LABORATORY EQUIPMENT AND THEIR FUNCTIONS

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- Laboratory equipments.
- Biochemical importance and application of laboratory equipments.

Beaker

- Measures liquids

(but not very accurately)

- May be heated
- Used to hold or mix chemicals

Stirring Rod

- Glass rod used for stirring
- ***BE CAREFUL!***
  They break easily

Erlenmeyer Flask

- Measures liquids
  (but not accurately)
- May be heated
- Used for mixing
- Used in titrations

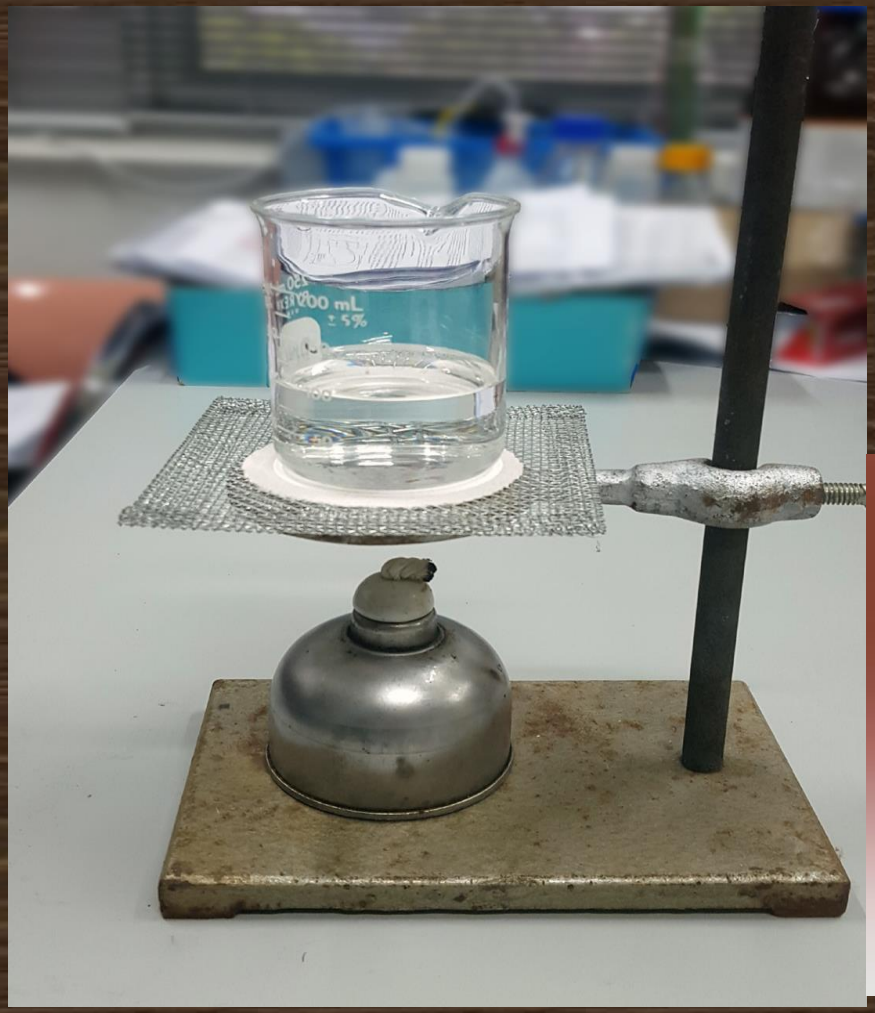
Graduated Cylinder

- Measures volumes of liquids <u>accurately</u>

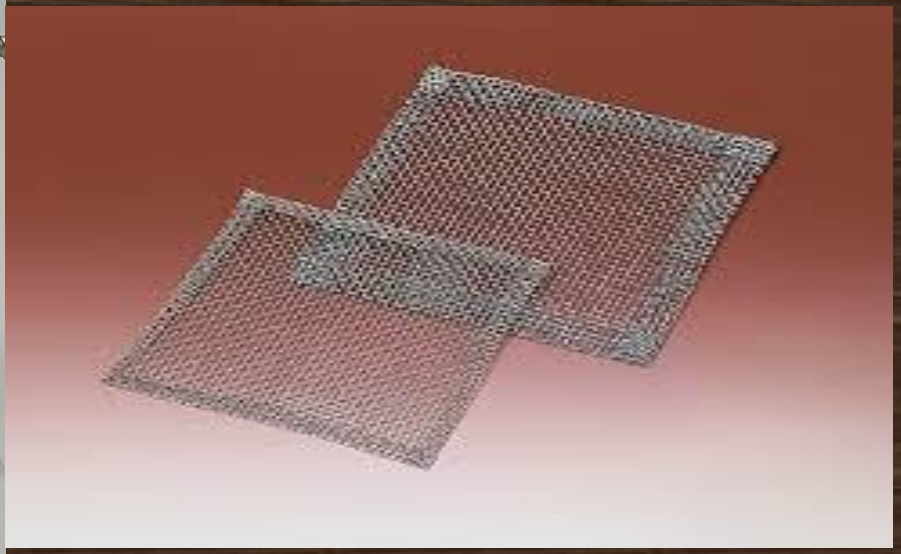
Test Tube

- May be heated
- Mix chemicals
- Holding small amounts of chemicals

Wire Gauze

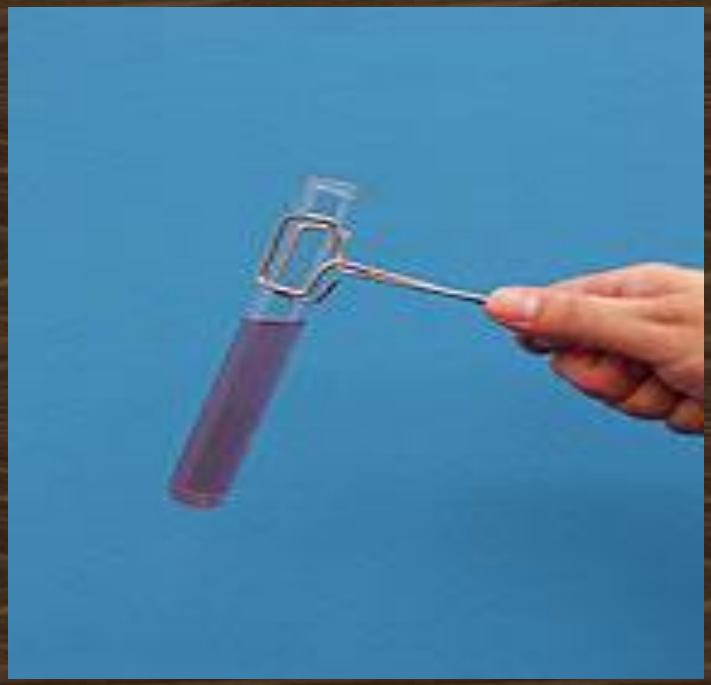


- Spreads out the heat produced by a Bunsen burner

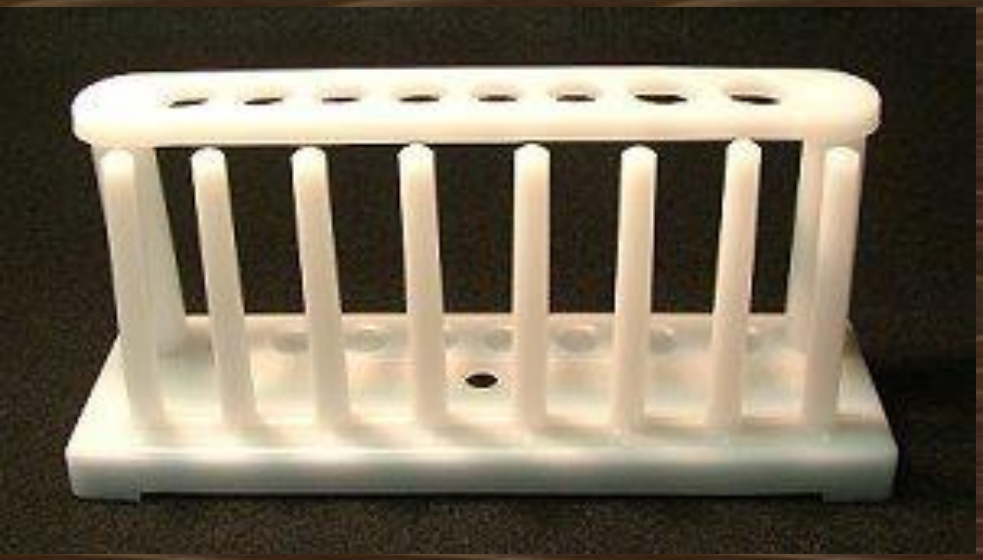


Test Tube Holder

It holds a test tube



Test Tube Rack



- Holds test tubes in a vertical position.
- Allows for clear sight.
- Drying rack

Ring Stand

- Multi-purpose, mostly used as a support to heat chemicals and hold burets.

Watch Glass

- Used as a beaker cover
- Can be used to place small amounts of chemicals on.

Funnel

- Holds filter paper for filtering solutions.
- Transferring liquids to smaller narrow necked containers.

Evaporating Dish

- Evaporating Dishes are glassware containers used for laboratory testing.
- They are used for the evaporation of liquids and solutions to produce a solid.

Plastic Wash Bottle

- Wash bottles are mainly used to wash or rinse various pieces of glassware or plastic ware in the laboratory.

Bunsen Burner

- A burner is a device designed to ensure that the flame is stabilized by establishing a suitable flow.

Electronic Balance

- Electronic balance is an instrument used in the **accurate measurement of weight of materials**.
- Electronic balance is a significant instrument for the laboratories for precise measurement of chemicals which are used in various experiments.
- Laboratory electronic balance provides digital result of measurement and measures mass in grams

Rubber Stopper

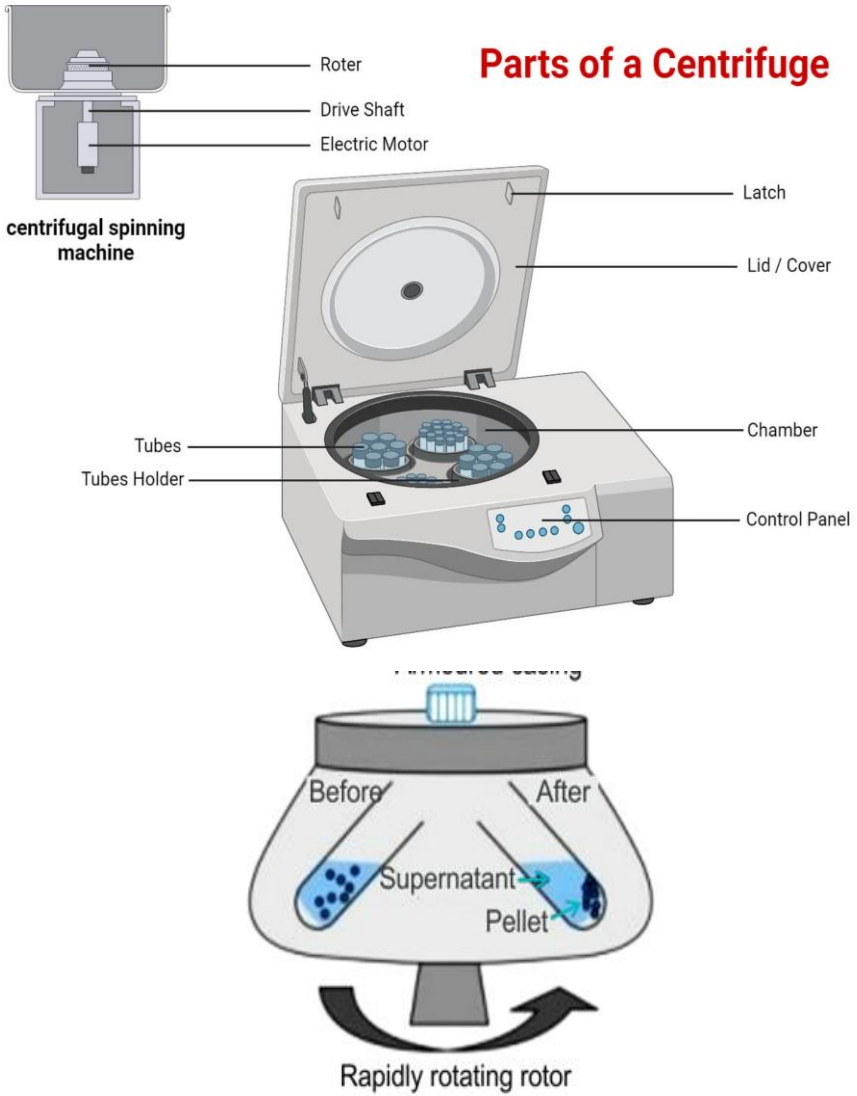
- Covers test tube and flask for mixing

Scoopula

- Used to transfer solids from one container to another

Centrifuge Machine

- A centrifuge is a device that uses centrifugal force to separate various components of a fluid.
- Centrifugation is a technique or method of separating molecules having different densities by spinning them in solution around an axis (in a centrifuge rotor) at high speed.



APPLICATIONS /USES

1. To separate two miscible substances. E.g. Removing fat from milk to produce skimmed milk.

1. Fractionation of sub-cellular organelles (including membranes/membrane fractions).

1. **Separation of urine components and blood components in forensic and research laboratories.**

1. Aids in separation of proteins using purification techniques such as salting out, e.g. ammonium sulfate precipitation.

1. To analyze the hydrodynamic properties of macromolecules.

Laboratory Shakers :

- Laboratory shakers and rotators are used to **blend or agitate samples within flasks or tubes.**
- These devices consist of a housing containing the motor and control panels, upon which an agitation platform is attached.
- The platform may have simple grooves for supporting flasks and tubes horizontally as the device moves, or it may have basket style holders that keep the sample holders upright.

APPLICATIONS/USES:

Homogenize a Solution

- Basically, all types of rotary shakers function ***to shake and mix chemicals at a constant speed and temperature so that the solution becomes homogeneous*** and evenly distributed.

- Meanwhile, in research or experiments, usually a rotary shaker is used for microbial incubation, for example bacteria in liquid media.

- Homogenous mixing of different liquid as well as of solid and liquid components (e.g. nutrient solution).

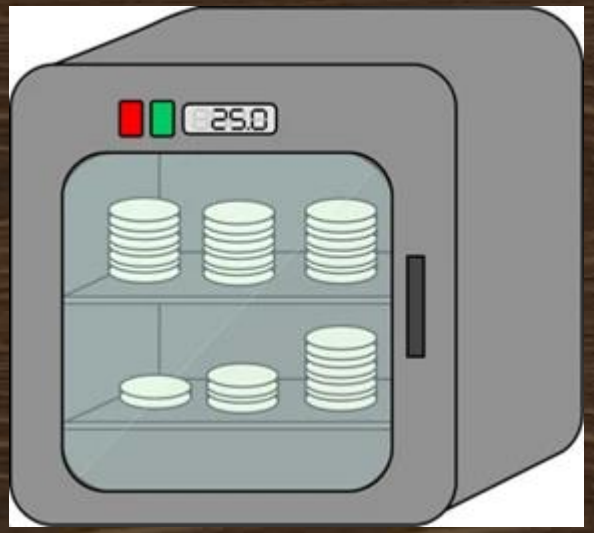
THERMOSTATIC BATH /WATER BATH:

- A water bath is laboratory equipment made from a container filled with heated water.
- It is used to **incubate** samples in water at a constant temperature over a long period of time.

APPLICATIONS /USES:

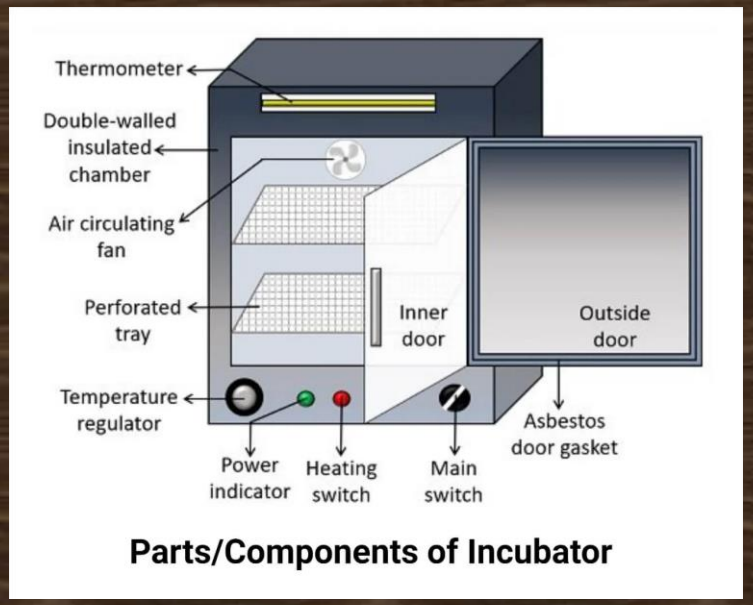
- It is used to improve the solubility of poorly soluble substance.
- For melting of some substances.
- Warming of a chemical reagent.
- For facilitation of some chemical reactions.
- Incubation of cell culture.
- As heat source for some substance, such as flammable chemicals.

Laboratory incubators



- Laboratory incubators provide a controlled, contaminant-free environment for safe, reliable work with cell and tissue cultures by regulating conditions such as temperature, humidity, and CO2.

- Microbiological incubators are used for the growth and storage of bacterial cultures.



Laboratory Oven

- The most basic laboratory ovens are used to sterilize lab equipment and glassware.

- Carried out in a hot air oven, the ideal temperature needs to be at least 160°C, with contents monitored at this heat for 45 to 60 minutes.

GLUCOMETER

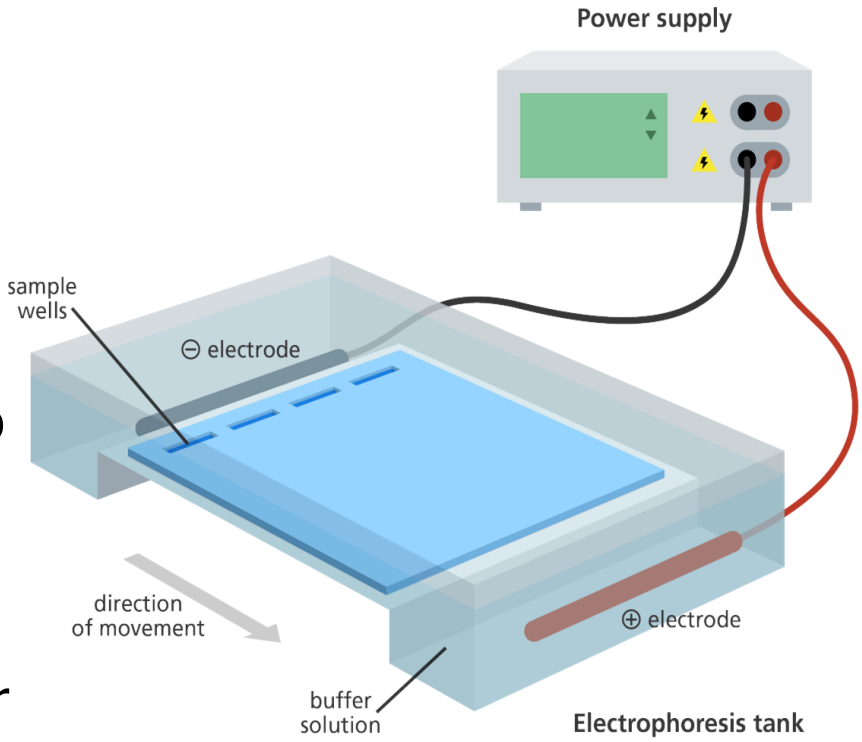
- Glucometer is commonly used in measurement of blood glucose

Laboratory pH meter

- Measuring the pH of liquids, specially designed electrodes are available to measure the pH of semi-solid substances, such as foods.
- pH meters are used for pH determination of different body fluids.

ELECTROPHORESIS

- Electrophoresis is a laboratory technique used to separate mixture of charged molecules based on their size and electrical charge.
- The positively charged particles (cations) move to cathode and negatively charged particles (anions) to anode.
- Since proteins exist as charged particles, this method is widely used for the separation of proteins in biological fluids.
- The technique was invented by Tiselius (Nobel Prize 1948).



Working Principle of Electrophoresis

- Charged macromolecules placed in an electric field move in the direction of the positive or negative pole.
- The movement ultimately depends on the charge of the macromolecules.
- Since nucleic acid is a negatively charged particle, it tends to move in the direction of the anode.

Types of Electrophoresis

- Routine electrophoresis.
- High resolution electrophoresis.
- Polyacrylamide gel electrophoresis.
- Capillary electrophoresis.
- Isoelectric focusing.
- Immunochemical electrophoresis.
- Two-dimensional electrophoresis.
- Pulsed field electrophoresis

APPLICATIONS/USES:

1. DNA Sequencing
2. Medical Research
3. Protein research/purification
4. Agricultural testing
5. Separation of organic acid, alkaloids, carbohydrates, amino acids, alcohols, phenols, nucleic acids, insulin.
6. In food industry

COLORIMETER

- Colored solutions have the property of absorbing light of definite wavelengths.
- The amount of light absorbed or transmitted by a colored solution is in accordance with the Beer-Lambert law.

"As per the Beer's law, the intensity of the color is directly proportional to the concentration of the colored particles in the solution. The Lambert's law states that the amount of light absorbed by a colored solution depends on the length of the column or the depth of the liquid through which light passes. The Beer-Lambert law combines these two laws".

- In the colorimeter, the length of the column through which the light passed is kept constant, by using test tubes of the same diameter for both test and standard, so that the only variable is the concentration.

SPECTROPHOTOMETER

- A spectrophotometer has all the basic components of photoelectric colorimeter with more sophistication.
- A spectrophotometer is an analytical instrument used to quantitative measurements of the reflected or transmitted light emitted from a material by measuring the intensity of light as a beam of light passes through sample solution.
- The reflected or transmitted light from the sample is collected and passed to a diffraction grating which separates it into its component wavelengths.
- The advantage of the spectrophotometer over the colorimeter, is that the former is 1000 times more sensitive. Therefore even minute quantities of the substance (very dilute solution) can be assessed in the spectrophotometer.

APPLICATIONS/USES:

- Spectrophotometry is an important technique used in many biochemical experiments that involve DNA, RNA, and protein isolation, enzyme kinetics and biochemical analyses.
- Spectrophotometer is used to measure colored compounds in the visible region of light (between 350 nm and 800 nm).
- This method is also convenient for use in laboratory experiments because it is an inexpensive and relatively simple process.