

# UCB008 - APPLIED CHEMISTRY



## Atomic Emission Spectroscopy

### *Instrumentation*

by

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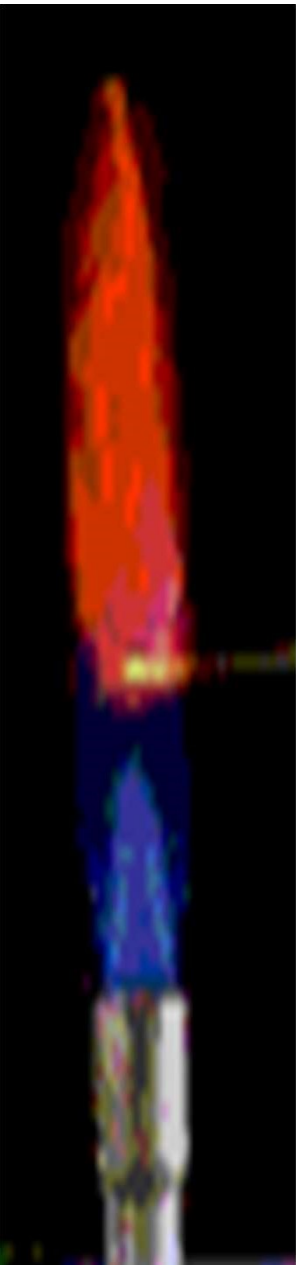
Thapar Institute of Engineering and Technology

Patiala -147004, India

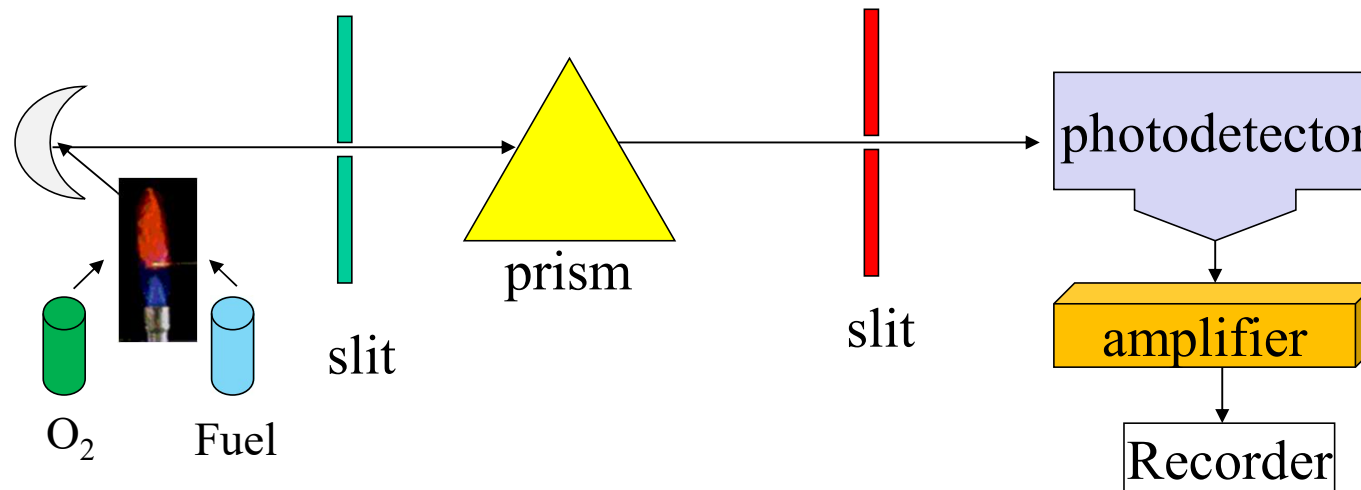
## Learning Outcomes

At the end of this session participants should be able to:

- Associate the principle with instrumentation of flame photometry

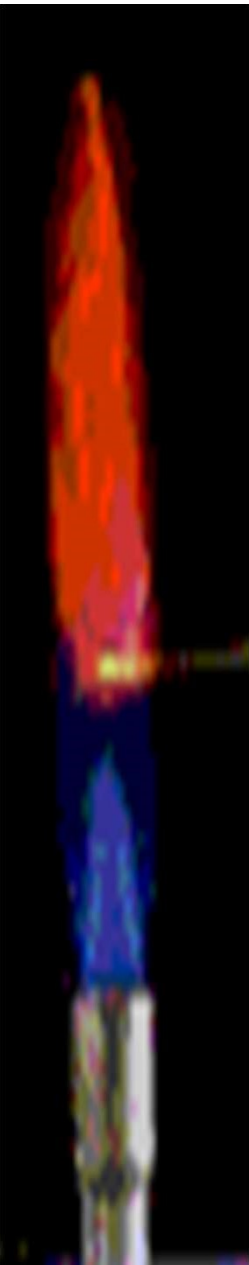


## Instrumentation

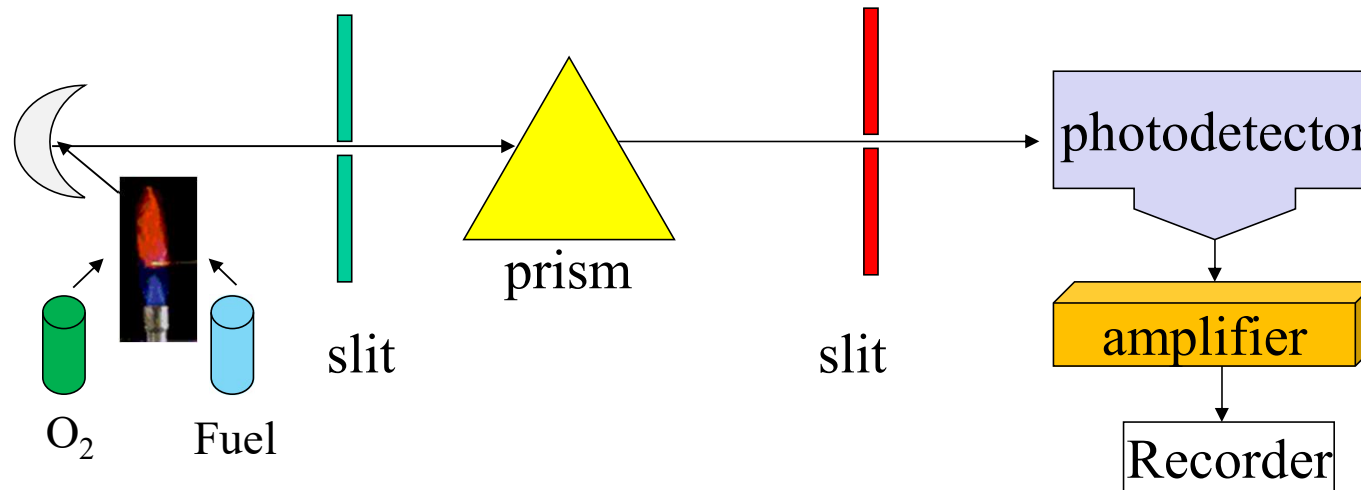


## Sequence of events in flame

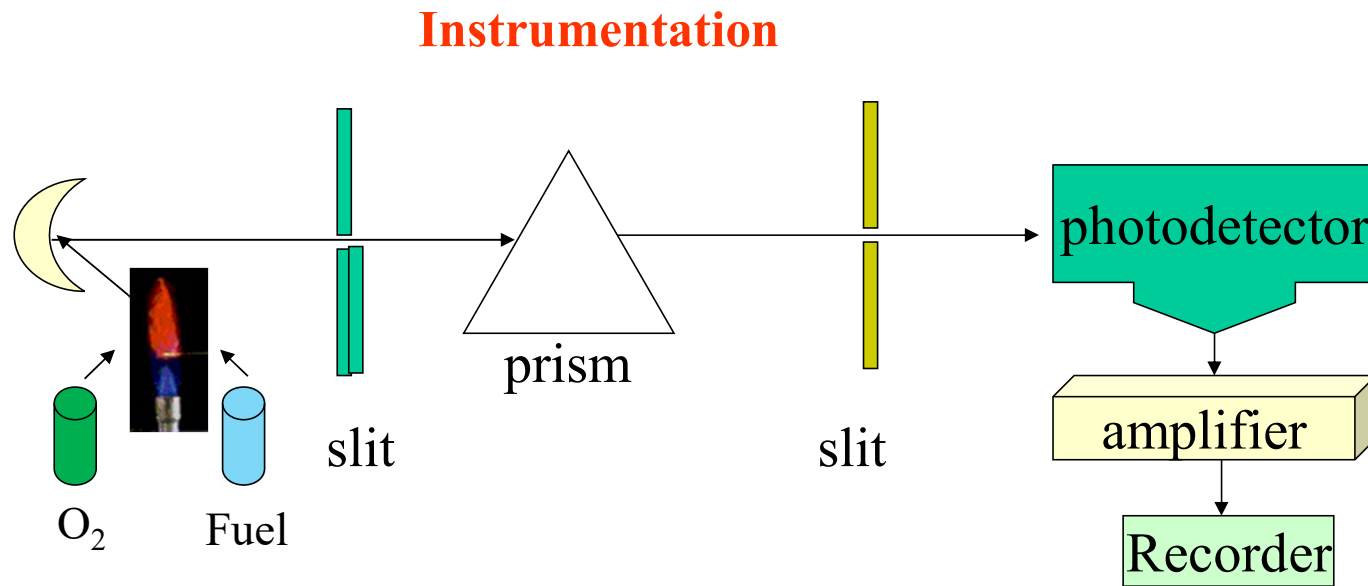
- Sample solution is converted into a fine aerosol (nebulized) and sprayed into the flame to desolvated, vaporized and atomized.
- Excitation of atoms



## Instrumentation



- c) Excited atoms relax and emit radiation
- d) The emitted radiant energy from flame emission is isolated by a monochromator and detected by a photomultiplier.



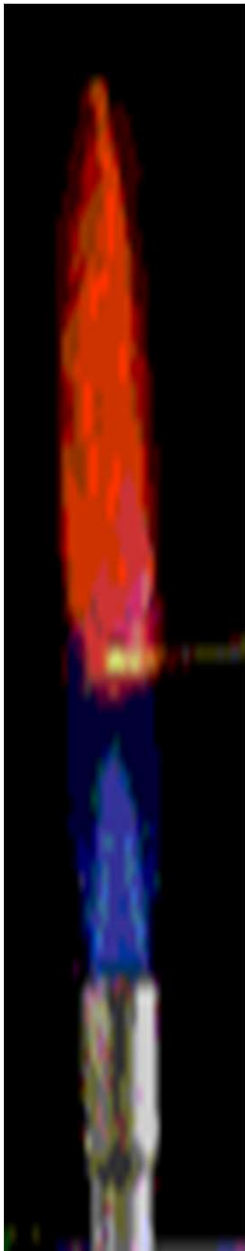
**The emitted radiant energy from flame emission is isolated by a monochromator and detected by a photomultiplier.**

**Burner-** used for producing flame and burning sample solution

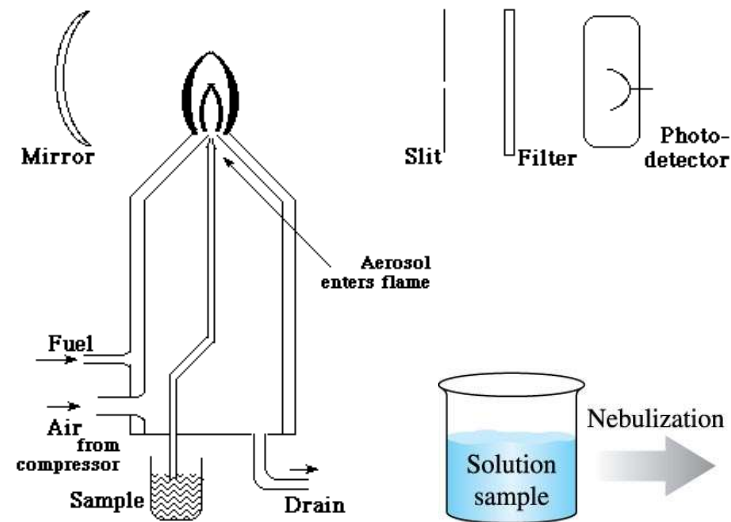
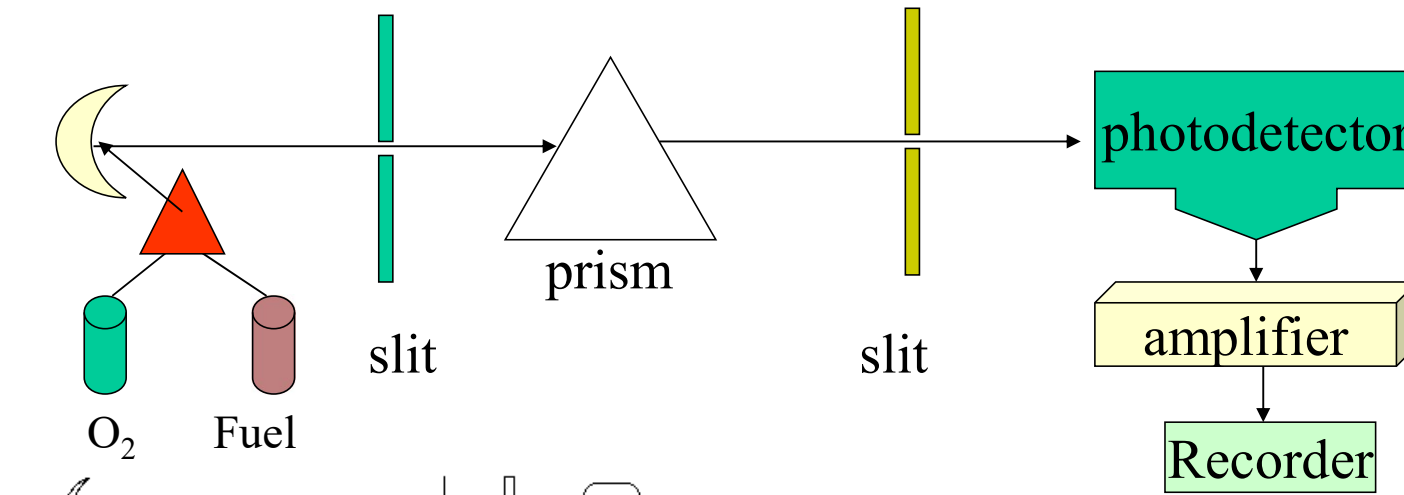
**Flame** – acts as an atomizer and emission intensity should be steady

**Temp. of flame depends on-**

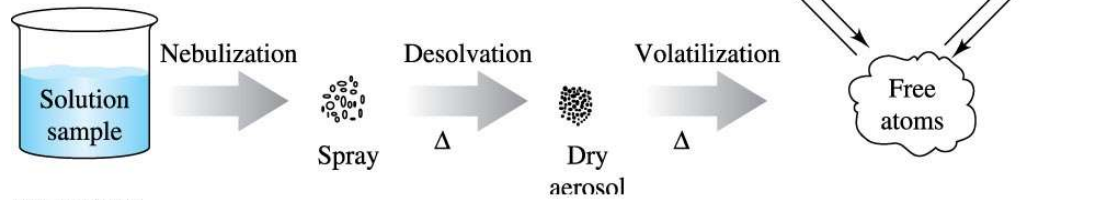
1. Type of fuel, oxidant, fuel to oxidant ratio
2. Type of solvent used for preparing sample solution
3. Amount of solvent entering in the flame
4. Type of burner used



# Instrumentation

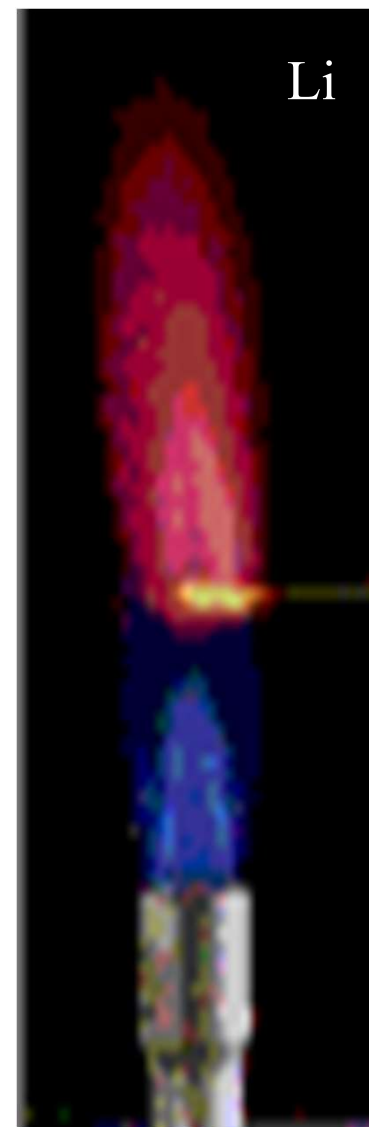
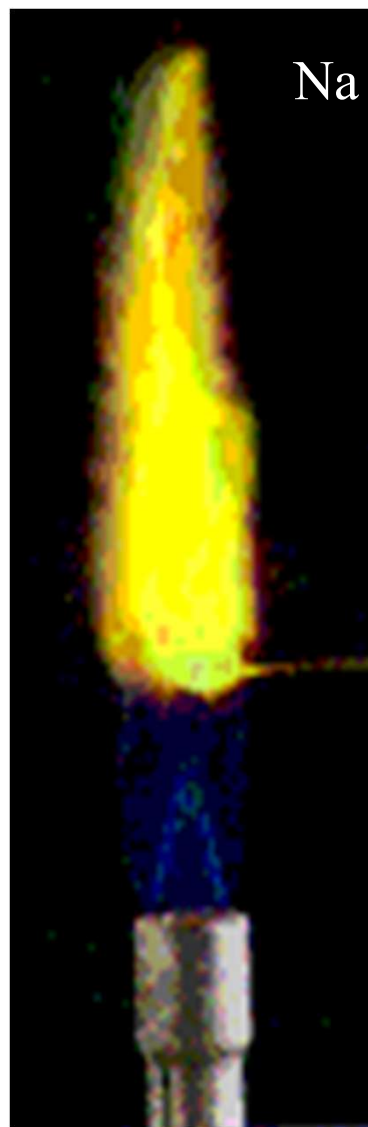
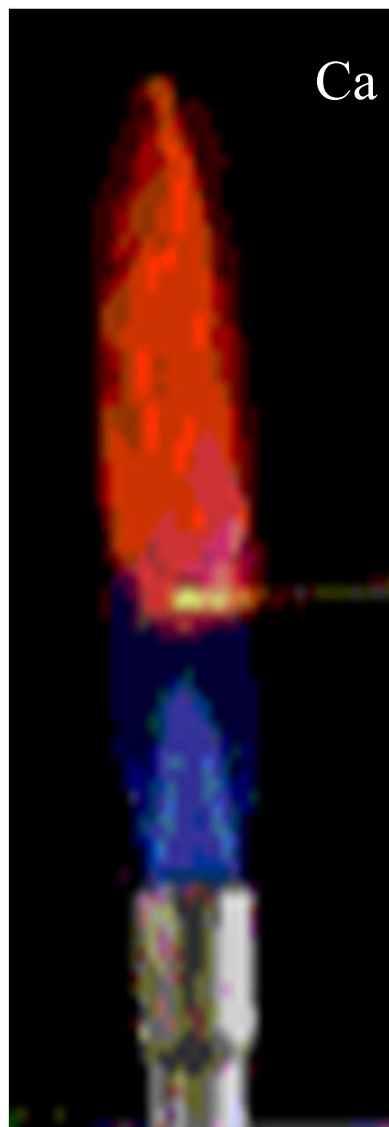
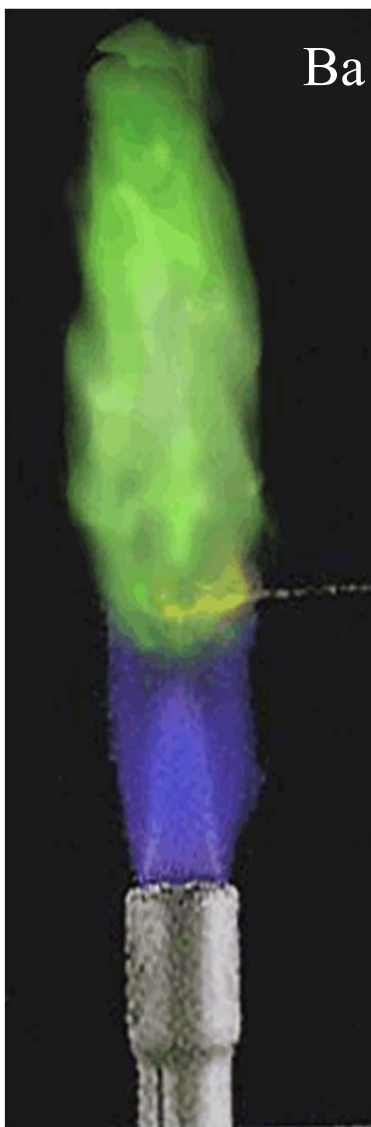


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## Applications

**The technique is used to detect elements of group I and II of the periodic table  
some elements can be detected visually by the colour in the flame**





## Qualitative Analysis

The technique is used to detect elements of group I and II of the periodic table

Within the flame, there are many more atoms in the ground state than in the excited state.

For Zn, for instance, in a 2000K flame, there are  $7.3 \times 10^{15}$  atoms in the ground state for every excited atom.

About 10 elements can be determined by conventional flame emission spectroscopy, since a flame provides sufficient energy for only a few elements to have a significant number of atoms in an excited state.

**Two methods are used for preparing the calibration curve**

- Standard addition method**
- Internal standard method**

**The alkali metals are elements with unoccupied atomic orbitals of low enough energy to be sufficiently populated by a flame.**

- Sodium and potassium ions play an important role in a number of biological systems and their functions. Since these ions form few insoluble compounds and exhibit essentially no acidic or basic properties, they cannot be determined readily by conventional wet chemical techniques and are usually measured instrumentally.**
- The usual techniques employed in determining these ions include atomic absorption spectroscopy (AAS), atomic emission spectroscopy (AES).**

**Both these methods require that the sample exist as, or be converted to, an aqueous form.**

**Choosing between the individual methods is based primarily on the sensitivity, speed and convenience of the method.**

**Detection limit for these ions is lowest by AAS but AES is simple, this method is generally used for Sodium and potassium ions determination.**

## **AES applications**

**Used for the analysis of biological fluids and tissues**

**Soil analysis**

**Natural and Industrial wastewater analysis**

## Limitations

- **Less reliable than AAS**
- **Both the techniques does not provide any information about the molecular structure of the compound**
- **Non radiating elements (C, H, halides) cannot be detected.**

In the next session.....

- Categorization of various burners used in atomic spectroscopy