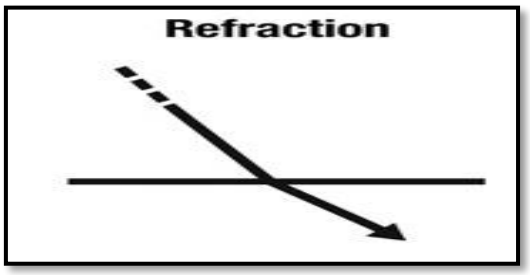
Photometer

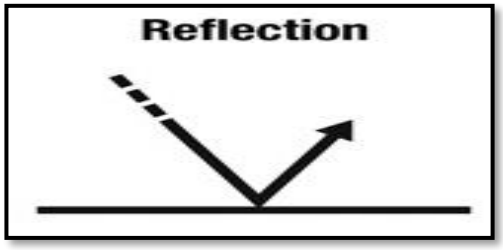
Visible light spectrum:

When a beam of light passes through a colored solution, it interacts with matters in the solution and the result may be ***refraction*** , ***reflection*** , ***absorption*** and ***transmission*** among others.

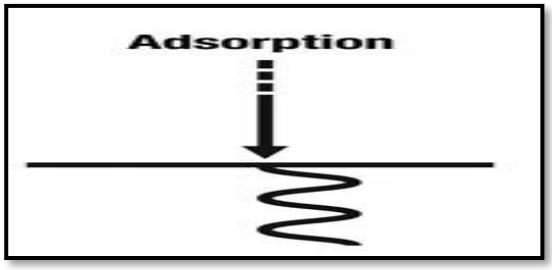
*****Refraction:*** Is defined as sudden change in the direction of the beam when the light passes from one medium to other with a different physical density.



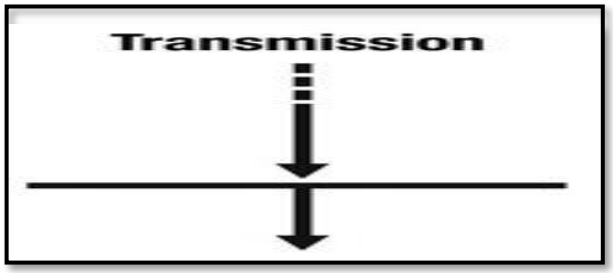
*****Reflection:*** Is a condition where the beam returns back towards its source such as mirror.



*****Absorption :***Is a situation where some components of the light (colors) are retained or absorbed.

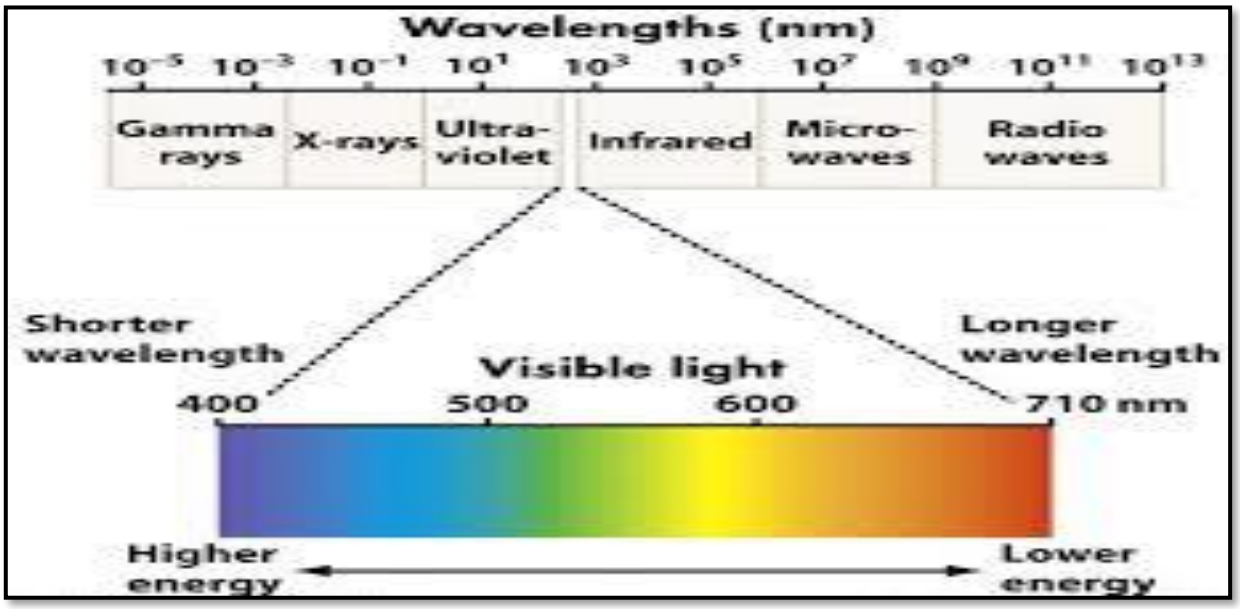


*****Transmission:*** Refers to the situations where some portions of the light permitted to pass through a given medium .

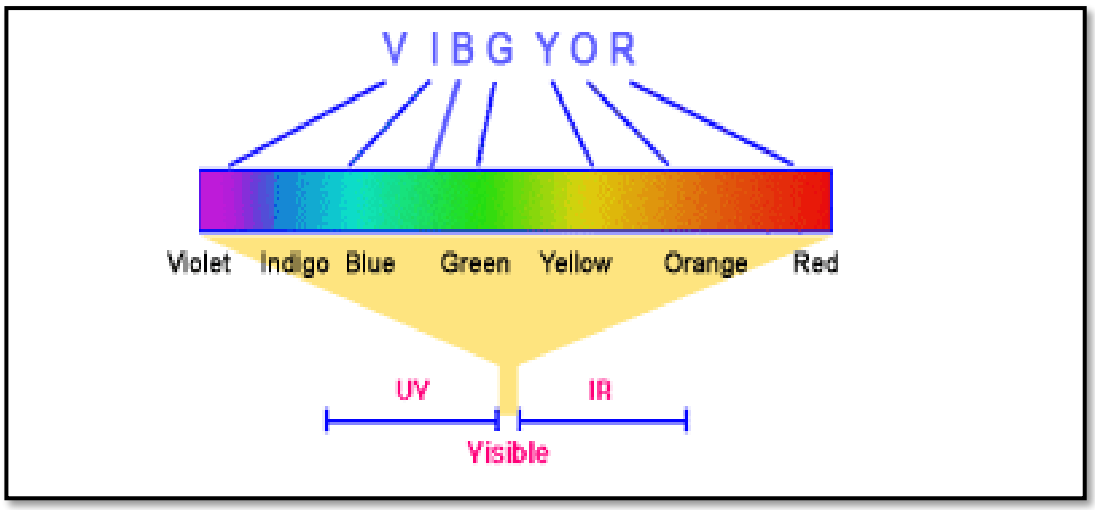


Radiation is characterized by waves on which basis the electromagnetic radiation spectrum could be divided in many regions including gamma rays, x-rays, ultraviolet rays, visible light , infrared, microwaves and radio waves .

Visible region is the radiant energy to which the human eye responds and their wavelength varies between 400 and 700 nm , Wavelength of about 700 nm are seen by the eyes as red colors while those of progressively shorter wavelengths give in descending order to orange, yellow, green, blue, indigo and finally violet colors which is produced in the short wavelength of 400nm.



The electromagnetic spectrum



Visible light spectrum

Beer's and Lambert's Law:

Most colorimetric analytical tests are based on the Beer's - Lambert's law which states that under the correct conditions the absorbance of a solution when measured at the appropriate wavelength is directly proportional to its concentration and the length of the light path through the solution. Using a standard, this law can be applied to measuring the concentration of a substance in unknown (test) solution by using the formula:

$$\textbf{Concentration of test (} C_t \textbf{) } = \frac{\textbf{Absorbance of test (At)}}{\textbf{Absorbance of standard (As)}} \textbf{ X Concentration of standard (Cs)}$$

OR : $C_t = \frac{At}{As} \text{ X } C_s$

Photometer

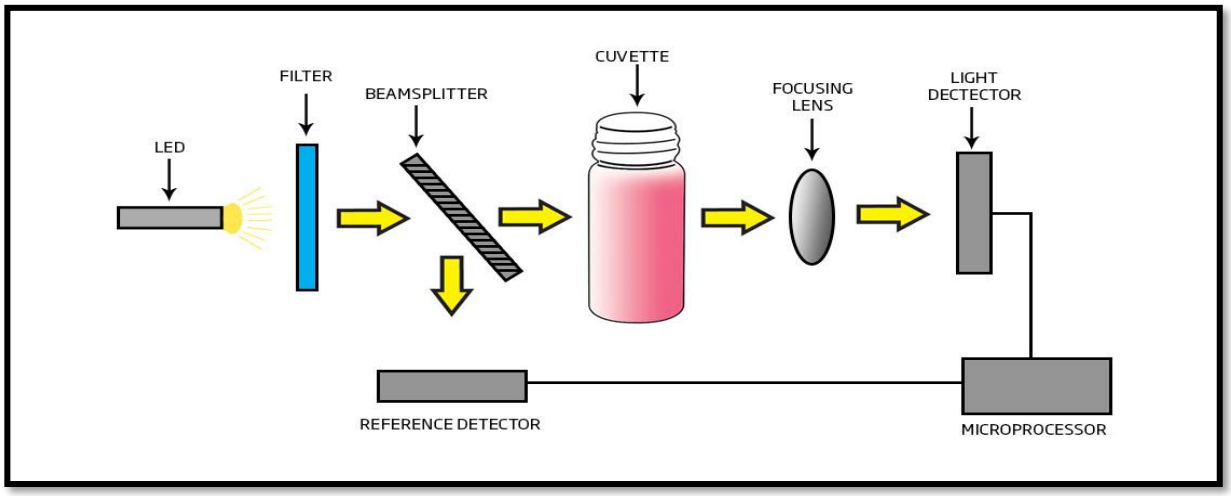
It is an instrument that measures the strength of electromagnetic radiation in the range from ultraviolet to infrared and including the visible spectrum . Most photometers convert light into an electric current using a photoresistor or photomultiplier . The measurement depending on color filter which give the complement color and in this case the reading less accurate than spectrophotometer which is use monochrometer

Parts of photometer :

1-**Light source .**
2- **Filter** : to give approximate wave length according to the color .
3-**Sample holder**: which can hold the sample .
4- **Photocell** : it will convert the light to electrical current .
5- **Galvanometer** : which can measure the current from photocell.
6-**Zero adjustment** : which can adjust the zero point and reading .

Types of filter :

1- **Blue filter :** it will pass the wavelength between (400 – 495) nm .
2- **Green filter :** it will pass the wavelength between(500 – 580) nm .
3-**Red filter :** it will pass the wavelength between (600 – 800) nm .



Light path in the photometer