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Spectroscopy:-

Study of interaction bet^{n} electromagnetic radiation and molecules.

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- There are 3 broad categories under which spectroscopy is investigated –
  (i) Absorption. (ii) Emission (iii) Scattering.

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- EMR – visible (400 -700nm), shorter (400 -200nm UV)
  – longer (700 -2000nm IR).

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- Shorter wavelength (nm) have high energy, high frequency, high wave number.

10^{-10} 10^{9} nm.

X-Ray ÷ UV- V,S -IR - Microwave - Radiowave.

→ wavelength.

← wavenumber and frequency.

Important formulas:

Frequency (ν) = c/lambda (c = speed of light).

1 Hz = 1 cycle/s.

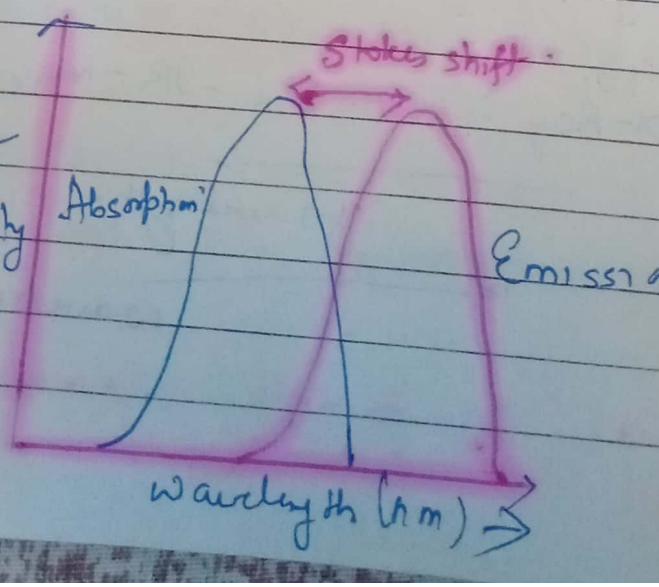
$E = h\nu = hc/\lambda$.

h = Plank's constant 6.6×10^{-34} J/sec.

Wave number ; $\upsilon = 1/\lambda$.

Spectroscopy:

- At selected wavelength, radiations intensity is attenuated – Absorption eg:- X ray, UV, IR.
- Scattering spectroscopy:- Amount of light that a substance scatters at certain wavelength eg: Raman spec.
- Emission:- Fluorscence:- Stoke shift – diff bet^{n} the absorption and emission wavelength is called stoke's shift.



It is the diff in wavelength or energy betⁿ the excitation and emission spectra of the same electronic transition. In practice, it is the diff betⁿ excitation and emission maxima.

Beer Lambert Law:-

Lambert's law:- When a monochromatic light passes through transparent medium, the intensity of transmitted light decreases exponentially as thickness of absorbing material increases.

Beer's →

$$A = -\log (I_t / I_0) = \varepsilon c l$$

ε = extinction coefficient

c = concn l = path length

Beer Lambert's law states that:-
Absorbance of a soln is directly proportional to the concn of absorbing species in the soln and the path length

$$T = \frac{I}{I_0} = 10^{-\alpha l} = 10^{-\varepsilon l c}$$

The fraction of the incident light absorbed by a soln at a given wavelength is related to:-

a) thickness of the absorbing layer (path length)
b) concn of absorbing species

Transmittance is inversely proportional to conc of absorbing

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

$$\% \text{ Transmittance } (T) = 100 \times \frac{I}{I_0}$$

$$A \text{ (OD)} = \log \frac{1}{T}$$

$$= \log \frac{I_0}{I} = KCL.$$

UV-Vis:-

Transition of e^- from one molecular orbital to other due to absorption of electromagnetic radiation.

(UV/Vis)

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Transition occurs from highest occupied orbital (π) to lowest unoccupied orbital (σ).

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Single bond bet^n C-H, O-H - (σ)

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Multiple bonds C=C, C=N (π).

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Atoms like nitrogen, oxygen contains n (non bonding) electrons