The quantity of radiation absorbed is given by the Beer-Lambert Law: $A = \log \frac{I_o}{I}$

Absorbance is also given by: $A = \varepsilon_\lambda \bullet C \bullet l$ where:

A is a dimensionless number

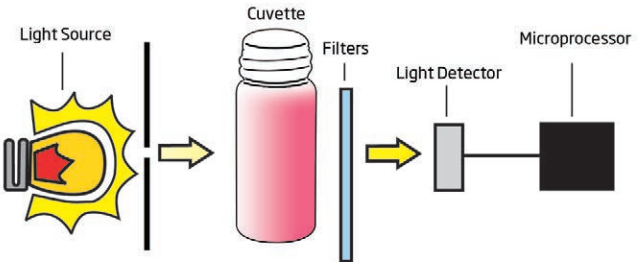
ε_λ the proportionality constant, is called the molar extinction coefficient or molar absorptivity; it is a constant for a given substance, provided the temperature and wavelength are constant [L/(mol•cm)]

C concentration of the substance (mol/liter)

l optical distance light travels through sample (cm)

Therefore, the concentration (**C**) can be calculated from the absorbance of the substance determined by the emitted radiation (**I**), as the other factors are known.

A typical block diagram of a photometer is shown below:



Sources of light used by Hanna colorimeters:

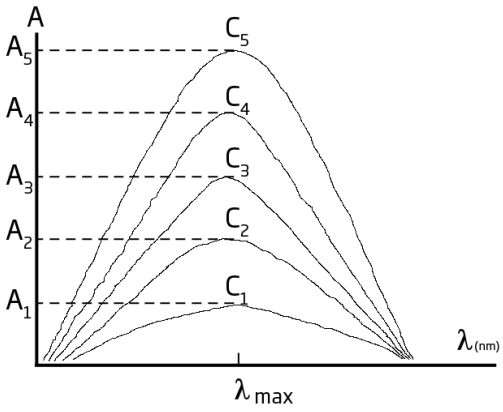
Tungsten lamp an incandescent lamp having a tungsten filament

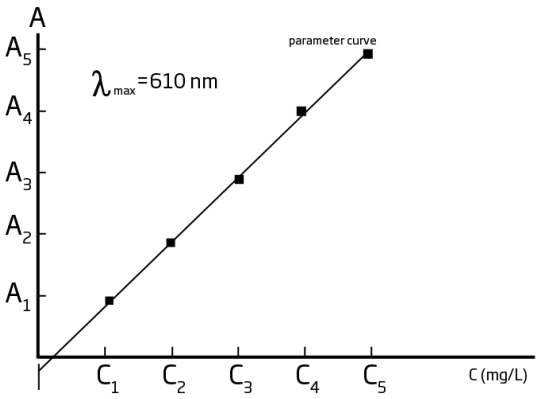
LED light emitting diode

The optical distance is measured by the dimension of the cuvette containing the sample. The photoelectric cell collects the radiation (**I**) emitted by the sample and converts it into an electric current, producing a potential in the mV range. The microprocessor uses this potential to convert the incoming value into the desired measuring unit and display it on the LCD.

In fact, the preparation of the solution to be measured occurs under known conditions, which are programmed into the meters microprocessor in the form of a calibration curve. This curve is used as a reference for each measurement. It is then possible to determine unknown concentrations of a sample by using a colorimetric reaction and the mV signal separated by a sensor in relation to the emitted intensity (**I**) (the color of the sample). By employing the calibration curve, one can determine the concentration of the sample that corresponds to the mV value.

Supposing that for one chemical substance there is a maximum absorbance at 610 nm. With the following graphs, you have one example of how the colorimeters are working to determine concentration:





One example of an early colorimetric analysis is Nessler's method for ammonia, which was first proposed in 1856. Nessler found that adding an alkaline solution of HgI_2 and KI to a dilute solution of ammonia produced a yellow to reddish brown colloid with the color intensity proportional to the concentration of ammonia present. A comparison of the samples color for a series of standards was used to determine the concentration of ammonia. Equal volumes of the sample and standards were transferred to a set of tubes with flat bottoms. The tubes were placed in a rack equipped at the bottom with a reflecting surface, allowing light to pass through the solution. The colors of the samples and standards were compared by looking down through the solutions. A modified form of this method is used for the analysis of ammonia in water and wastewater.