LABROTORY INSTUMENTATION AND TECHNIQUES

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LECTURE THIRTEEN
SPECTROPHOTOMETER

Spectrophotometer

It is an instrument that measures the amount of photons (intensity of light) absorbed after it passes through sample solution.

In the spectrophotometer, the concentrations of a known chemical substance can be determined by measuring the intensity of light detected depending on the range of wavelength of light source

Types of Spectrophotometer:

1-UV-visible spectrophotometer: uses light of the ultraviolet range (185 - 400 nm) and visible range (400 - 700 nm) of electromagnetic radiation spectrum.

2-IR spectrophotometer: uses light of the infrared range (700 - 15000 nm) of electromagnetic radiation spectrum.

Parts of spectrophotometer

1-**Photocell :** convert the light into electrical current

2-Prism or granting (monochrometer) :it will analyze the light to selected spectra and wavelength

3-Wavelength (knob) : to control the certain wavelength applied

4-Cuvatte and sample holder

5-Galvanometer : it will measure the electrical current from photocell or detector

6-Zero point adjustment : it is to set up the equipment to the zero point before use

Types of photocells

1- Red photocell (600 – 800) nm

2- Blue photocells (400 – 495)nm.

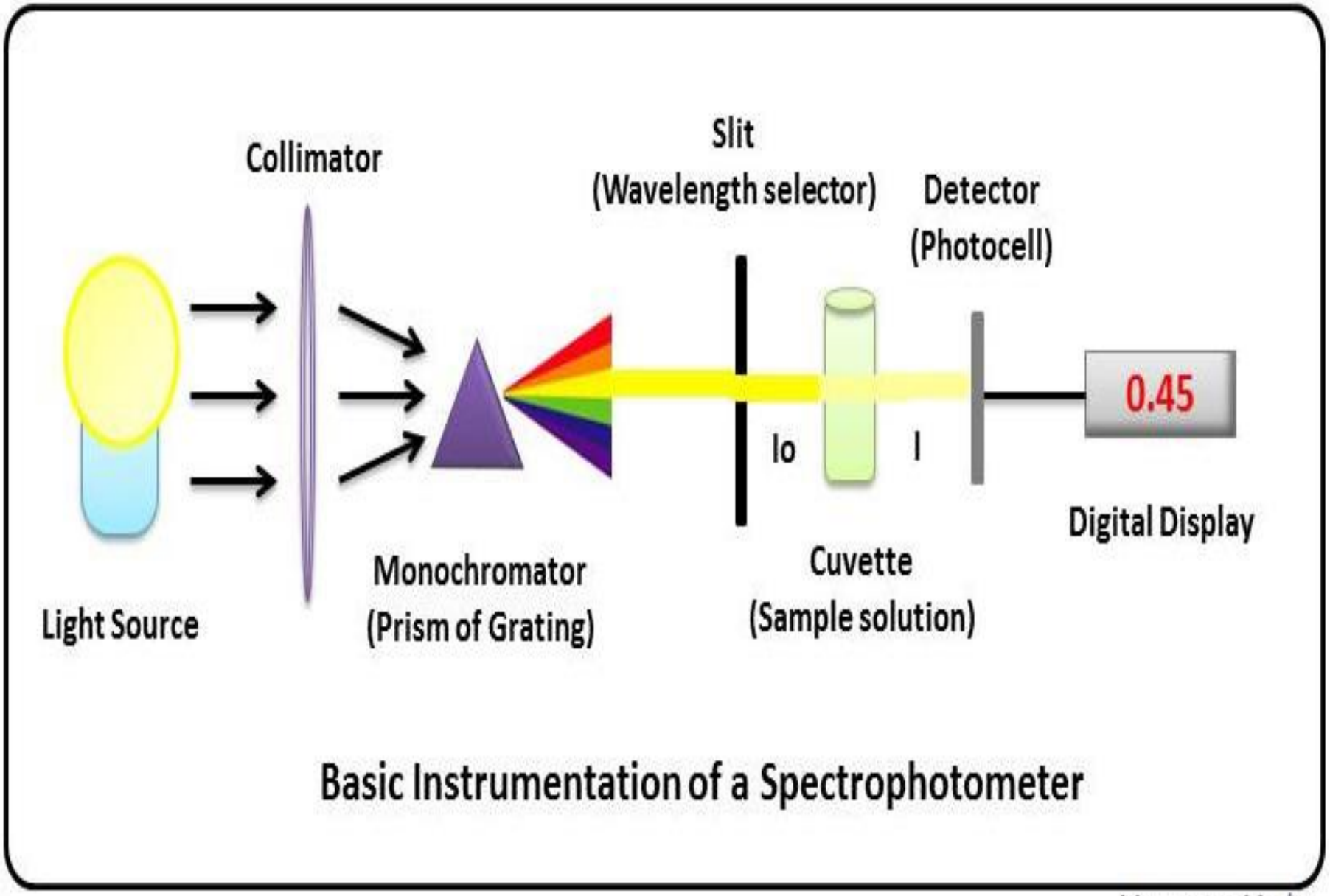
: Source of light

1-Tungsten filament : The most commonly used source for visible light ranging from (400 – 700) nm

2-Halogen lamp : It will give more bright light with . minimum of the red and has a long life in use

3-Deuterium lamp : It will use in ultraviolet spectra . measurement ranging(190 – 400) nm

. It is use only in spectrophotometer



Basic Instrumentation of a Spectrophotometer

Diffraction Grating :

It is an optical device consisting of many closely spaced parallel slits or grooves. In a transmission type of grating, light passes through the narrow transparent slits that lie between the dark lines on a glass or plastic plate. In a reflecting grating, light is reflected by the many parallel, narrow, smooth surfaces and absorbed or scattered by the lines cut in the reflecting surface of the grating .A diffraction grating does not bend anything. It shifts the position of wave crests so that they add together at different angles.

Prism

It is An object made up of a transparent material like glass or plastic that has at least two flat surfaces that form an acute angle (less than 90 degrees). White light is comprised of all the colors of the rainbow. When white light is passed through a prism, the colors of the rainbow emerge from the prism (it changes the speed of light differently for different colors — it . bends the light differently for the different colors)

Photometer	Spectrophotometer
1-It use filter which give approximate a wavelength according to the color 2-Lower cost 3- Smaller number of calibrations 4-Fixed applications 5- Simpler chemistries 6-Photometers are “tuned” for a specific application 7- Do not require in-house chemometrics (PLS) expertise 8-They will not work for other applications that require different wavelengths unless modified	1-It use prism or grating (monochrometer) which give exact wavelength More expensive, but may be necessary- 2 3- Unlimited number of calibrations 4-Completespectral coverage accommodates new processes 5- More complex chemistries 6-Enhanced spectral processing . 7-Generally requires chemometrics (PLS) expertise within the company