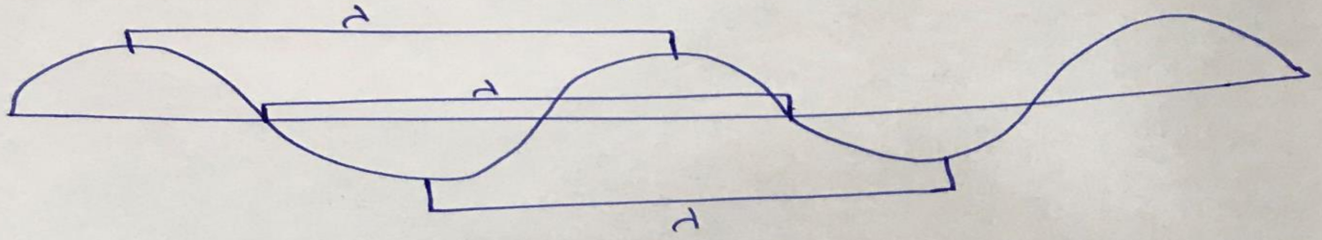
Spectroscopy

We must have to learn about
Electromagnetic Radiations (EMR)

	wavelength (λ)
* Gamma rays	<0.001 nm
* X- rays	$0.01 - 10$ nm
* Ultra violet	$200 - 400$ nm
* Visible light	$400 - 800$ nm
* Infra red	$0.8 - 200$ μm
△ Near IR	$0.8 - 2.5$ μm
△ Mid IR	$2.5 - 15$ μm (some times $2.5 - 25$ μm)
△ far IR	$15 - 200$ μm (some times $25 - 200$ μm)
* Microwave	$0.01 - 1$ m
Radio wave	$1 - 10^7$ m

Wave length (λ)



Wave No. [Nu bar $\bar{\nu}$]

an unit area no. of waves pass through

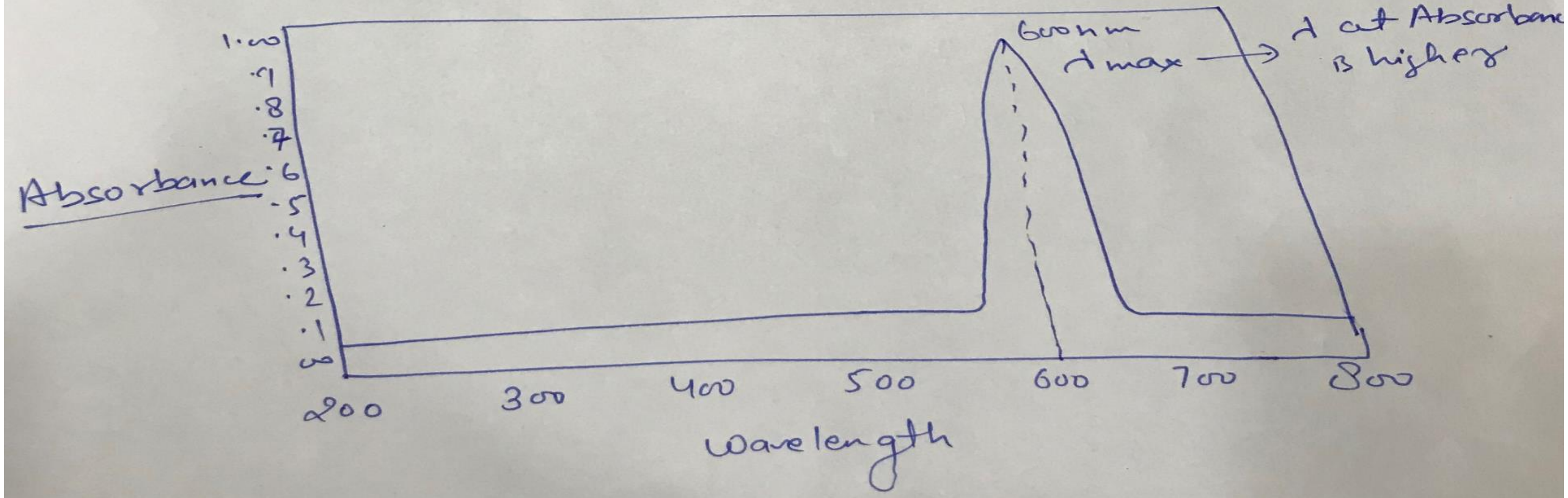
$$\bar{\nu} = \frac{1}{\lambda}$$

Frequency [Nu ν]

At perticular point no. of waves pass in unit second.

$$\nu = \frac{c}{\lambda} \rightarrow \text{speed of light}$$

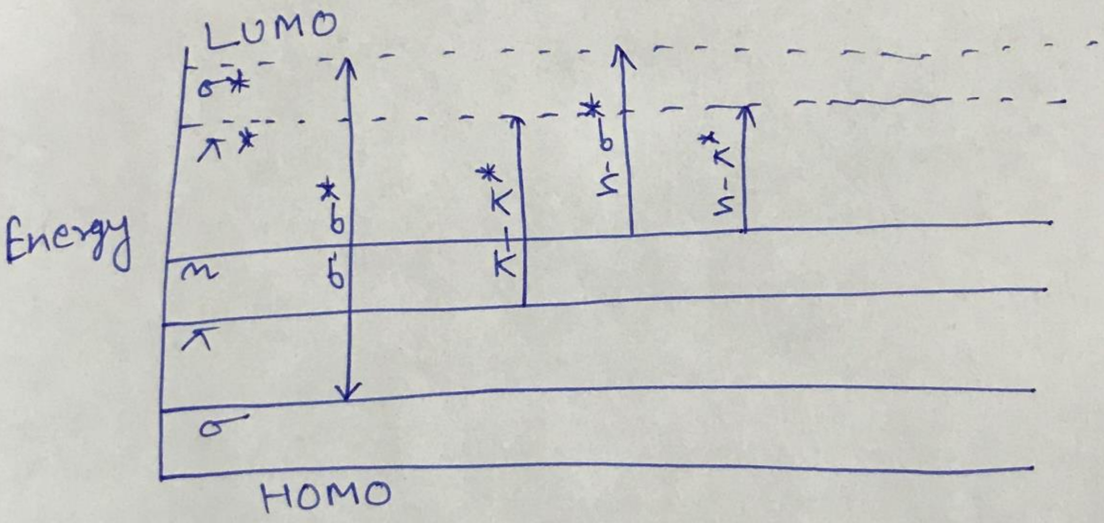
UV VISIBLE SPECTRUM



Principle of UV-Visible Spectroscopy

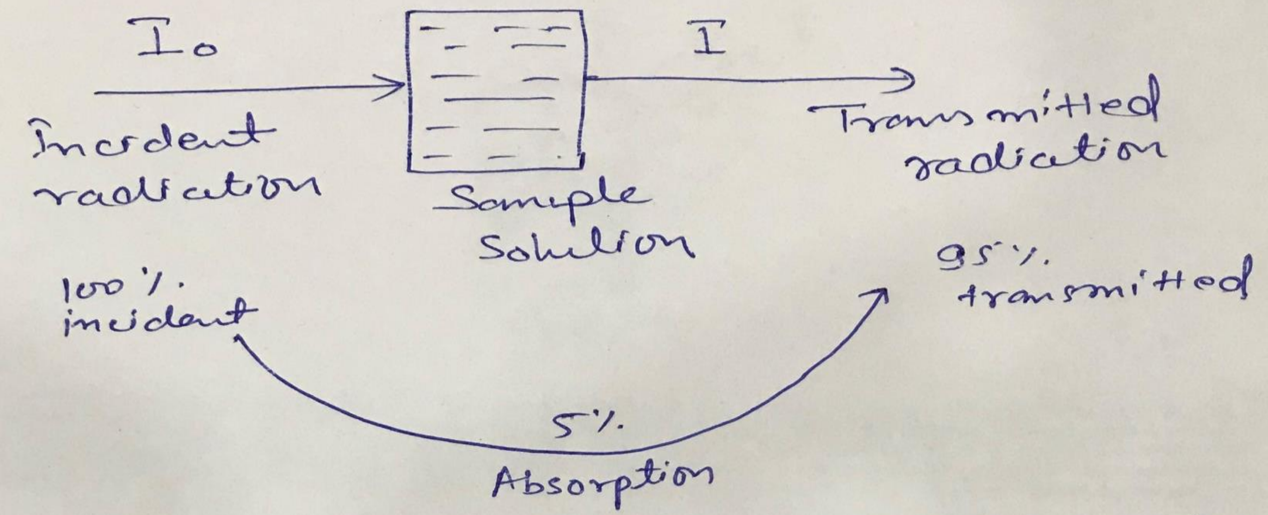
* Energy absorbed in the UV-visible region produces changes in the electronic energy of the molecule resulting from transition of valence electrons in the molecule

* The distinct types of electrons are involved in organic molecules. These are as follows
  σ, π & n electrons.



$\sigma-\sigma^* > n-\sigma^* > \pi-\pi^* > n-\pi^*$

Absorption laws



Case I: If sample solution is Transparent

$\because$ Absorbance % 'A' = 0 %.

$\therefore$ Transmittance % 'T' = 100 %.

$$I_0 = I$$

Case II: If sample solution is not Transparent

A % = more than 0

T % = less than 100 %.

$$\therefore I_0 > I$$

Transmittance:- It is the ratio of intensity of transmitted radiation (I) to the intensity of incident radiation (I_0)

$$\Rightarrow T = \frac{I}{I_0}$$

Absorbance or optical density:- It is the logarithm of reciprocal of transmittance

$$A = \log_{10}\left(\frac{1}{T}\right) \quad — \quad (1)$$

where A = Absorpance

T = Transmittance

$\because T = \frac{I}{I_0} \Rightarrow \frac{1}{T} = \frac{I_0}{I}$ put in eq^n (1)

$$A = \log_{10}\left(\frac{I_0}{I}\right) \quad — \quad (2)$$

Lambert's Law

when a beam of monochromatic radiation is passed through the absorbing medium, then the decrease in the intensity of radiation will be directly proportional to the thickness (path length) of solution

$$A = \log_{10}\left(\frac{I_0}{I}\right) \propto l$$

$$A \propto l \Rightarrow A = \underset{\downarrow}{\epsilon} l \cdot \text{path leng}$$

(Molar Extinction Coefficient or Molar absorptivity

Beer's Law

When a beam of mono chromatic radiation is passed through absorbing medium then the decrease in the intensity of radiation is directly proportional to concentration of the solution

$$A = \log_{10}\left(\frac{I_0}{I}\right) \propto C$$

$$A \propto C$$

$$A = \underset{\text{Molar extinction coefficient}}{\epsilon}\ C$$. concentration

unit of ϵ = L/mol-cm

Lambert - Beer's law or Beer-Lambert's law

when a beam of monochromatic radiation is passed through the absorbing medium, then the decrease in the intensity of radiation is directly proportional to thickness (path length) as well as concentration of solution.

$$A = \log_{10}\left(\frac{I_0}{I}\right) \propto l \cdot c$$

$$A \propto l \cdot c$$

$$\boxed{A = \epsilon l c}$$