TP3: Spectrophotometric dosage

Objectives: .

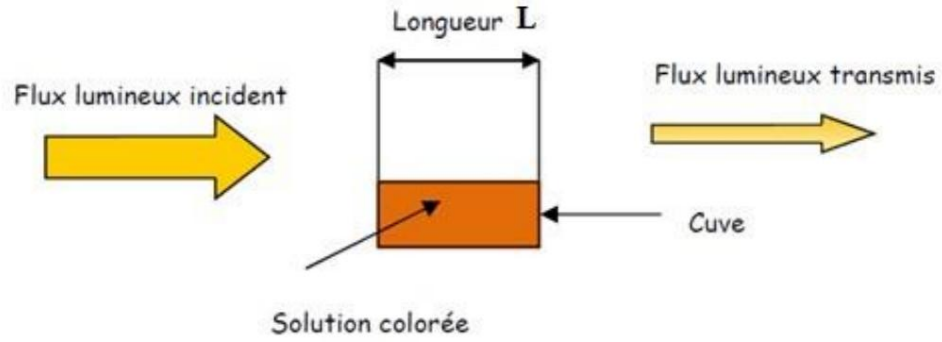
Know the spectrophotometry technique.

· Know and use the relationship between absorbance and the concentration of an absorbing species in solution (Beer Lambert's law).

· Determine the concentration of a Methyl Orange solution from a calibration curve.

I-Operating principle of the spectrophotometer Spectrophotometry is a quantitative analytical method which consists of measuring absorbance.

The spectrophotometer passes monochromatic radiation (of wavelength ÿ) through a cell of length L containing a colored solution. It then measures the absorbance A (a quantity linked to the quantity of light absorbed by the solution).

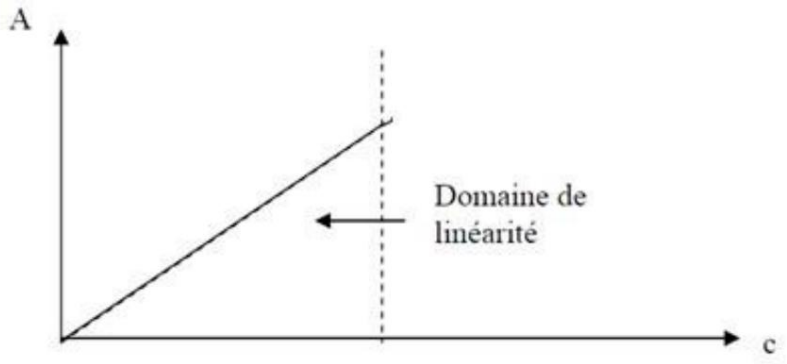


II- Beer Lambert's law (A = ÿ.CL)

The Beer-Lambert Law is a law that determines the relationship between absorbance and the concentration of an absorbing species in solution.

L = length of the tank (1 cm in general, with an accuracy of 1%) • C = concentration of the solution

• ÿ = Specific extinction coefficient which depends on the wavelength. ÿ also varies according to intermolecular forces and therefore the solvent used.



The graph representing absorbance as a function of concentration, called a **calibration** line (or **curve) ,** allows the unknown concentration of of a solution to be determined from the measurement of spectrophotometric absorbance.

The correlation coefficient, "R2 ", and the "Y" axis at the origin of the regression line allow you to demonstrate the acceptability of the linearity of the data.

1-Preparation of Methyl Orange solutions We have an aqueous solution of Methyl Orange So with a mass concentration of Co = 100 mg/L (3 10-4 mol/L). We are trying to produce different solutions of Methyl Orange with concentrations of Ci to be determined by dilution (see table below).

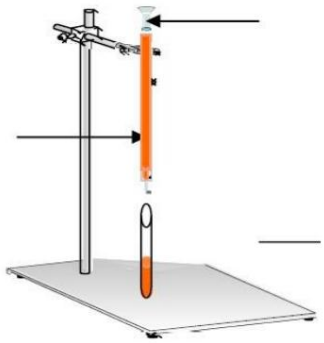
Complete the four columns of the table.

No. solution n	Volume Vi of S0 of water added (mL)	Volume Total (mL)	volume (mL) 50 mL	Concentration Ci of the diluted solution of Methyl orange (mg/L) 5 mg/	Absorbance A (unitless)
1				L 8 mg/	
2			50 mL	L 10 mg/	
3			50 mL	L 12 mg/	
4			50 mL	L 15 mg/	
5			50 mL	L 20 mg/L	
6			50 mL		

ÿ Rinse a burette with Methyl Orange So solution . Then fill it with this same solution. ÿ Prepare in different 50 mL flasks the solutions S1 to S6 :

_ Pour the required volume of Methyl Orange solution (indicated in the table) then the corresponding volume of water,

_ Complete the necessary volume with distilled water (up to 50mL), cap and shake.



2- Measures

The reading wavelength is constant: ÿ = 465 nm.

For a reference (or "blank") solution set A = 0 (red "zero" push button).

_ Measure the absorbance of each of the solutions produced. _

Complete the last column of the table.

Data: Methyl orange: Its chemical formula is C14H14N3O3SNa

(Molar mass: 327.33 g/molSolubility: 5.2 CH3 g/L (at 20°C) and pKa = 3.4 CH3