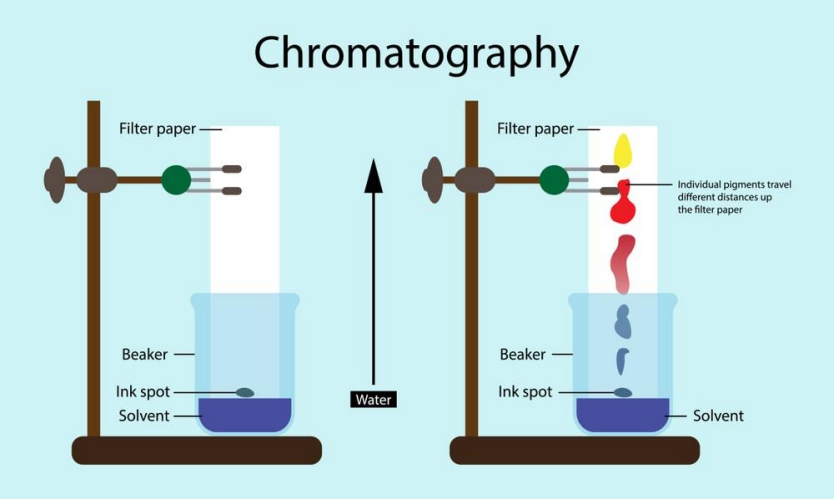
Separation equipment

A. Chromatography apparatus:

Chromatography: is a technique used to **separate** and **analyze** the components of a mixture based on their **physical and/or chemical properties**.

Principle:

The technique works by passing a mixture through a stationary phase, which is typically a solid or liquid material that is packed into a column or spread out on a surface, and a mobile phase, which is typically a liquid or gas that is passed through the stationary phase. As the mobile phase moves through the stationary phase, the components of the mixture are separated based on their interactions with the stationary phase.

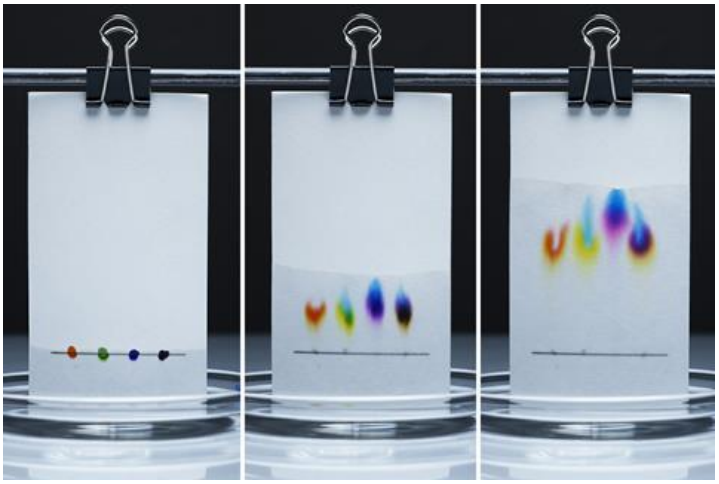


Uses:

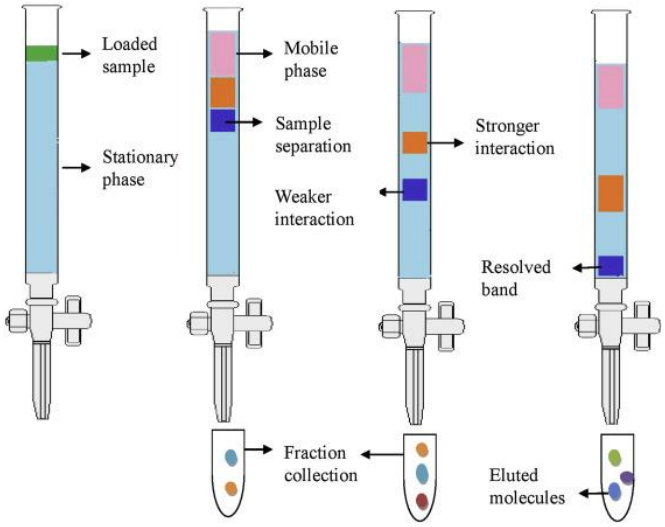
1. Chemical analysis: Chromatography is widely used in chemical analysis to separate and identify the components of complex mixtures
2. Biotechnology: used in biotechnology to purify proteins, nucleic acids
3. Food and beverage industry: s used in the food industry to analyze and quantify the levels of various compounds.
4. Quality control: is used in various industries, such as pharmaceuticals and petrochemicals, to monitor the quality.

Type of chromatography:

1. **Paper chromatography:** Paper chromatography in which a small amount of a mixture is placed onto a **strip of filter paper** and allowed to **separate into its individual components as a solvent flow through the paper**. The principle of paper chromatography is based on the **differential affinity of the sample components for the mobile phase and the stationary phase (the filter paper).**



2. **Thin layer chromatography:** thin layer chromatography (TLC) which a small amount of a mixture is spotted onto a **thin layer of adsorbent material (such as silica gel or alumina) coated on a flat plate or sheet**. The separation of the mixture occurs as a solvent moves through the adsorbent layer, separating the components based on their **differential affinities for the mobile phase and the stationary phase.**
3. **Column chromatography:** is a type of chromatography in which a mixture is separated by passing it through a vertical column packed with a stationary phase (such as silica gel, alumina, or a polymer resin). The separation occurs as the mixture components interact differently with the stationary phase and the mobile phase (solvent), leading to differential migration through the column.



B. Electrophoresis

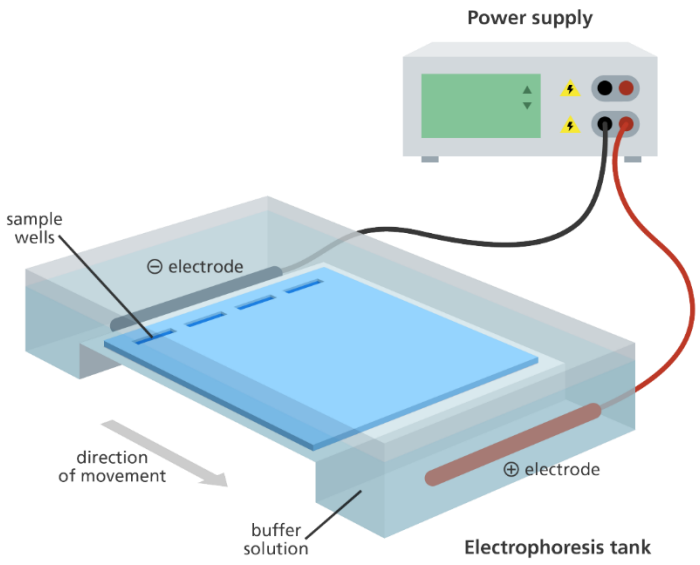
Electrophoresis is a laboratory technique that separates molecules based **on their size, shape, and charge using an electric field**.

Uses: It is commonly used to separate DNA, RNA, and proteins

Types of electrophoresis:

a) Agarose gel electrophoresis
b) Polyacrylamide gel electrophoresis
c) Capillary electrophoresis.

Principle: is based on the fact that charged particles will move in response to an electric field. In electrophoresis, an electric field is applied to a medium that contains the sample of interest, causing charged molecules to move through the medium towards the oppositely charged electrode.



Care and safety:

1. Wear appropriate personal protective equipment (PPE)
2. Handle equipment with care
3. Use appropriate buffers and reagents
4. Dispose of waste properly
5. Avoid electrical hazards

Self-assessment 😊

1. What is chromatography and how does it work?
2. Name some industries where chromatography is used.
3. What is the principle of paper chromatography?
4. What is the principle of column chromatography?
5. What is electrophoresis and what is it commonly used to separate?
6. What are the three types of electrophoresis mentioned in the text?
7. What is the principle of electrophoresis?
8. What are some safety measures to be taken while performing electrophoresis?
9. What is the difference between agarose gel electrophoresis and polyacrylamide gel electrophoresis?
10. How is capillary electrophoresis different from the other two types of electrophoresis?

Multiple choice questions:

What is the stationary phase in chromatography?

a) A liquid or gas

b) The material packed into a column or spread out on a surface

c) A mixture of components

d) None of the above

Which industry commonly uses chromatography to monitor quality?

a) Food and beverage

b) Biotechnology

c) Petrochemicals

d) None of the above

What is the principle of paper chromatography based on?

a) The differential affinity of sample components for the mobile phase and the stationary phase

b) The size and shape of molecules

c) The charge of molecules

d) None of the above

What is the principle of electrophoresis based on?

a) The differential affinity of sample components for the mobile phase and the stationary phase

b) The size and shape of molecules

c) The charge of molecules

d) None of the above

What type of electrophoresis is commonly used to separate DNA?

a) Agarose gel electrophoresis

b) Polyacrylamide gel electrophoresis

c) Capillary electrophoresis

d) None of the above

What type of PPE should be worn while performing electrophoresis?

a) Lab coat

b) Gloves

c) Safety goggles

d) All of the above

What is the mobile phase in chromatography?

a) A liquid or gas

b) The material packed into a column or spread out on a surface

c) A mixture of components

d) None of the above

What is the principle of thin layer chromatography?

a) The differential affinity of sample components for the mobile phase and the stationary phase

b) The size and shape of molecules

c) The charge of molecules

d) None of the above

What is the principle of column chromatography?

a) The differential affinity of sample components for the mobile phase and the stationary phase

b) The size and shape of molecules

c) The charge of molecules

d) None of the above

What type of waste should be disposed of properly while performing chromatography?

a) Solid waste only

b) Liquid waste only

c) Both solid and liquid waste

d) None of the above