**Autoclave**

- **Principle:** Autoclaves use pressurized steam as their sterilization agent. The basic concept of an autoclave is to have each item sterilized—whether it is a liquid, plastic ware, or glassware—come in direct contact with steam at a specific temperature and pressure for a specific amount of time. Time, steam, temperature, and pressure are the four main parameters required for a successful sterilization using an autoclave.

- **Uses:** Autoclaving is used to sterilize culture media, instruments, dressings, intravenous equipment, applicators, solutions, syringes, transfusion equipment, and numerous other items that can withstand high temperatures and pressures. The laboratory technician uses it to sterilize bacteriological media and destroy pathogenic cultures. The autoclave is equally valuable for glassware and metalware, and is among the first instruments ordered when a microbiology laboratory is established. Autoclaves are also used on large industrial scale. Large industrial autoclaves are called retorts, but the same principle applies for common household pressure cooker used in the home canning of foods.

- **Autoclave disadvantage:** The autoclave also has certain limitations. For example, some plasticware melts in the high heat, and sharp instruments often become dull. Moreover, many chemicals breakdown during the sterilization process and oily substances cannot be treated because they do not mix with water.

- **Function of certain parts:**
  
  **Pressure gauge:**

  **Safety valve:**
Steam release valve:

Vacuum release valve:

**Ph meter**

\textbf{pH} is a logarithmic scale used to specify the acidity or basicity of an aqueous solution. It is approximately the negative of the base 10 logarithm of the molar concentration, measured in units of moles per liter, of hydrogen ions. A \textbf{pH meter} is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as pH. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter".

- **Principle**: pH meter basically works on the fact that interface of two liquids produces a electric potential which can be measured. In other words when a liquid inside an enclosure made of glass is placed inside a solution other than that liquid, there exists an electrochemical potential between the two liquids.

- **Uses**: It is very important to understand the pH value of any substance, so that it can be put to effective use. If the pH value of a soil sample is found to be in an optimal range, it is considered to be the most suitable for cultivating wheat and other crops, thus maximizing the yields and returns from the soil. In some situations, the rainwater’s pH was found closer to 0 than to 7. Thus, that sample was more acidic.

- Maintaining perfect and accurate pH levels helps in several daily activities like keeping the milk from turning sour. Thus, a pH meter plays a significant role in everyday life, even though it is not explicitly used by a common man.

- pH meters are employed profusely in other diverse fields like chemical industry, water purification processes like reverse osmosis, Hexavalent chromium destruction, electroplating, cyanide destruction, neutralization of effluent in steel, pulp and paper, pharmaceutical manufacturing, biotechnology and petrochemical industries etc. Hence, pH meter helps in analyzing the exact pH value of chemical substances and food grade products, thus ensuring high levels of safety and quality.

![Image of pH meter](image)

**Function of certain parts:**

- Electrode stand
- Set zero
- Set buffer
- Temperature compensation knob
- Selector
- Electrode
- Indicating meter
Digital balance

The digital mass balances in labs are very sensitive instruments used for weighing substances to the milligram (0.001 g) level.

- **Principle:** An electromagnet levitates the balance’s sample pan above a permanent cylindrical magnet. The amount of light reaching a photodetector indicates the sample pan’s position; the amount of light reaching the detector in the absence of a sample defines the balance’s null point. Placing an object on the balance displaces the sample pan downward by a force equal to the product of the sample’s mass and its acceleration due to gravity. The balance detects this downward movement and generates a counterbalancing force by increasing the current to the electromagnet. The current returning the balance to its null point is proportional to the object’s mass.

**Uses:** Accurate weighing substances to the milligram (0.001 g) level.

**Function of certain parts:**

- **display:**
- **Tare:**
- **power (on/off):**
- **Draft shield:**
**Micropipette**

Micropipettes are used to measure and deliver accurate volumes of liquid. Micropipettes measure a much smaller volume, starting at 1 microliter.

- **Principle:** Micropipette works on air cushion principle. In the air cushion principle, an air cushion separates the liquid in the tip from the piston inside the pipette. The piston moves the air cushion and the liquid is thus taken up into the pipette tip or dispensed out of it. The air cushion thus works like an elastic spring, to which the liquid sticks. Since the air space is stretched during the pipette aspiration, the piston must move a volume about 2 to 4% greater than the aspirated volume of liquid. A piston is depressed by the thumb and as it is released, liquid is drawn into a disposable plastic tip. When the piston is pressed again, the liquid is dispensed.

- **Uses:** Exact and reproducible dispensing of liquids is a prerequisite for many applications in medical and molecular biology laboratories. The performance of test systems is largely dependent upon the exact proportions of the individual reaction components in an assay. Modern pipettes enable the user to manually dispense amounts of liquid down to about 0.1 µL. Using this mature technology, even users with little experience can dispense such small amounts of liquid without fearing the effects on the precision of the results.
Function of certain parts:

puncture:

dial:

tip:

window:

releaser:

**Colorimeter**

A colorimeter is a light-sensitive device used for measuring the transmittance and absorbance of light passing through a liquid sample. The device measures the intensity or concentration of the color that develops upon introducing a specific reagent into a solution.

- **Principle:** The colorimeter is based on Beer-Lambert’s law, according to which the absorption of light transmitted through the medium is directly proportional to the medium concentration. In a colorimeter, a beam of light with a specific wavelength is passed through a solution via a series of lenses, which navigate the colored light to the measuring device. This analyzes the color compared to an existing standard. A microprocessor then calculates the absorbance or percent transmittance. If the concentration of the solution is greater, more light will be absorbed, which can be identified by measuring the difference between the amount of light at its origin and that after passing the solution. To determine the concentration of an unknown sample, several sample solutions of a known concentration are first prepared and tested. The concentrations are then plotted on a graph against absorbance, thereby generating a calibration curve. The results of the unknown sample are compared to that of the known sample on the curve to measure the concentration.

**Fig: Principle of colorimeter**

- **Uses:** Besides being used for basic research in chemistry laboratories, colorimeters have many practical applications such as testing water quality by screening chemicals such as chlorine, fluoride, cyanide, dissolved oxygen, iron, molybdenum, zinc and hydrazine. They are also used to determine the concentrations of plant nutrients such as ammonia, nitrate and phosphorus in soil
or hemoglobin in blood. Colorimetry is also used in color printing, textile manufacturing and paint manufacturing for precise quality inspection. Colorimeters are widely used to monitor the growth of a bacterial or yeast culture. They provide reliable and highly accurate results when used for the assessment of color in bird plumage. They are used to measure and monitor the color in various foods and beverages, including vegetable products and sugar. Certain colorimeters can measure the colors that are used in copy machines, fax machines and printers.

Function of certain parts:

- Display:
- Cuvette:
- Cuvette slot:
- Filter:

**Centrifuge**

A centrifuge is the equipment generally driven by an electric motor that puts an object to rotate around fixed axis, and a perpendicular force is applied to axis. The particles get separated according to their size, shape, density, viscosity of the medium and rotor speed.

**Principle:** The centrifuge involves principle of sedimentation, where the acceleration at centripetal force causes denser substances to separate out along the radial direction at the bottom of the tube. By the same concept lighter objects will tend to move to the top of the tube; in the rotating picture, move to the center. In a solution, particles whose density is higher than that of the solvent sink (sediment), and particles that are lighter than it float to the top. The greater the difference in density, the faster they move. If there is no difference in density (isopycnic conditions), the particles stay steady. To take advantage of even tiny differences in density to separate various particles in a solution, gravity can be replaced with the much more powerful “centrifugal force” provided by a centrifuge.

**Uses:**
- **Small Bench Centrifuges** are used to collect small amount of material that rapidly sediment like yeast cells, erythrocytes etc. They have maximum relative centrifugal field of 3000-7000 g.
- **Large Capacity Refrigerated Centrifuges** have refrigerated rotor chamber and have capacity to change rotor chambers for varying size. They can go up to maximum of 6500 g and are used to sediment or collect the substances that sediment rapidly like
erythrocytes, yeast cell, nuclei and chloroplast.

- **High Speed Refrigerated Centrifuges** can generate speed of about 60000g and are used to collect micro-organism, cellular debris, larger cellular organelles and proteins precipitated by ammonium sulphate.

- **Ultra Centrifuges** can produce relative centrifugal force of about 600000g and its chamber is refrigerated, sealed and evacuated. It is employed for separation of macromolecules/ligand binding kinetic studies, separation of various lipoprotein fractions from plasma and deprotonisation of physiological fluids for amino acid analysis.

Function of certain parts:

**roter:**

**temperature control knob:**

**speedometer:**

**centrifuge tube:**