

★ The Beer-Lambert law

→ The Beer-Lambert law (also called Beer's law) is a relationship between the attenuation of light through a substance and the properties of that substance.

In this article, the definitions of transmittance and absorbance of light by a substance are first introduced followed by an explanation of the Beer-Lambert law.

Q: What are transmittance and absorbance?

→ Consider monochromatic light transmitted through a solution; with an incident intensity of I_0 and a transmitted intensity of I .

The transmittance T , of the solution is defined as the ratio of the transmitted intensity, I , over the incident intensity, I_0 and takes values b/w 0 & 1.

$$T = I/I_0$$

However, it is more commonly expressed as a percentage transmittance:

$$T(\%) = 100 \cdot I/I_0$$

The absorbance, A of the solution is related to the transmittance and incident and transmitted intensities through the following relations:

$$A = \log_{10} I_0/I$$

$$A = -\log_{10} T$$

The absorbance has a logarithmic relationship to the transmittance; with an absorbance of 0 corresponding to a transmittance of 100% and an absorbance of 1 corresponding to 10% transmittance. Additional values of transmittance and absorbance pairings are given in a visual demonstration of the effect that the absorbance of a solution has on the attenuation light passing through it, where a 510 nm laser is passed through three solutions of Rhodamine 6G with different absorbance.

Absorbance and Transmittance values :-

Absorbance

Transmittance

0	100 %
1	10 %
2	1 %
3	0.1 %
4	0.01 %
5	0.001 %