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INTRODUCTION

- A Photoelectric flame photometer is a device used in **inorganic chemical analysis** to determine the concentration of certain metal ions, among them sodium, potassium, lithium and calcium.

How does a flame photometer works

- In Flame Photometry, the Flame Photometer is used to simultaneously detect and display five ions (K, Na, Li, Ca, and Ba) and to accurately determine the concentration of each within a given substance.
- Flame Photometry works by measuring the intensity of light emitted (measured using a wavelength of a colour) when the element is exposed to a Flame.





History

- During **1980's** Bowling barnes , **David Richardson, John berry , Robert hoot** are developed an instrument to measure the low concentration of sodium and potassium in a solution .
- They named it **FLAME PHOTOMETER.**

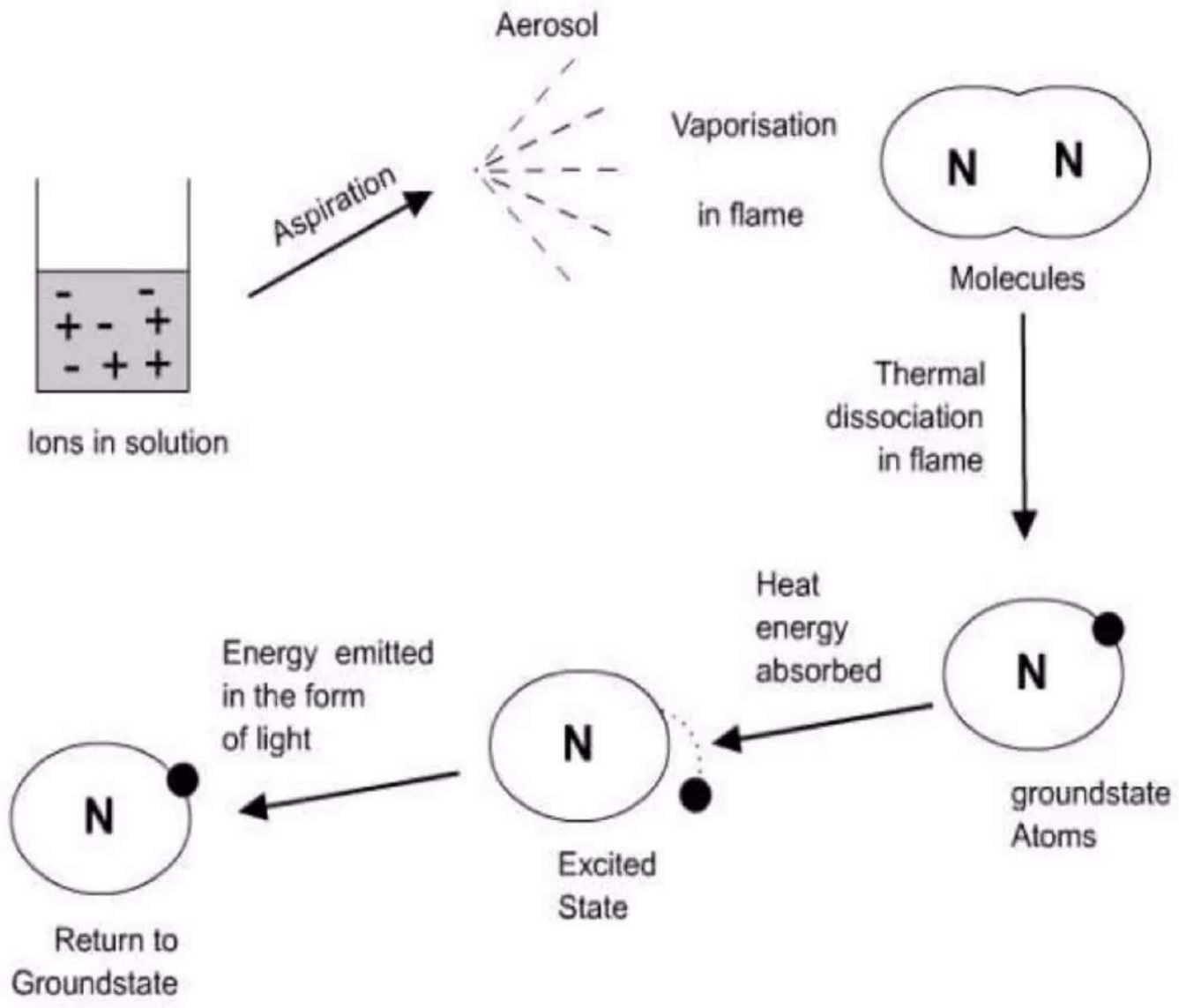


PRINCIPLE

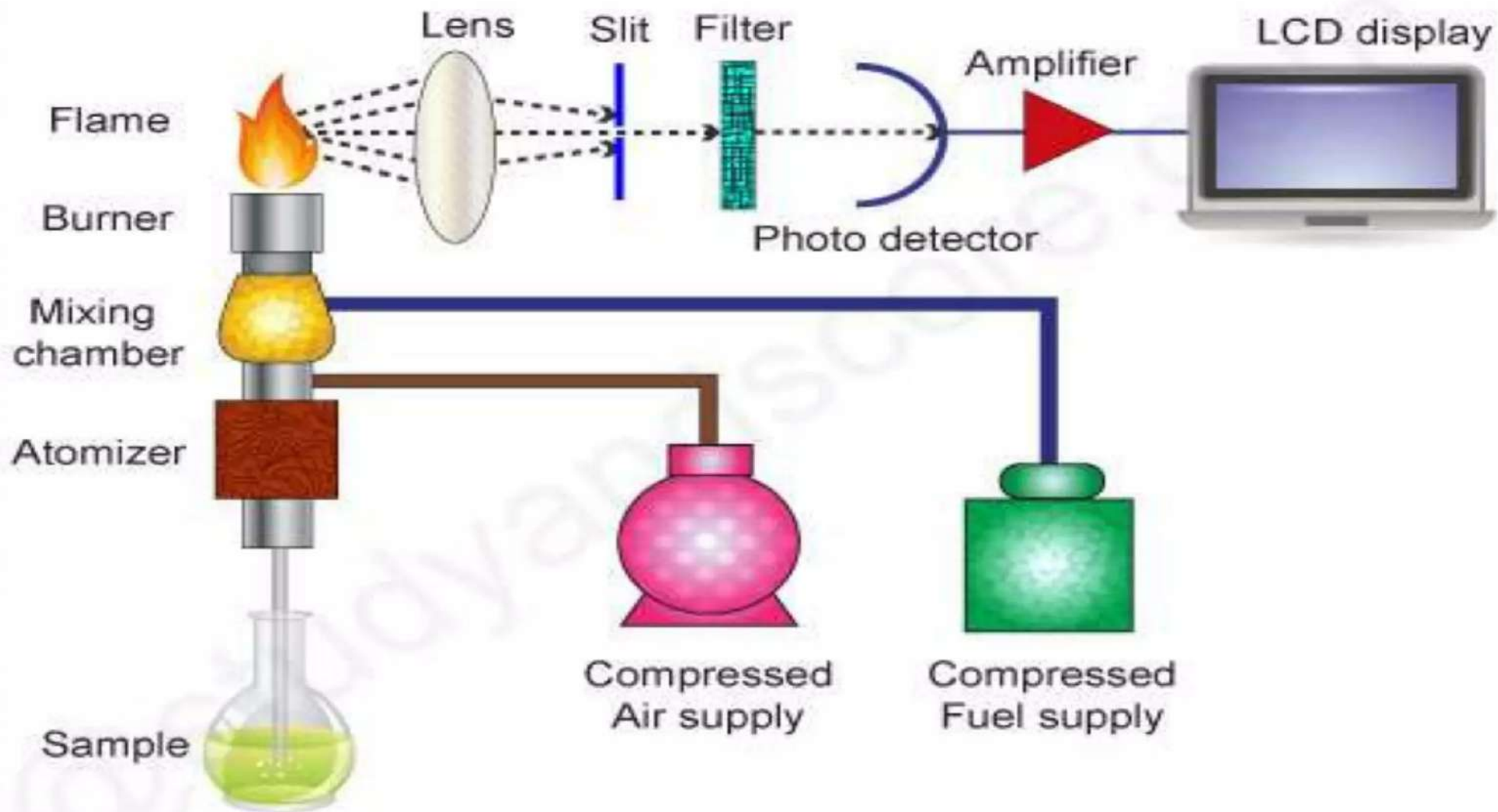
- The principle of flame photometer is based on **the measurement** of the **emitted light intensity** when a metal is introduced into the flame
- The **wavelength of the colour** gives information about the **amount of the element** present in the sample.
- The compounds of the alkali and alkaline earth metals (Group II) dissociate into atoms when introduced in the flame.

Element	Emitted wavelength	Flame colour
Potassium (K)	766 nm	Violet 
Lithium (Li)	670 nm	Red 
Calcium (Ca)	622 nm	Orange 
Sodium (Na)	589 nm	Yellow 
Barium (Ba)	554 nm	Lime green 

Emitted wavelength and flame colors of various alkali and alkaline earth metals



DIAGRAM



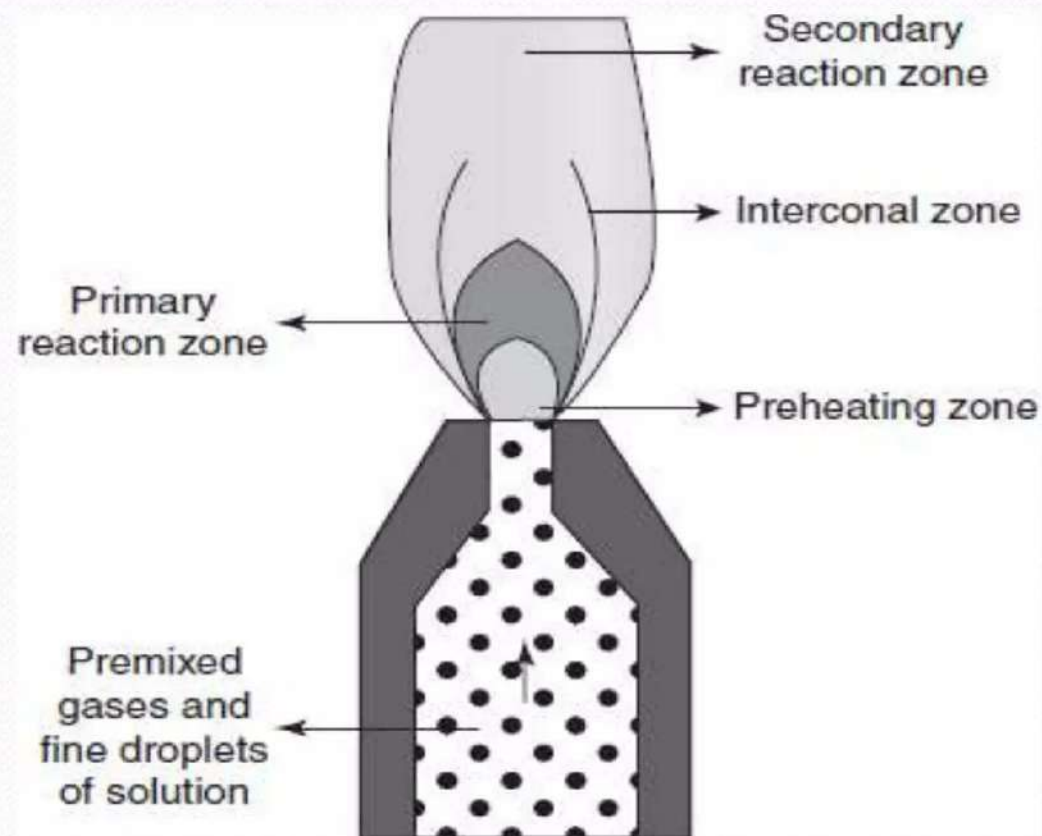
FLAME PHOTOMETER

PARTS OF A FLAME PHOTOMETER

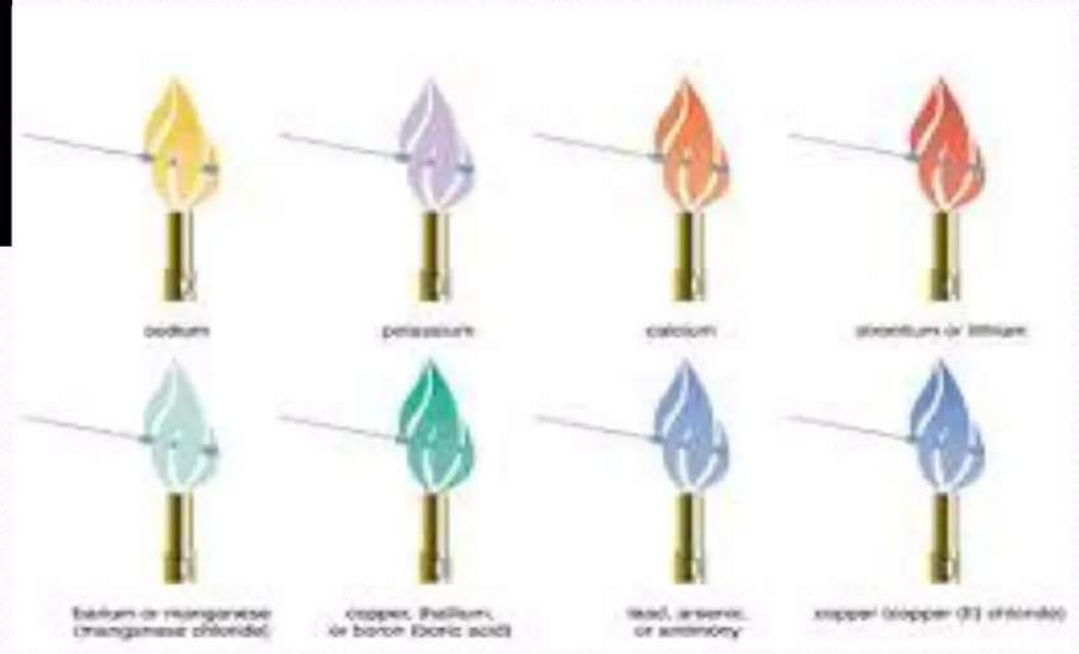
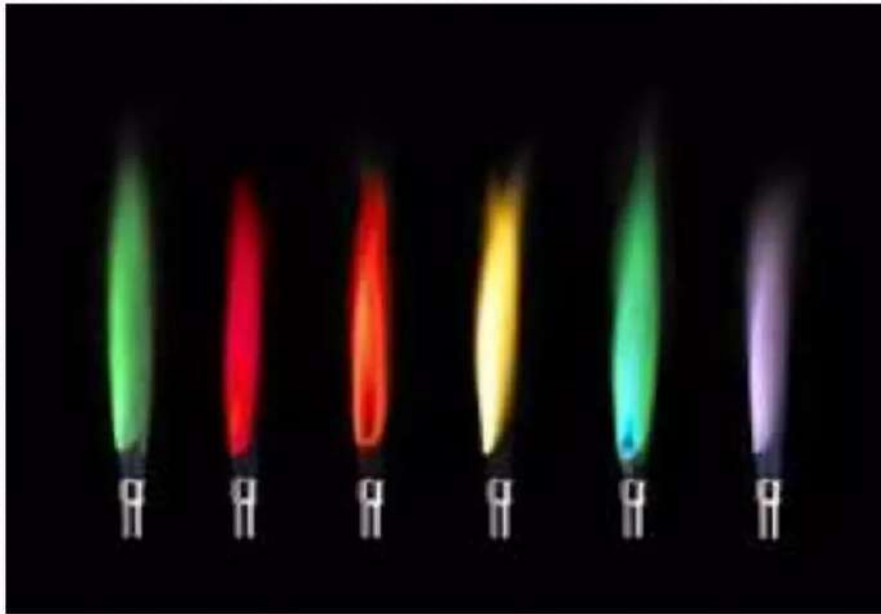
- SOURCE OF FLAME
- NEBULISER
- OPTICAL SYSTEM
- PHOTO DETECTOR

1.SOURCE OF FLAME

- A Burner that provides flame and can be maintained in a constant temperature.

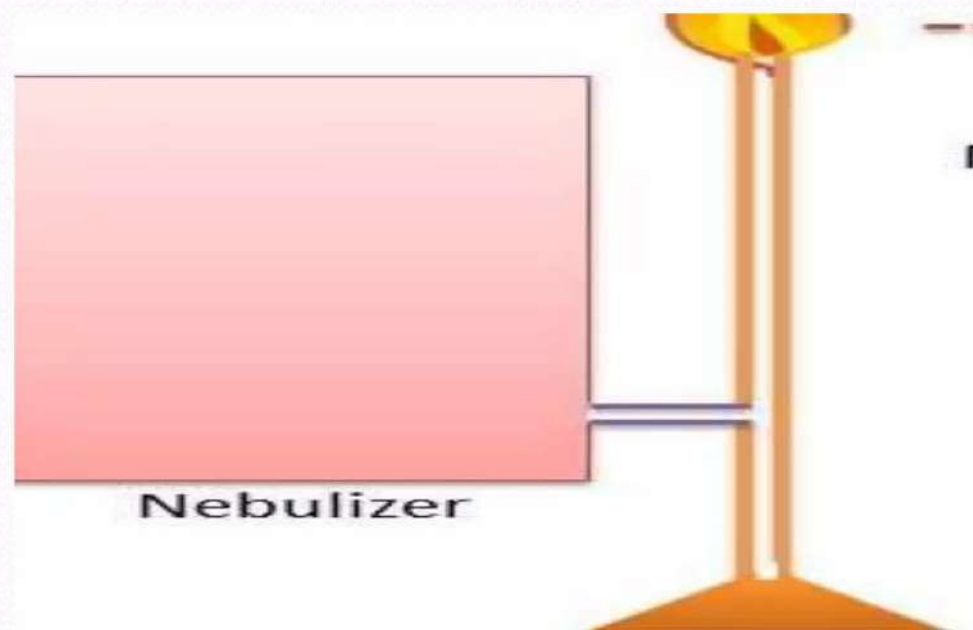


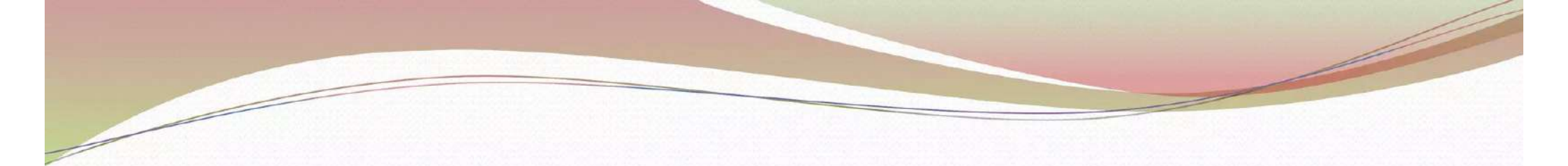
Different flames



2. NEBULIZER

- Helps to transport the homogeneous solution of the substance into the flame at a steady rate.
- The Nebulizer breaks up the sample into atoms.



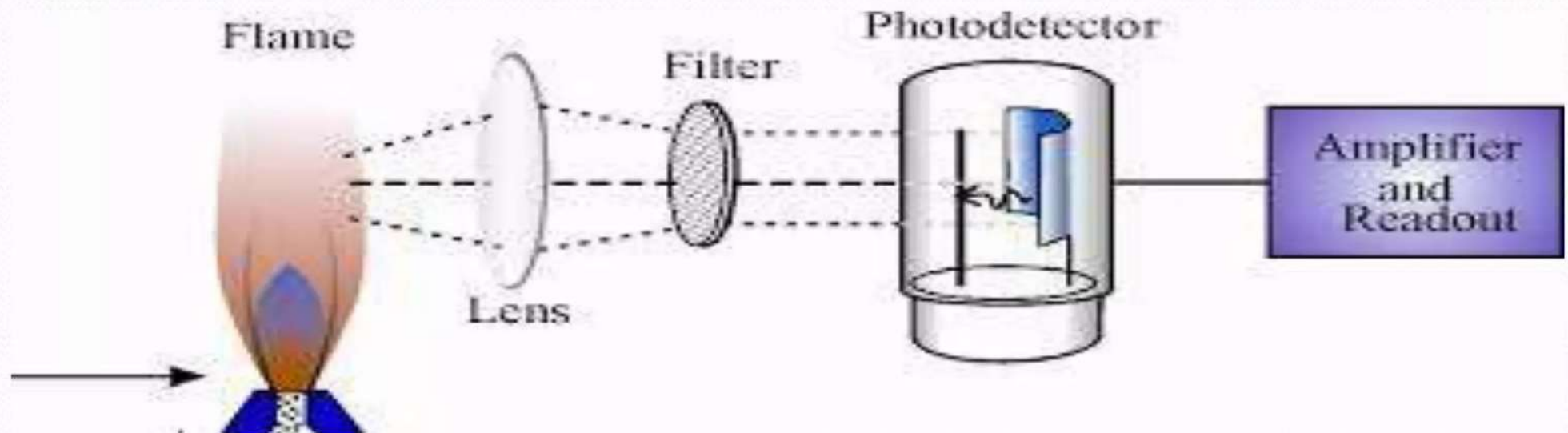
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- The mixing chamber mixes the relevant solution with the sample.
 - The colour filters show us which metals are present.
 - The photo detector tells us which metal the sample contains and to what concentration level.

3.OPTICAL SYSTEM

- The optical system comprises three parts:
 1. Convex mirror
 2. Lens
 3. Filter .

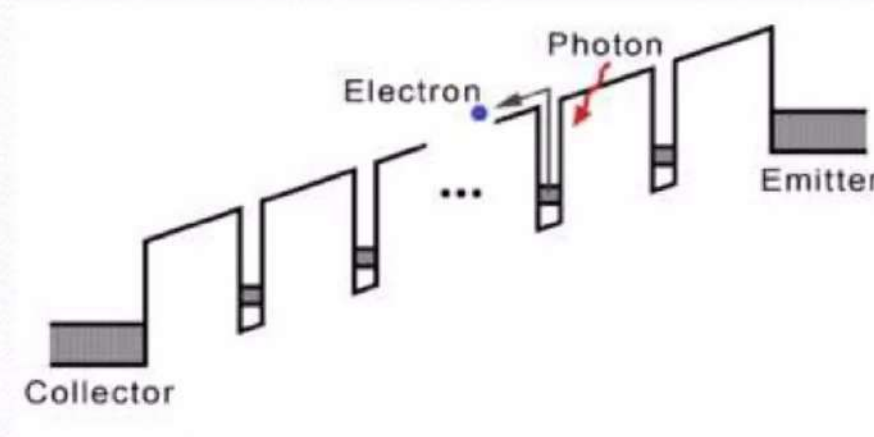
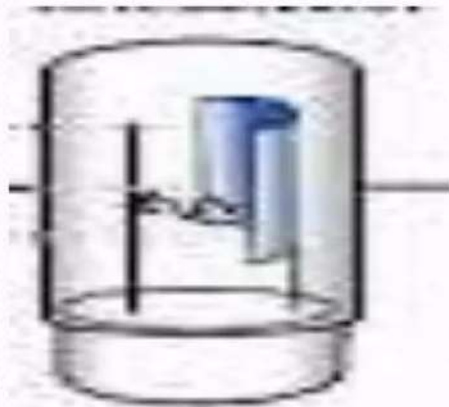
The **convex mirror** helps to transmit light emitted from the atoms and focus the emission to transmit light the lens.

- The lens help to focus the light on a point called slit . The reflection from the mirror pass through the slit and reach the filters.
- This will isolate the wavelength to be measured from that of any other emissions. Hence it act as interference type colour filters.



4. PHOTO DETECTOR

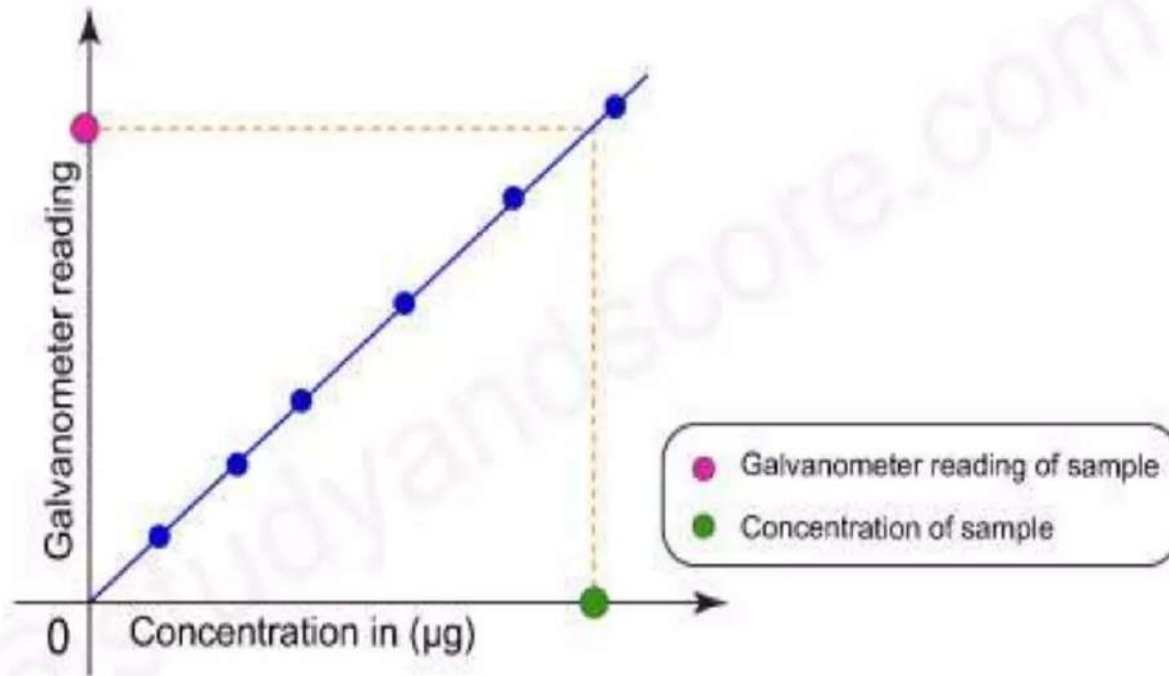
- Detect the emitted light and measure the intensity of radiation emitted by the flame.
- That is the emitted radiation is converted to an electrical signal with the help of photo detector.
- electron + photon = emitter.



WORKING PROCEDURE

- Both the standard stock solution and sample solution are prepared in fresh distilled water.
- The flame of photometer is calibrated by adjusting the air and gas. Then the flame is allowed to stabilize for five minutes.
- Now the instrument is switched on and open appropriate colour filters. The readings of galvanometer are adjusted to zero by spraying distilled water in flame . The sensitivity is adjusted by spraying conc. standard working solution.

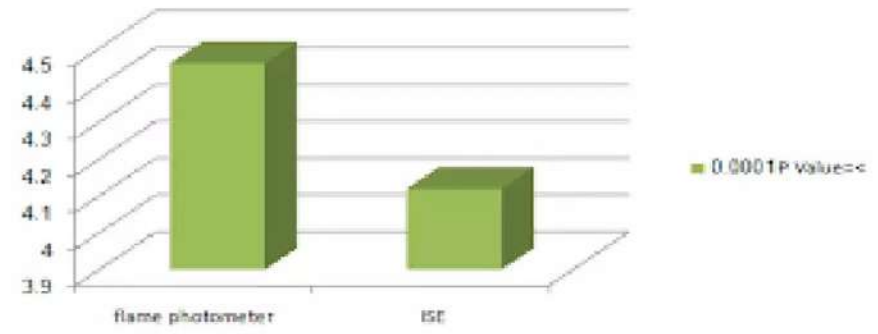
- Again distilled water sprayed in flame to reading of galvanometer .
- Now each of standard working solutions is sprayed into flame to get readings in G.
- Finally sample solution is sprayed into the flame and readings in galvanometer.
- Calculate the mean of galvanometer reading.
- PLOT the Graph of concentration of galvanometer & concentration of element in the sample.



FLAME PHOTOMETER: GRAPH

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Mean of ser. K by flame photometer and K ISE

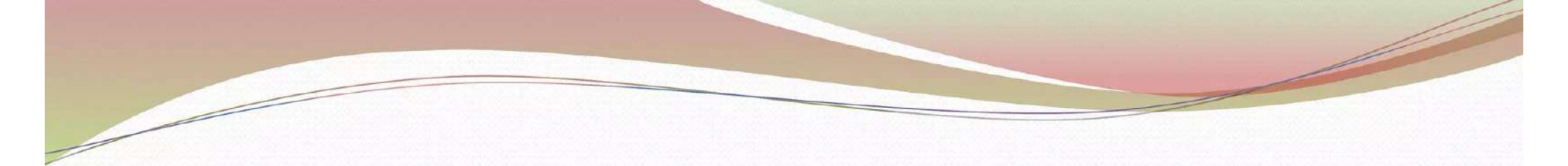


PROCESSES

DESOLVATION-Desolvation involves drying a sample in a solution.

VAPORIZATION-The metal particles in the sample are also dehydrated.

ATOMIZATION -Atomization is the separation of all atoms in a chemical substance..



EXCITATION- The electrostatic force of attraction between the electron and nucleus of the atom helps them to absorb a particular amount of energy.

EMISSION- Since the higher energy state is unstable the atoms jump back to the ground state or low energy state gain stability

SCHEIBE-LOMAKIN EQUATION

- Scheibe - lomakin equation describes intensity of light emitted with help of formula

$$I = K \times C_n$$

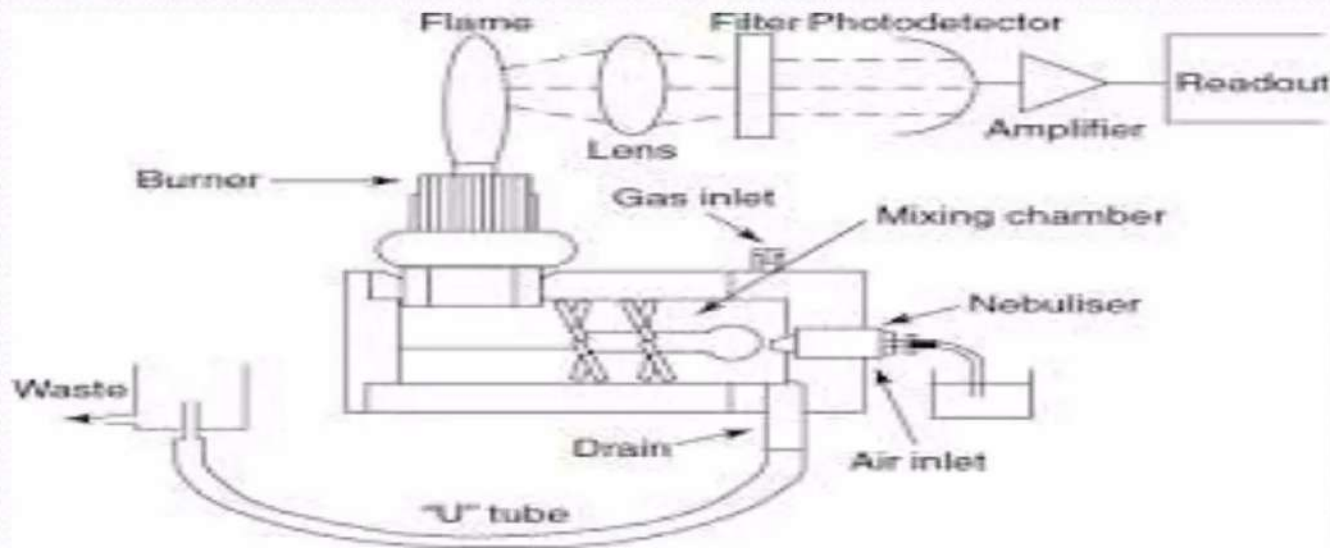
I - Intensity of emitted light

C_n - concentration of element

K - proportionally constant.

APPLICATION

- Flame Photometer has both quantitative and qualitative applications
- It is with monochromators emits radiations of characteristic which help to detect the presence of particular metal in the sample.



ADVANTAGES

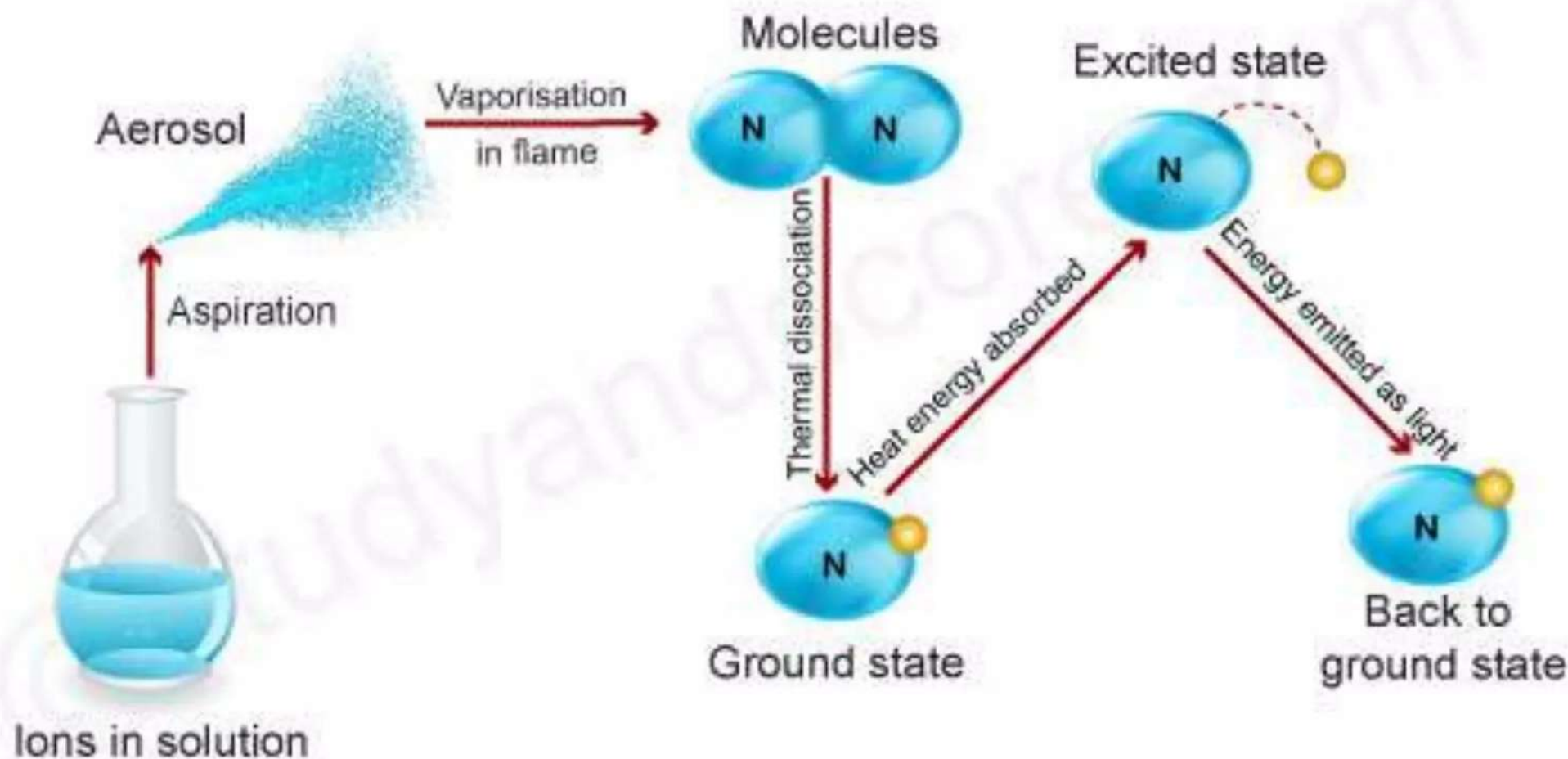
- Inexpensive
- Simple quantitative analytical test based on flame analysis.
- Quite quick , convenient, and selective & sensitive to even parts.

DISADVANTAGES

- It is difficult to obtain the accurate result of ions with higher concentration.
- The information about the molecular structure of compound present in the sample solution cannot be determined.

Looks of flame photometer





OVERVIEW OF FLAME PHOTOMETRY