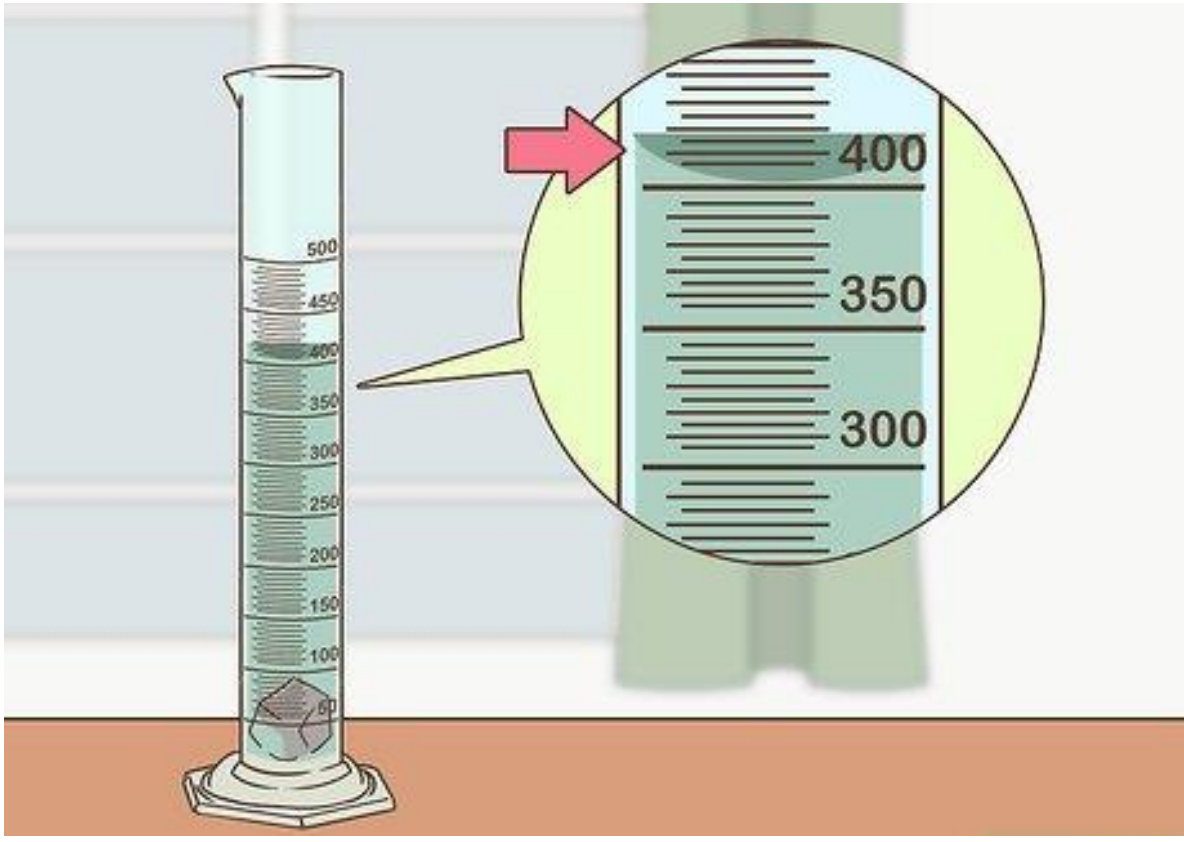
Micro-Pipette

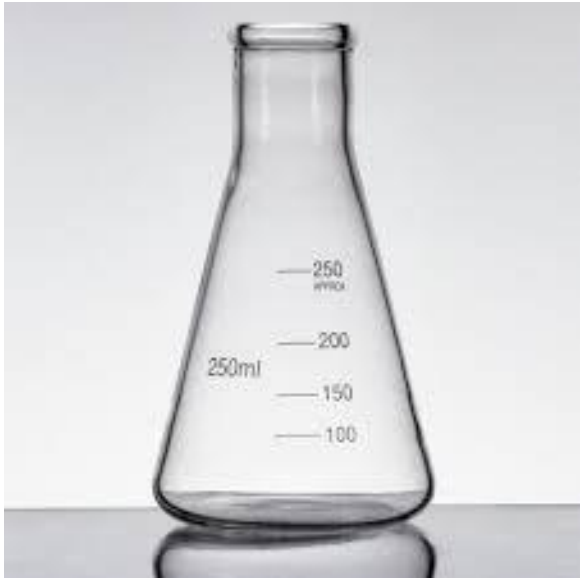
Disposable Pipette



Burette

Graduated Cylinder





Conical Flask

Round Bottom Flask

Volumetric Flask

Two-Necked Round Bottom Flask

Funnel

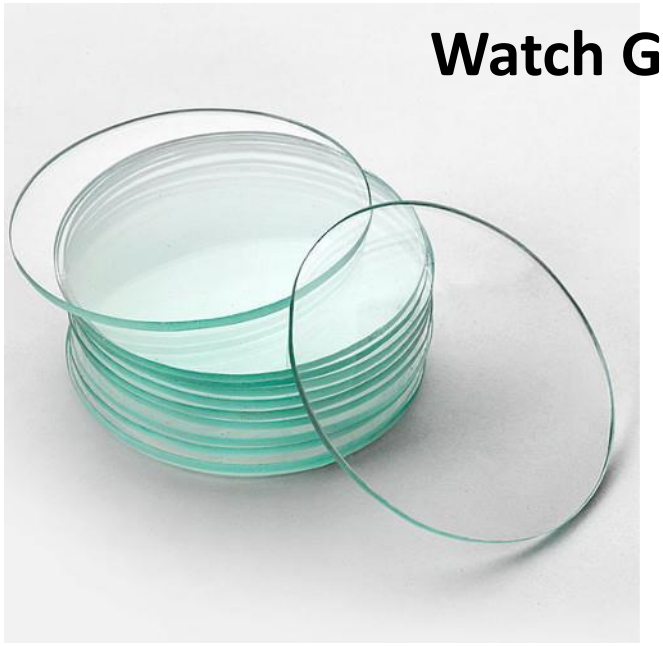
Beaker

Washing Bottle

Buchner Funnel

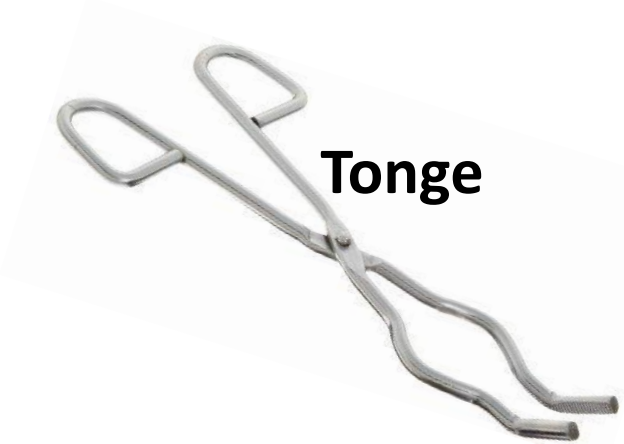
Dropper

Watch Glass



Balance

Sensitive Balance



Separation Funnel

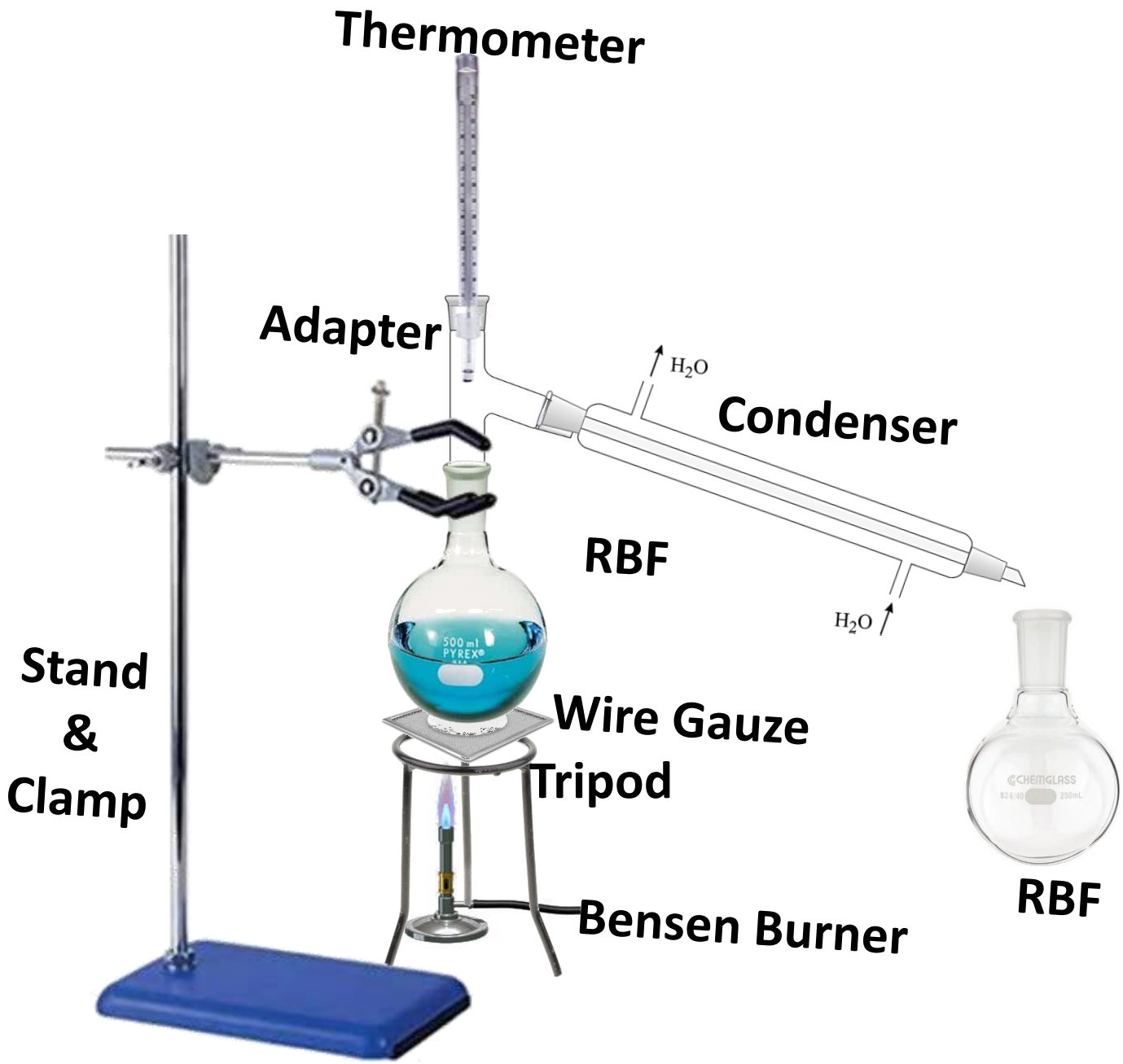
Crucible

Wire Gauze

Tripod

Bensen Burner

Mortar & Pestil


Thermometer
Adapter
H_2O
Condenser
RBF
H_2O
Stand
&
Clamp
500 ml
PYREX
Wire Gauze
Tripod
Bensen Burner
RBF

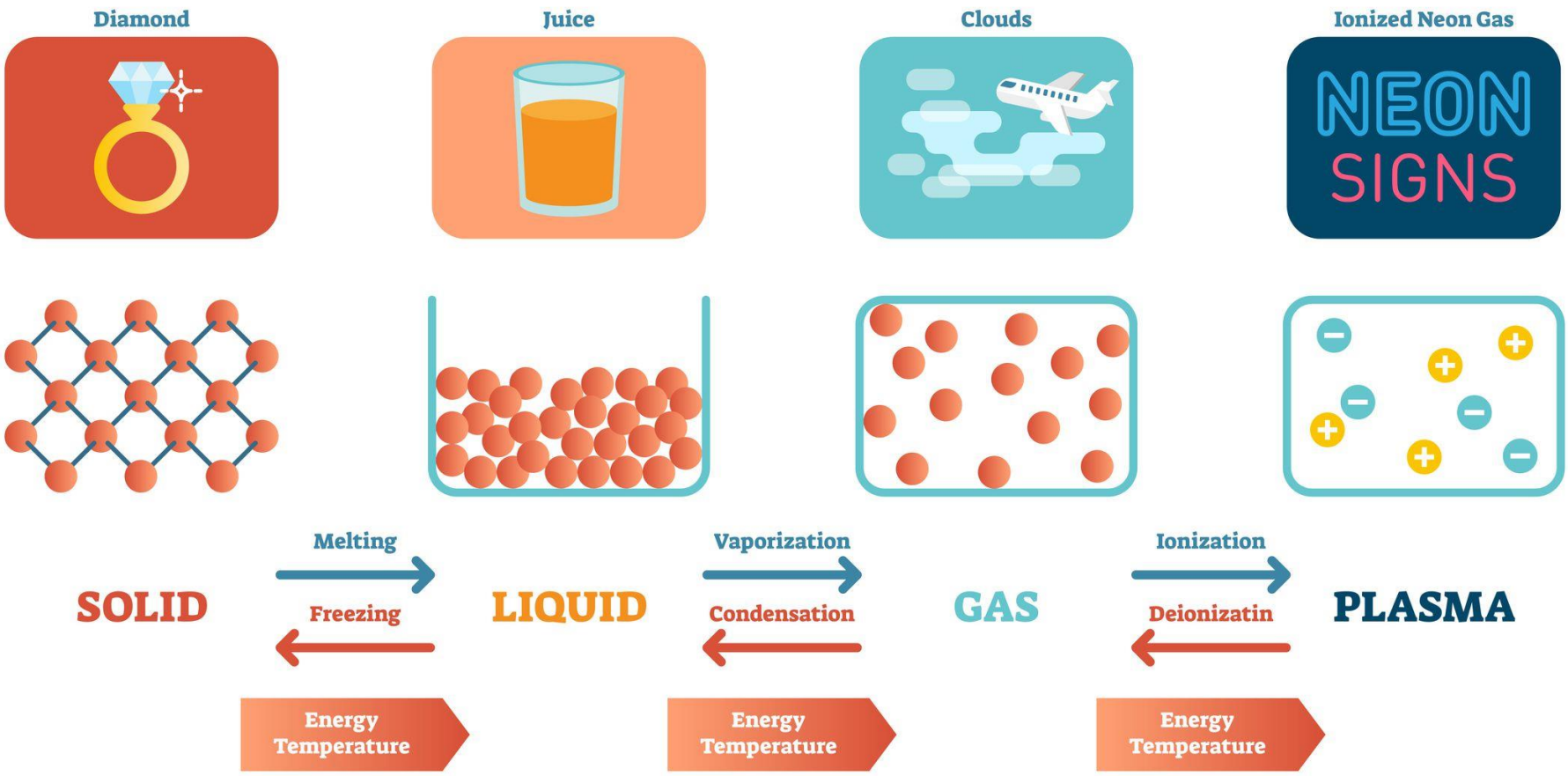
Tishk International University
Faculty of Science
Medical Analysis Department

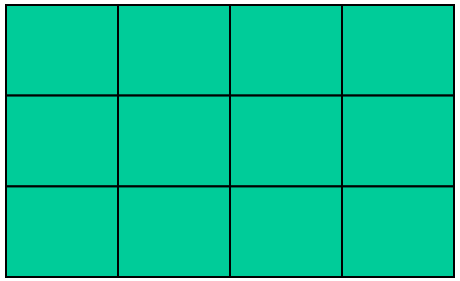
Lab. 03

Melting and Melting Point

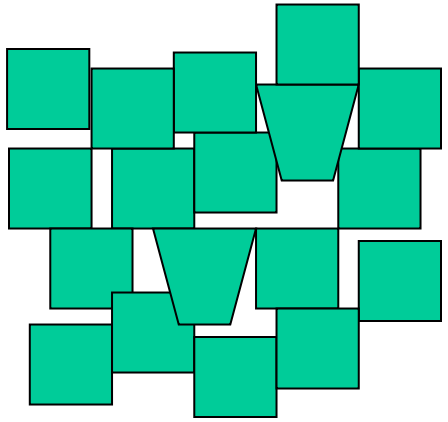
Practical General Chemistry
For
First grade Students

States of Matter





Solid Compounds



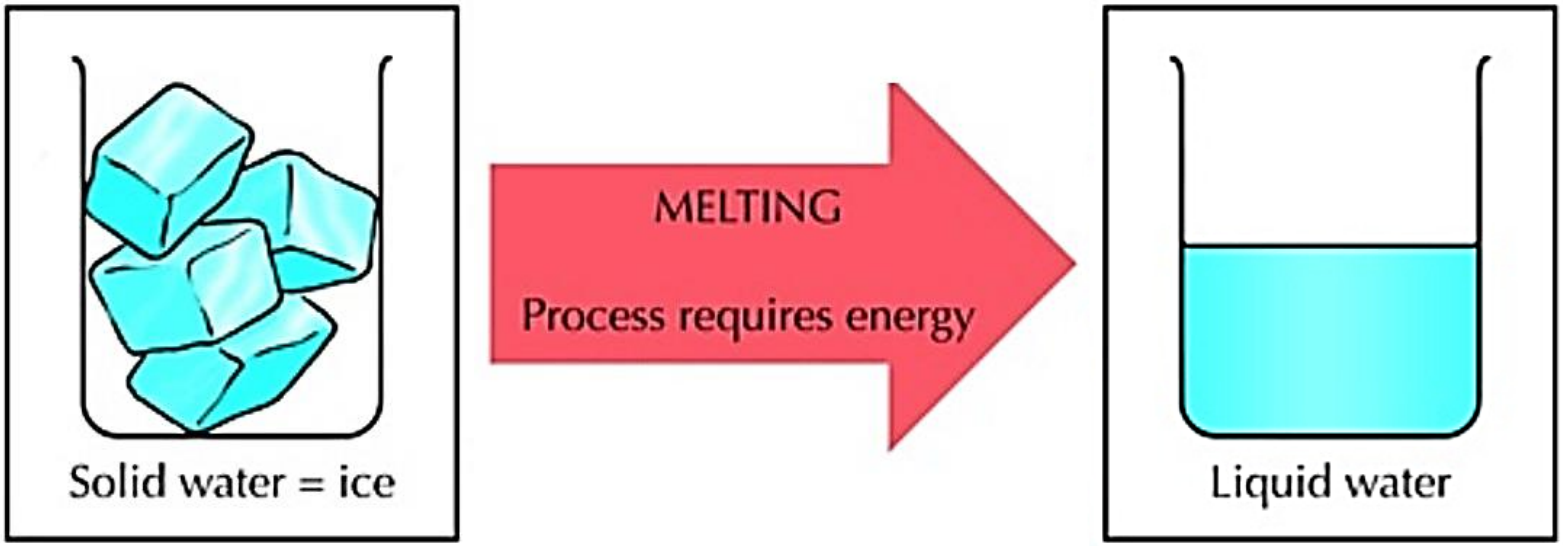
Liquid Compounds

1- High ordered arrangement of particles.
2- Low thermal energy of particles.
3- Restricted motion of particles
4- Regular shape.

1- Low ordered arrangement of particles.
2- High thermal energy of particles.
3- free motion of particles
4- Random shape.

Melting Process

Melting is a physical process in which a solid phase compound changed into liquid phase, without changing the properties of the compound



Melting point: is a temperature in which the liquid and solid are in equilibrium.

All the solid compounds during the heating gave a range, known as melting range.

Pure compounds during heating process characterized by a **sharp melting range (0 – 2) °C**, while compounds containing impurities characterized by a **broad (wide) melting point range (higher than 2) °C**

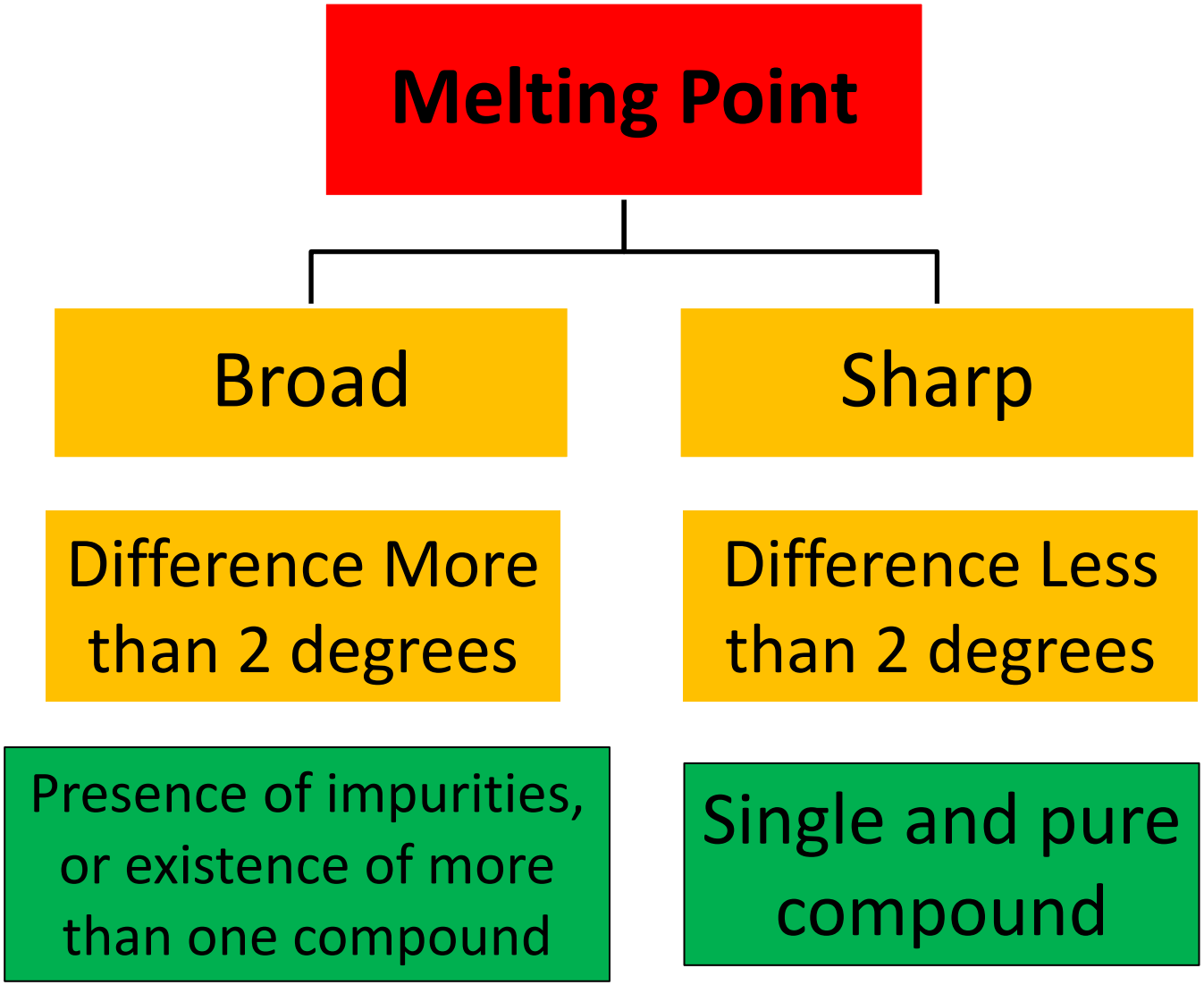
Melting point used to:

1. Determination the purity criteria

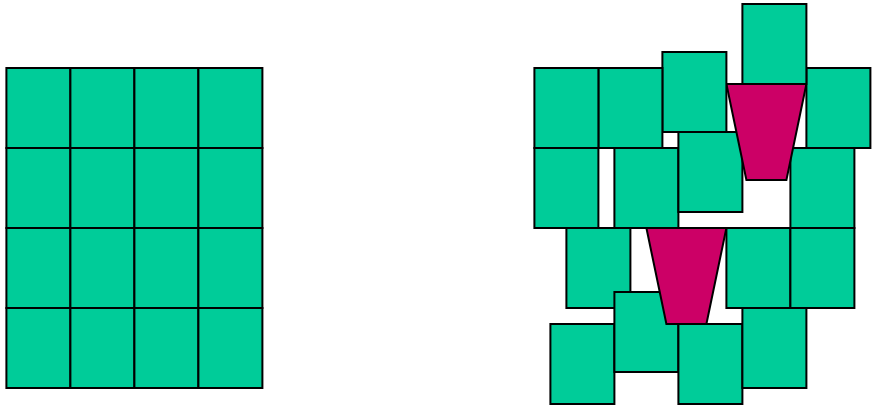
Ex. M.P. of impure Benzoic acid = 121 – 124 °C

2. Identification of the compounds

Ex. M.P. of pure Benzoic acid = 121 – 122 °C


Melting Point
Broad
Sharp
Difference More than 2 degrees
Difference Less than 2 degrees
Presence of impurities, or existence of more than one compound
Single and pure compound

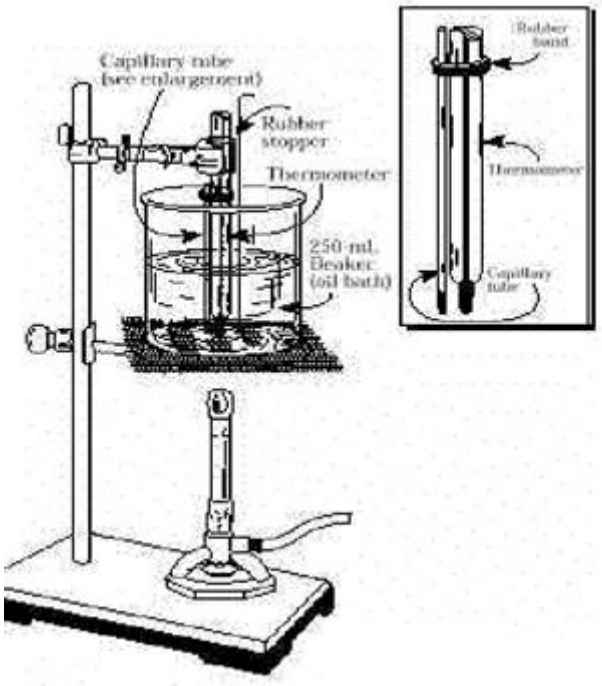
- Impurities lower melting point:
  - takes less energy to disrupt crystal lattice when impurities are present
  - melting point will be lower
  - melting point will be broader



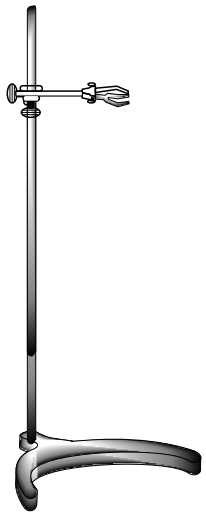
Melting point apparatus

Digital melting point apparatus.

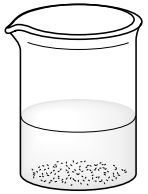
Classical melting point apparatus



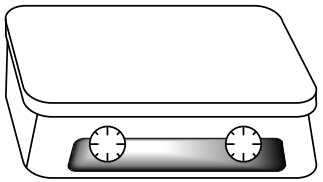
Apparatuses used in determination of Melting point

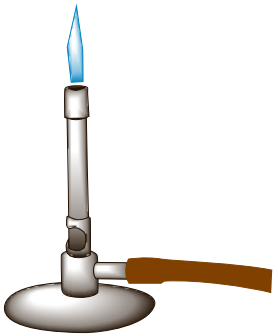


Stand and Clamp



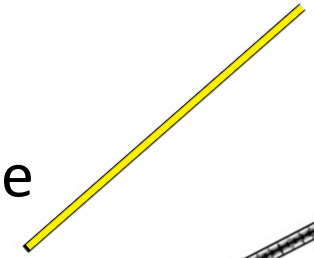
Beaker



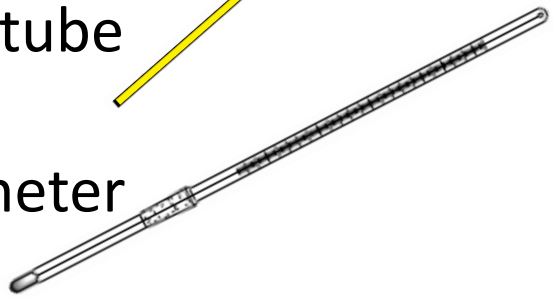


Heating Source

Test tube



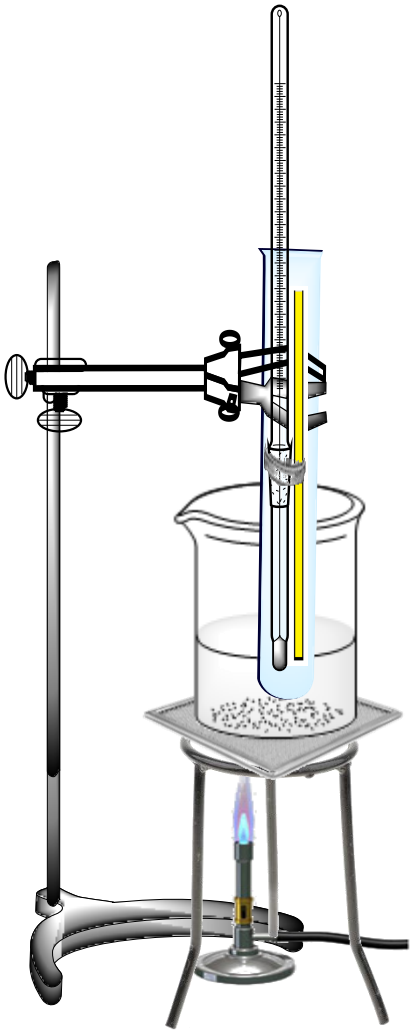
Capillary tube



Thermometer

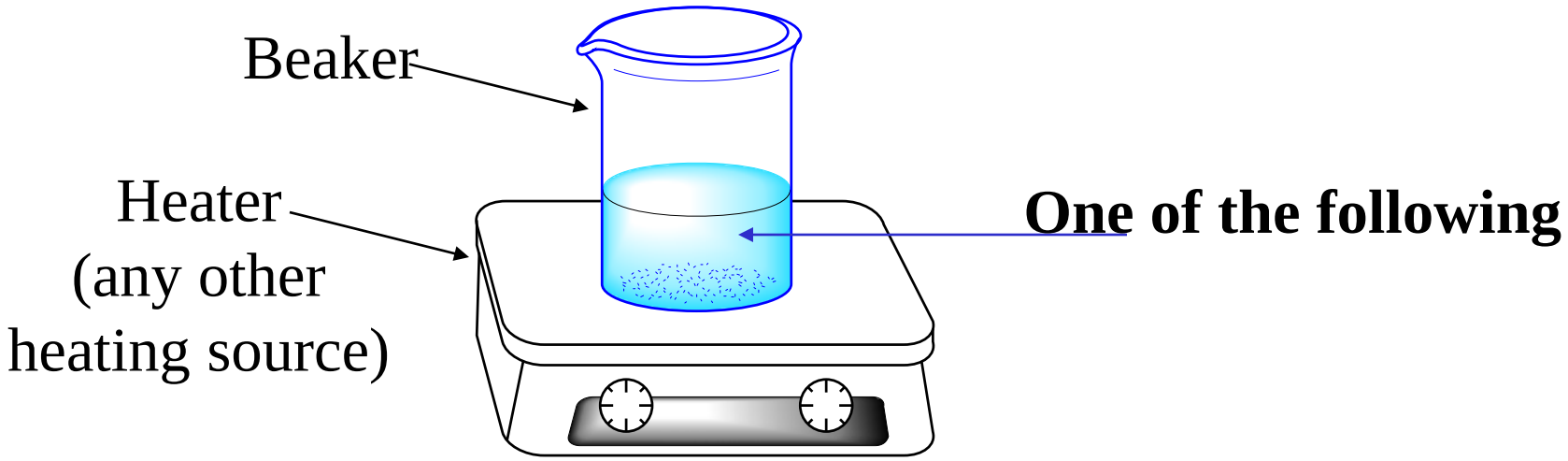
Tripod and Wire Gauze (If Bensen Burner used)

Classical (Manual) melting point apparatus



When the first solid particle starts turning to liquid record the temperature till al the solid has been converted into liquid. This is the melting range

Type of baths for classical melting point apparatus:-



1- Water bath (used for heating less than 100 ^{o}C)

2- Oil bath (used for heating 100 – 160 ^{o}C)

3- Acidic bath (used for heating 160 – 310 ^{o}C)

4- Silicon bath (or wax) more than 300 ^{o}C

SAMPLE SIZE

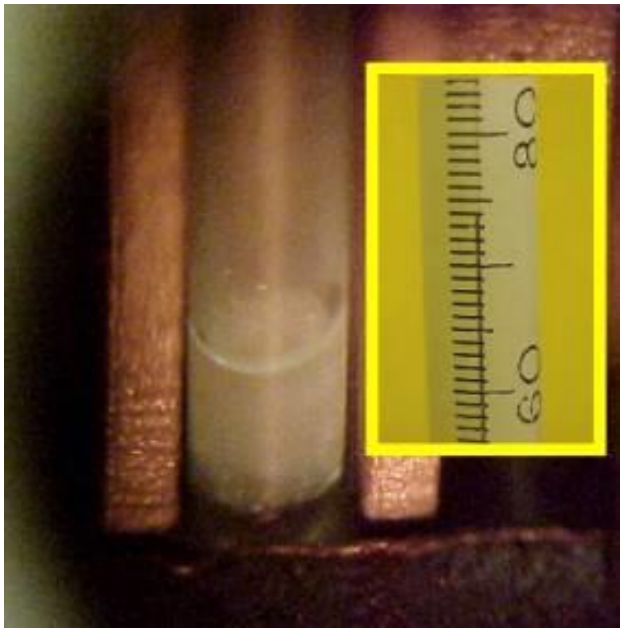
Pure Ibuprofen extracted from commercial drug

First transformation from solid is 72 ^{o}C

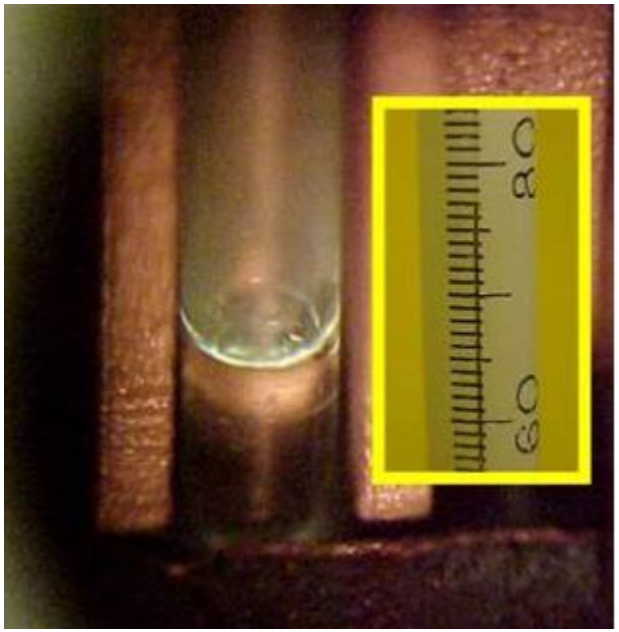
Last particle which transferred from solid to liquid is at 73 ^{o}C

Commercial Ibuprofen drug (not purified)

First transformation from solid is 74 °C



Last particle which transferred from solid to liquid is at 77 °C



Exp. 1

Melting point :(mp)

1- Close one end of a standard melting –point tube in a Benzene flame.

2-Inroduce the sample to a depth of about 2mm at the sealed end of the tube.

3-place the tube in an electrically heated melting-point apparatus.

4- Adjust the rate of heating so that the temperature rises about 3-4 for a min.

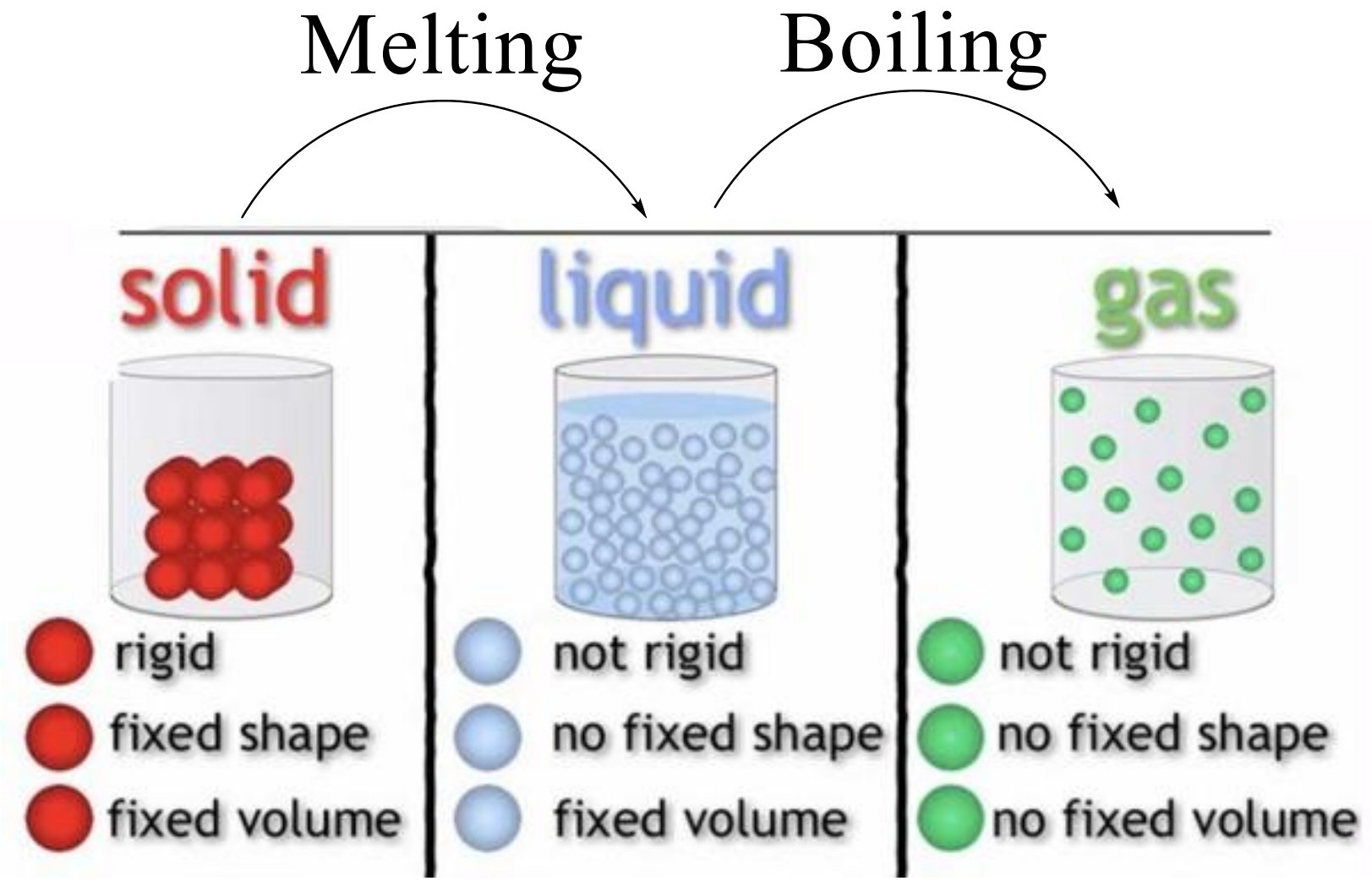
5-Watch the temperature carefully .Note it down in your report; deliver it with answers of questions to your supervisor

Tishk International University
Faculty of Science
Medical Analysis Department

Lab. 04

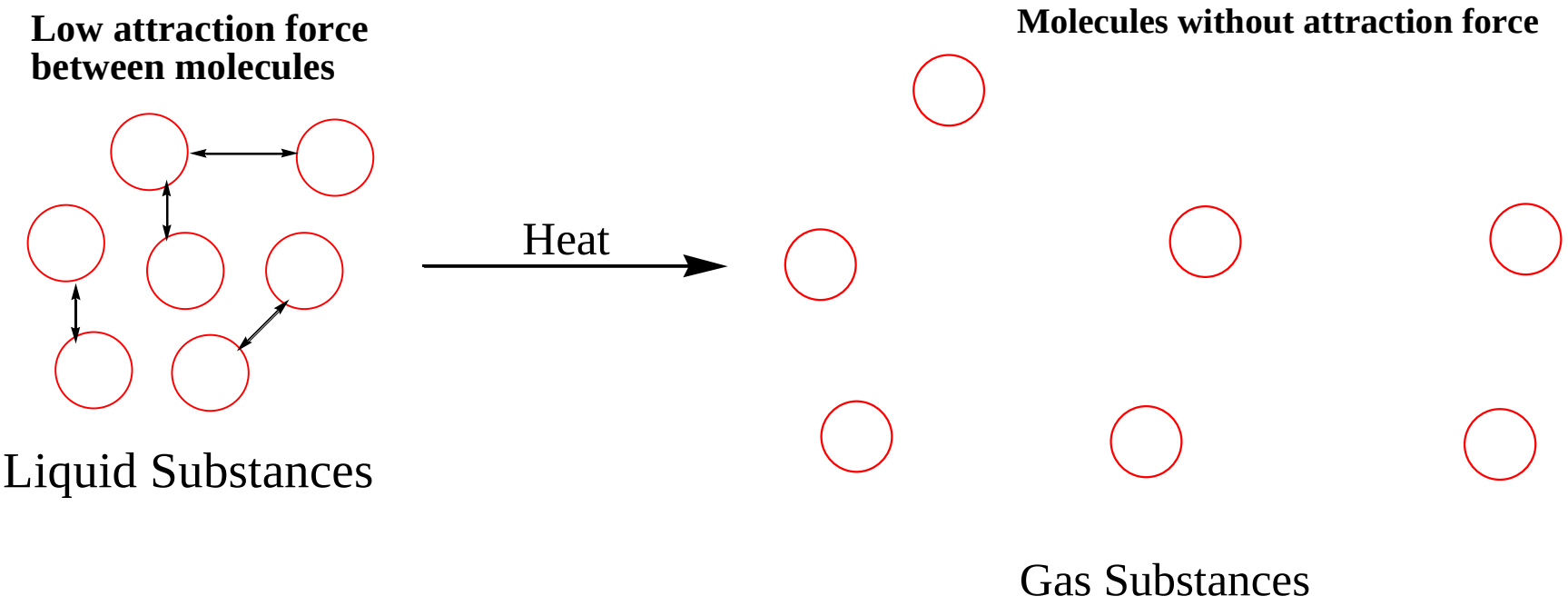
Boiling and Boiling Point

Practical General Chemistry
For
First grade Students


Melting
Boiling
solid
liquid
gas
rigid
fixed shape
fixed volume
not rigid
no fixed shape
fixed volume
not rigid
no fixed shape
no fixed volume

Boiling process:-

Is the amount of the energy to overcome the attraction force between the molecules of the liquid substances.



Boiling point:-

- The boiling point of a liquid is the temperature at which the vapor pressure of the liquid equals to the applied pressure (normally 1 atm) . Or

- *Is a temperature at which the vapor pressure of the liquid equals to the pressure of the surrounding system.*

- *Boiling point is a characteristic physical constant of the liquid compounds and pure sample give us a sharp boiling point. Therefore, like that the melting point, boiling point can be used to identify and characterize liquid compounds.*

Factors affecting on boiling point

1- Pressure

2- Impurity

3- Attraction forces

1- Pressure

Generally with increasing the pressure, the boiling point increase.

2- Impurities

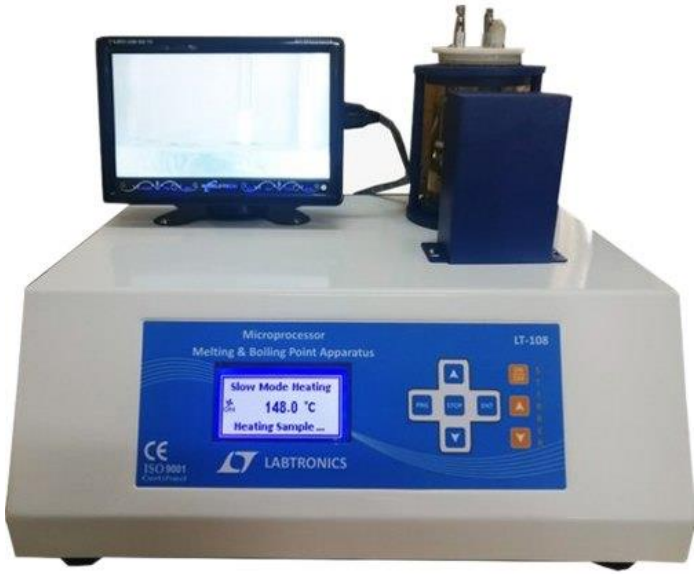
The effect of an impurity on the boiling point of a liquid, varies with the characteristics of the impurities (nature of the impurities), depending upon its solubility and volatility.

3- Attraction forces

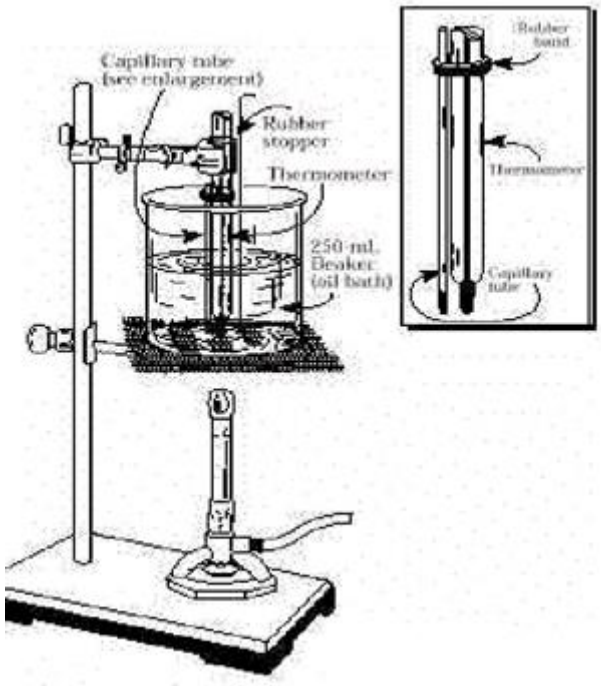
H.W. What is the effect of Attraction force on the Boiling point ?

Boiling point apparatus

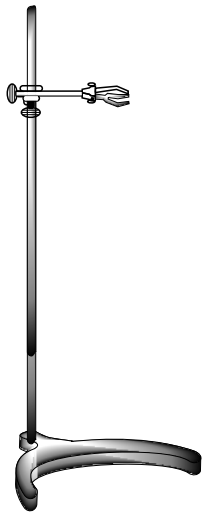
Digital Boiling point apparatus



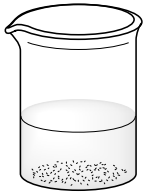
Classical Boiling point apparatus



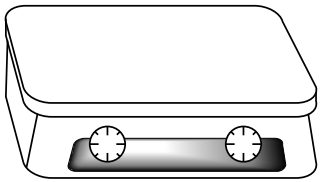
Apparatuses used in determination of Boiling point

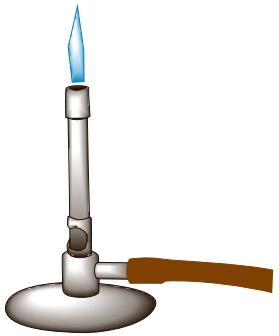


Stand and Clamp



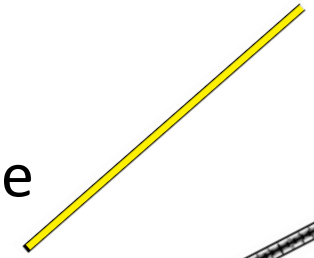
Beaker



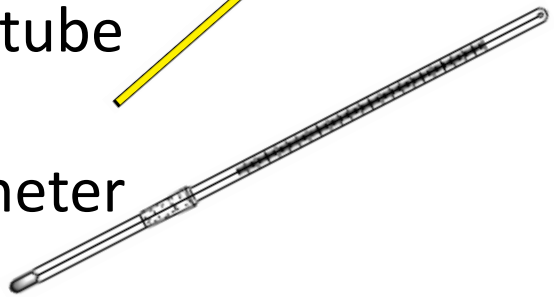


Heating Source

Test tube



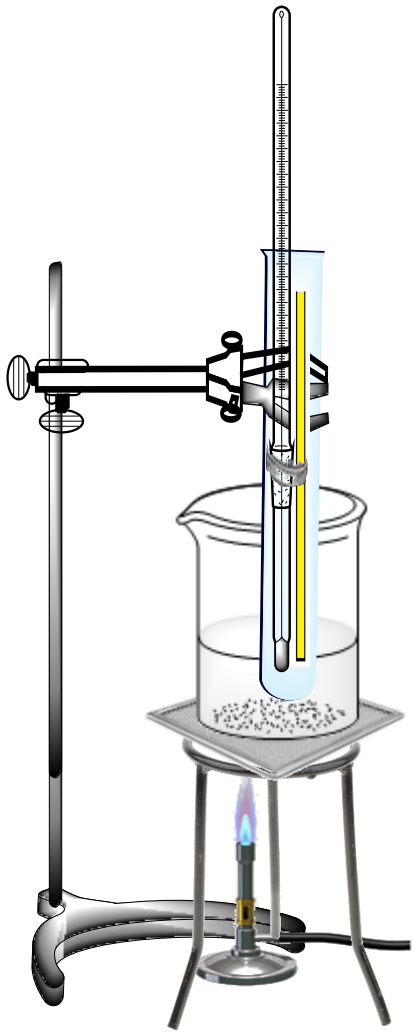
Capillary tube



Thermometer

Tripod and Wire Gauze (If Bensen Burner used)

Classical (Manual) Boiling point apparatus



When the first bubble appeared, record the temperature till all the bubble appeared and then disappeared. Record both temperatures, summation of both and dividing by 2 is the Boiling point.

Procedure:-

1- Add about (0.5-1)ml of the liquid sample into the test tube.

2- Enclose one ends of the capillary tube, then immerse the opened side into the test tube.

3- Place the test tube beside a *thermometer,* using a rubber for such process .

4- Put the (test tube + *thermometer)* into an oil bath gently.

5- Heat the oil bath gently.

6- Record the temp. (T_1) at which a rapid, continues stream of air bubble come out from the capillary tube.

7- Record the temp. (T_2) at which stream of air bubble disappeared from the capillary tube.

8- Find the real boiling point of the sample through detecting average boiling point.

$$T_{real} = (T_1 + T_2) / 2$$

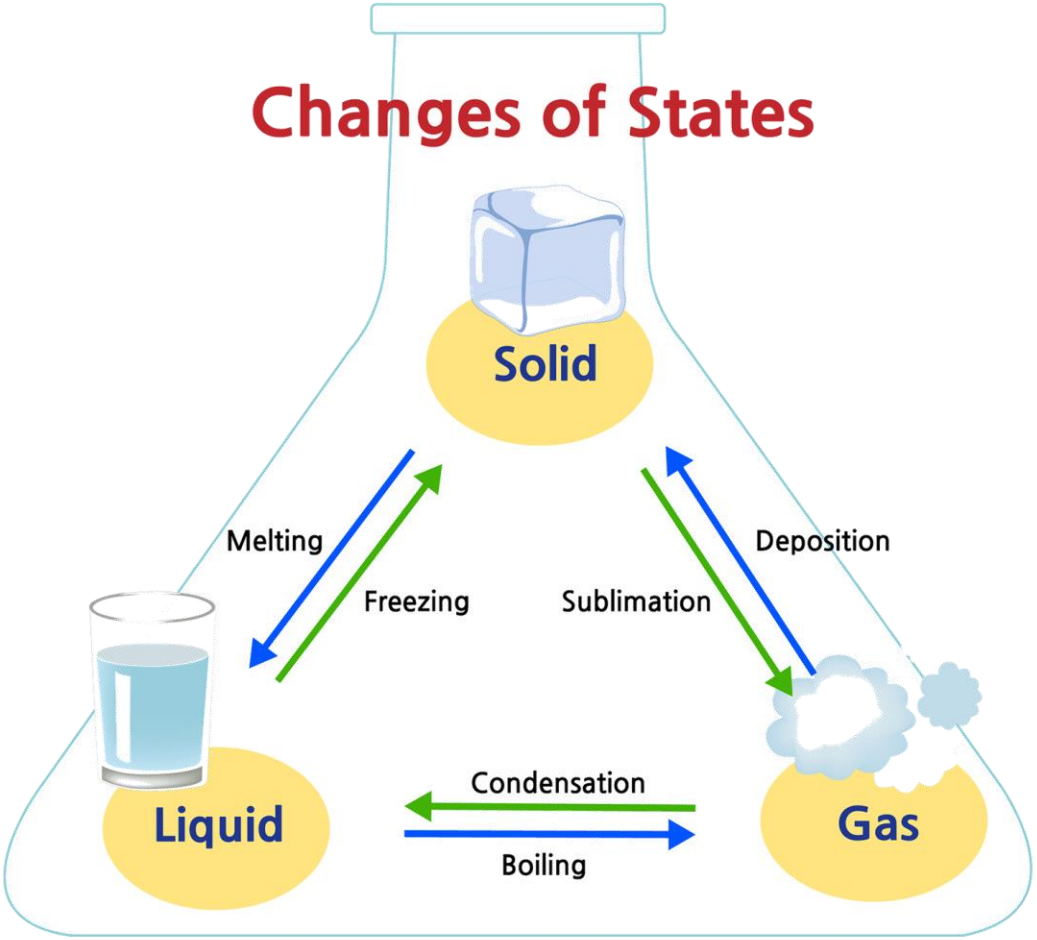
Tishk International University
Faculty of Science
Medical Analysis Department

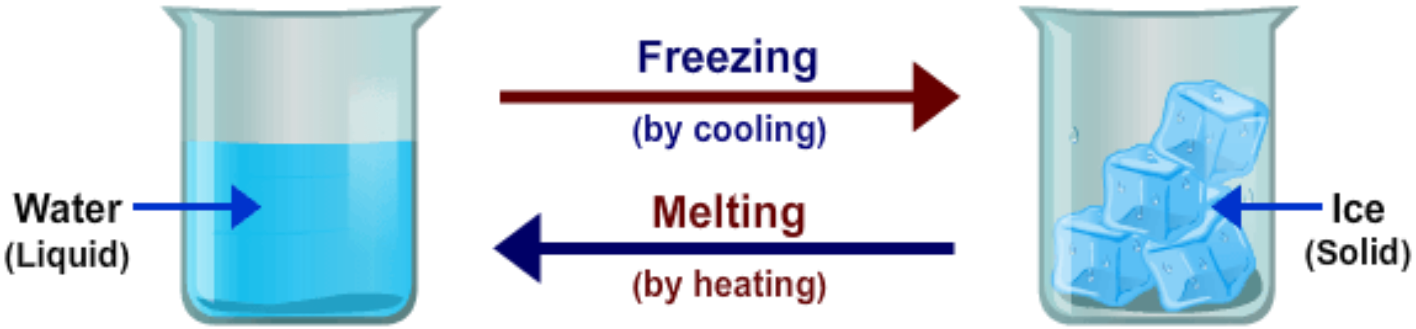
Lab. 05

Freezing Point

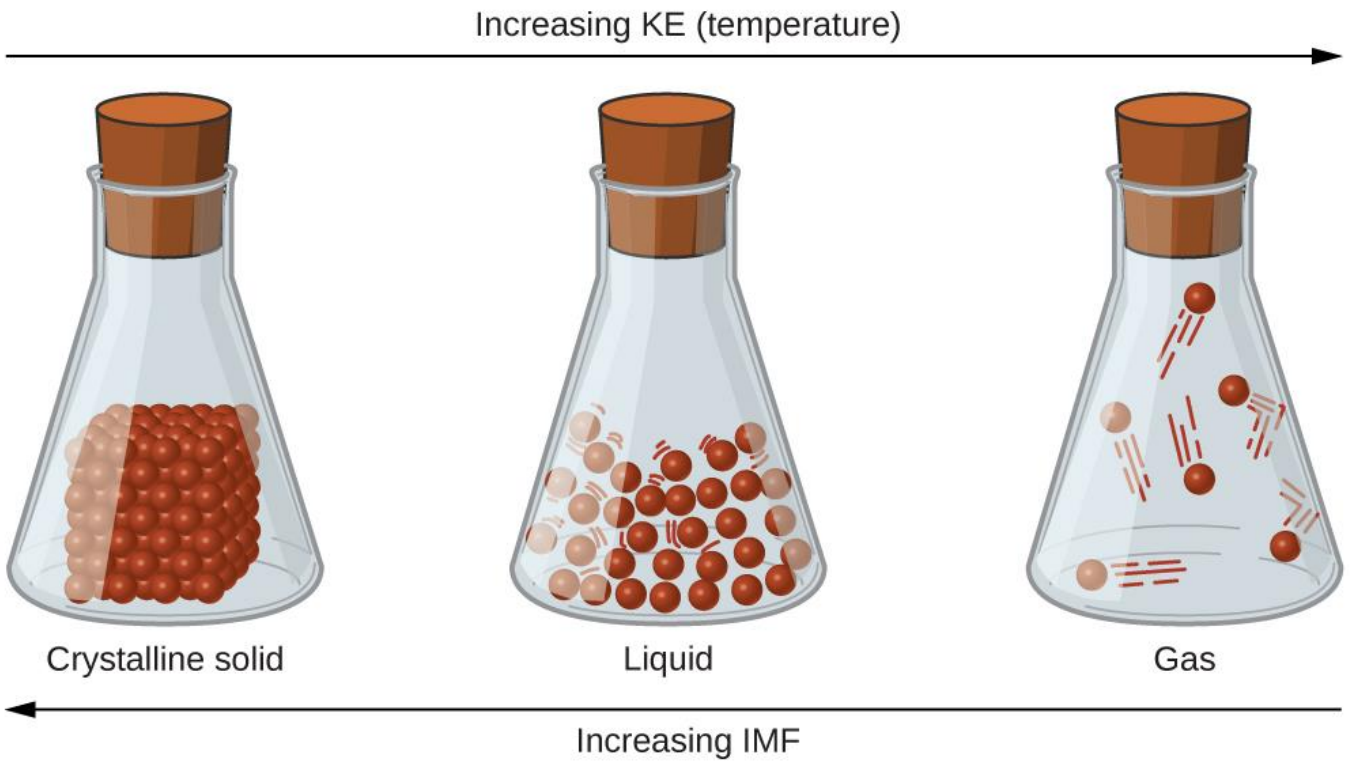
Practical General Chemistry
For
First grade Students

Changes of States





Freezing is the **process** in which a liquid changes to a solid. It occurs when a liquid cools to a point at which its particles no longer have enough energy to overcome the force of attraction between them.



Freezing point:-

The freezing point of a substance is the temperature at which it freezes.

Freezing point: is a temperature in which the liquid and solid are in equilibrium.

Some liquids can be **supercooled**—*i.e.,* cooled below the freezing point—without solid crystals forming.

Factors affecting on freezing point

1. Pressure:

Increases pressure usually raises the freezing point.

2. Presence of a Soluble compound:

Decreases the Freezing Point

3. Attraction forces:

Stronger attraction force, higher freezing point

- **Solution** freezes at a lower temperature than does the **pure solvent**. This phenomenon is called ***freezing point depression***.

- The freezing point depression of a solution is a **colligative property** of the solution which is dependent upon the number of dissolved particles in the solution.

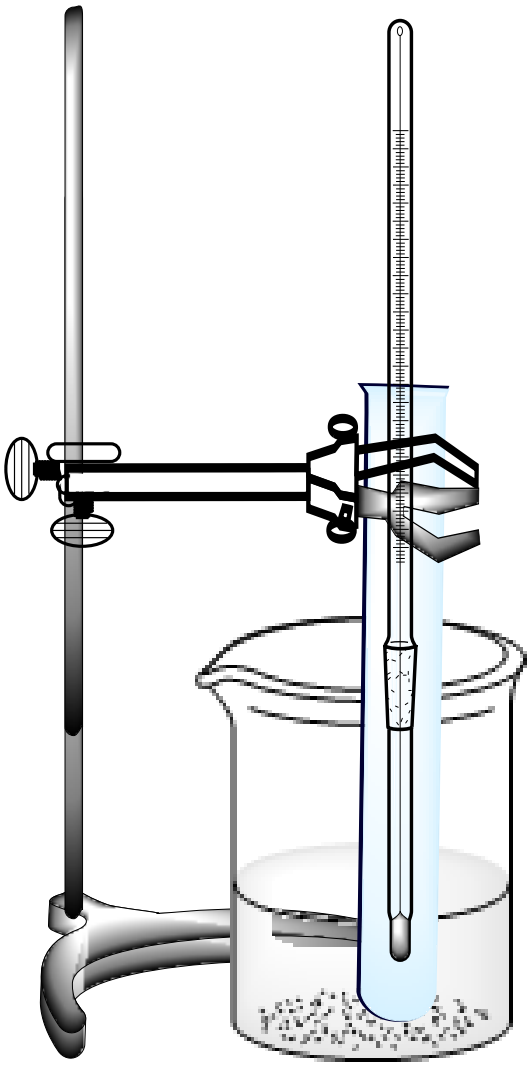
- The higher the solute concentration, the greater the freezing point depression of the solution.

Freezing point apparatus

Digital Freezing point apparatus

Classical Freezing point apparatus

Classical (Manual) Freezing point apparatus

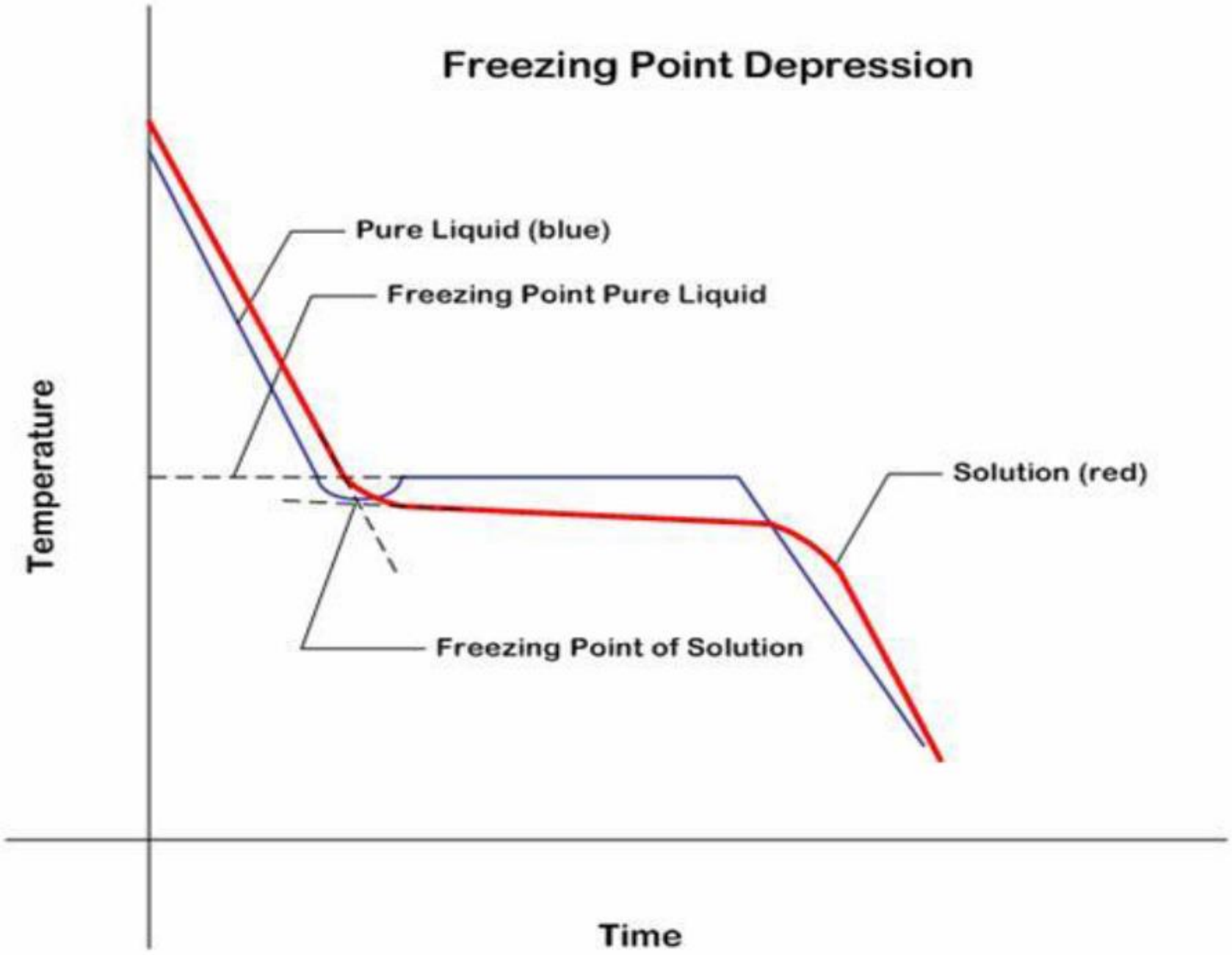


Stand and Clamp

Beaker

Test tube

Thermometer


Freezing Point Depression
Pure Liquid (blue)
Freezing Point Pure Liquid
Solution (red)
Freezing Point of Solution
Temperature
Time

Tishk International University
Faculty of Science
Medical Analysis Department

Lab. 06

Recrystallization

Practical General Chemistry
For
First grade Students

The general methods of purification

- Sublimation
- **Crystallization (Recrystallization)**
- Distillation
- Differential Extraction
- Chromatography

Recrystallization Process

Recrystallization :

is a very important *purification technique, purifying* substances by removing unwanted by-products. It is also used to manufacture the correct crystal size and shape of a material.

What are the principles behind recrystallization?

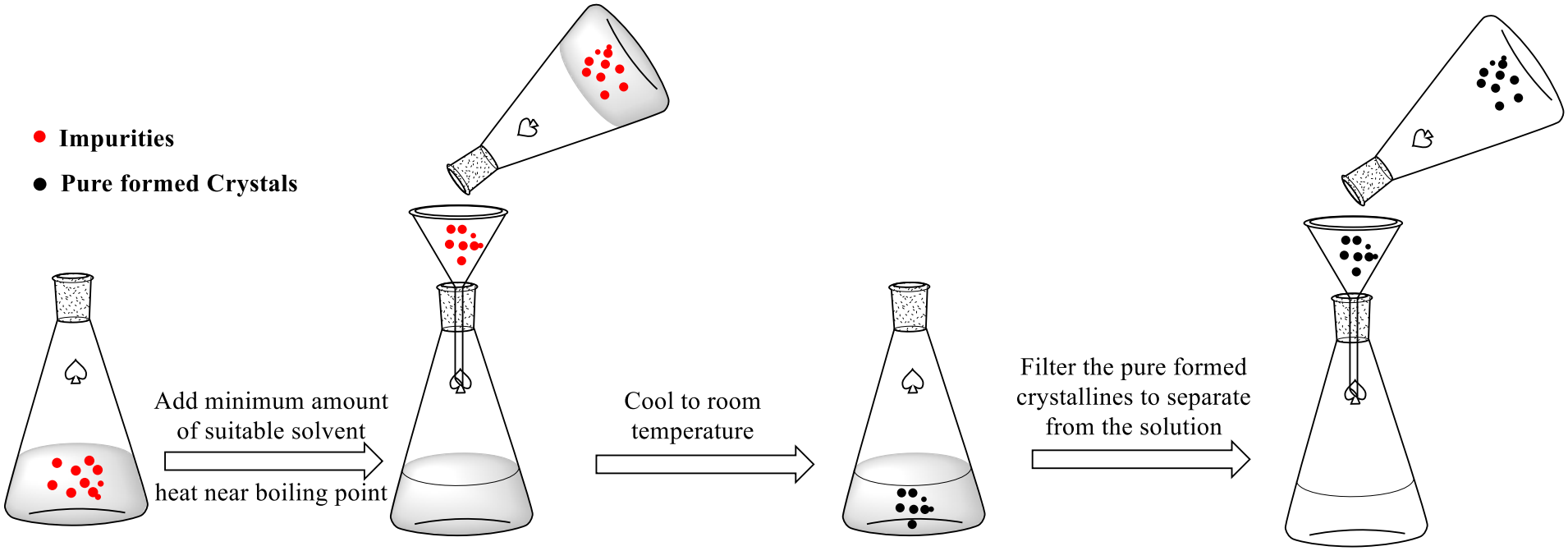
The process depends on two principles; the fact that substances tend to be more soluble in a hot solvent than in cold solvent, and that each solute tends to behave as though it were alone in the solvent.(solubility)

Recrystallization process

- The chemical substance is dissolved in a minimum amount of suitable solvent, then the solution heated near the boiling point of the solvent.
- Insoluble (suspended) impurities can be filtered away while the solution is hot.
- Cooling the solution till the room temperature, then using an ice bath to form a beautiful crystals.
- Separation of the crystals from the solution by filtration process, Finally the crystals should be dried using an oven.

Method of Recrystallization:

- **Impurities**
- **Pure formed Crystals**



Recrystallization

Impure benzoic acid

Benzoic acid after recrystallization

Drying Agents

- Drying agents (also called Desiccants)
- Desiccant is a hygroscopic substance that induces or sustains a state of dryness in its vicinity.
- Chemically stable and inert.
- Calcium chloride (**$CaCl_2$**), sodium sulfate (**Na_2SO_4**) calcium sulfate (**$CaSO_4$**) and magnesium sulfate (**$MgSO_4$**), all in their anhydrous form.

Example: Calcium sulfate

If the compound is pink, the water can be removed by heating the compound to 210 ^{o}C for an hour.

Dry (blue)

Wet (wet)

Desiccator

Use of drying agents and their properties

S.No	Drying agent	Properties	Uses
1	$CaCl_2$	Neutral	Good preliminary drying agent. It has large water absorption capacity giving the hexahydrate.
2	Sodium sulphate	Neutral	It has large water absorption capacity for the absorption of water forming the decahydrate.
3	Barium oxide	Basic	Suitable for drying organic bases
4	Sulphuric acid	Acidic	It is suitable for drying bromine, saturated hydrocarbons, etc.,

Procedure

- Weight out (1.0)g of crud (impure) sample then put it into a conical flask.
- Dissolve the sample in (30)ml of distilled water (D.W).
- Heat the solution near the boiling point of the solvent.
- Remove the suspended impurities from the ***hot*** solution through filtration process.
- Cool the solution at room temperature, then using an ice bath (If necessary).
- Separate the purified crystals from the solution by the second filtration process.
- Dry the collected crystals, then calculate the percentage yield of the purified sample.