SUBJECT - CHEMISTRY
CLASS (B.Sc Hons) PART - III
PAPER - V
TOPIC - Quantum efficiency

Dr Hari Mohan prasad Singh
Department of chemistry
Dr. L.K.V.D College Tajpur Samastipur

Q Explain "Quantum yield or efficiency" in a photochemical reaction.

Ans. Quantum yield: The Quantum yield is the ratio of the number of molecules reacted to the number of quanta of light absorbed in a photochemical reaction. It is denoted by ϕ.

$$\therefore \phi = \frac{\text{Number of molecules reacting in a given time}}{\text{Number of quanta absorbed in the Same time}}$$

$$= \frac{\text{Number of moles reacting in a given time}}{\text{Number of quanta absorbed in the Same time}}$$

$$= \frac{\text{Rate of reaction}}{\text{Number of einsteins absorbed}}$$

The ϕ value should always be unity provided that Einstein-Stark's law is strictly obeyed. This law is applicable to only primary process of activation of the reactant molecule in a photochemical reaction. The quantum yield depends on the light intensity.

Many photochemical reactions do not obey Einstein-Stark law as their quantum yields are widely off from unity. In many such reactions, a molecule activated photochemically initiates a series of Secondary processes such a free radical and recombination reactions.

i.e chain reactions. Hence many reactant molecules undergo reactions by absorbing one quantum only. Therefore these reactions have high quantum yield.

Some reactions have low quantum yields because some excited molecules undergo quick deactivation thereby decreasing the effective number of molecules capable of undergoing reactions while some excited molecules may not get enough energy to react and dissociation fragments obtained from the excitation may also recombine in such cases. the number of molecules reacted is too less than one per quantum absorbed.