SUBJECT - CHEMISTRY
CLASS - B.Sc (Hons) PART-III
PAPER - V
TOPIC - photochemical equivalence

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Q State and explain Einstein-Stark law of photochemical equivalence.

Ans Einstein-Stark law: According to this law, each reactant molecule of a photochemical reaction absorbs one quantum of light. Therefore this law is also called one molecule - one quantum law. one quantum is $h\nu$, where h is planck's constant and ν is the frequency of radiation in the primary process of a photochemical reaction, the number of molecules that are activated is equal to The number of quantum absorbed

$$\text{Molecule} + h\nu = \text{Activated molecule}$$

Products of the primary process may participate in dark reaction known as Secondary processes. Secondary processes mask the operation of this law. Hence the energy needed (E) for activation of one mole of the Substance = $L h\nu$ where L is the Avogadro Constant. The quantity of energy per mole of a reactant during photochemical process is called einstein. The magnitude of einstein is given as

$$E = Lh\nu = \frac{Lhc}{\lambda}, \text{ where } c = \text{velocity of light.}$$

$$= \frac{6.02 \times 10^{23} \cdot 6.62 \times 10^{-34} \cdot 2.997 \times 10^{8}}{\lambda} = \frac{11.945}{\lambda} \times 10^{-2} \text{ Joules.}$$

Hence $\lambda / 11.945 \times 10^{-2}$ molecules of absorbing Substance should decompose per Joule of radiation energy by it

Q Explain Lambert - Beer's law. Explain the molar extinction coefficient.

Ans. Lambert - Beer's law: When a beam of monochromatic light of intensity (I_0) passes through an absorbing medium, Then the intensity of transmitted or unabsorbed light (I) is always less than I_0 and the absorbance (A) is given as

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

According to Lambert's law, the absorbance is directly proportional to path length (l) i.e

$$A \propto l \text{ ... Lambert's law}$$

According to Beer's law the absorbance is proportional to the molar concentration (c) of the substance in a medium of single absorbing substance i.e

$$A \propto c \text{ ..... Beer's law}$$

Combining these two laws, the Lambert- Beer's law takes the form

$$A \propto l.c \text{ ... Lambert- Beer's law}$$

or $\log_{10} I_0/I \propto l.c$

or $\log_{10} I_0/I = \epsilon . l.c$

where ϵ is the molar extinction co-efficient therefore, we can have -

$$\epsilon = \frac{\log_{10} I_0/I}{l.c}$$

The molar extinction co-efficient is expressed in litre mol^{-1} cm.