"Photochemistry"....

⇒ INTRODUCTION:-

Chemical reactions which shows a chemical change by the absorption of light radiations are called photochemical reactions. The branch of chemistry which deals with the study of photochemical reactions is called photochemistry.

Photochemical reactions absorb light radiations in the range of 200 - 800 nm in UV - visible region of a spectra.

* 200 to 400nm ⟶ UV region.
* 400 to 800 nm ⟶ Visible region.

* $C = \nu\lambda$

$\therefore E = h\nu = \frac{hc}{\lambda}$

Here, E = energy.
λ = wavelength
c = velocity of light.
h = Planck's constant.

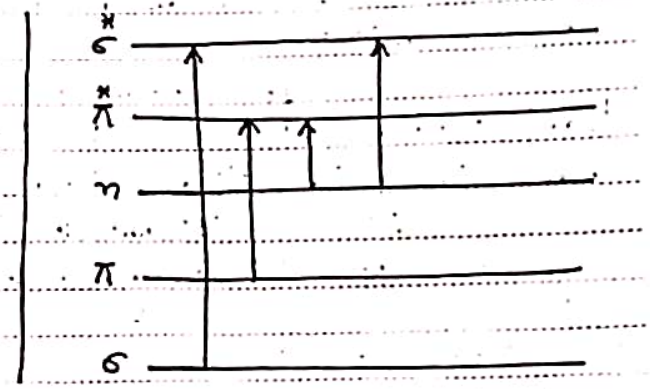
* Energy associated with 250 nm wavelength = 48 $KJ\,mol^{-1}$.
* Energy required to break C—C bond = 347 $KJ\,mol^{-1}$.

⇒ GROTTHUSS - DRAPER LAW:-

This law states that the photon ($h\nu$) absorbed by molecule can be effective in

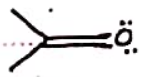
causing a chemical change. However, not every photon absorbed by a molecule can be effective in causing a chemical change.

The excitation energy of the molecule can be lost by fluorescence, phosphorescence or a molecular collision.



* $H_2C=CH_2 \longrightarrow \pi - \pi^*$
(171 nm)

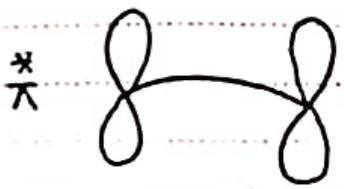
* $H_2C=CH-CH=CH_2 \longrightarrow \pi - \pi^*$
(214 nm).

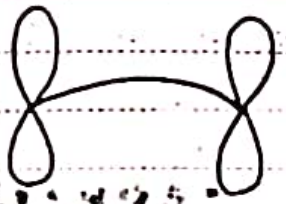
*  $\longrightarrow n - \pi^*$
(280 nm).

* Energy order $\longrightarrow n-\pi^* < \pi-\pi^* < n-\sigma^* < \sigma-\sigma^*$
* λ order $\longrightarrow \sigma-\sigma^* < n-\sigma^* < \pi-\pi^* < n-\pi^*$.

⇒ $\pi - \pi^*$ EXCITATION IN ETHYLENE

$CH_2 = CH_2$:-





Here,

* S_0 = Ground State.
* S_1 = 1st excited state, a singlet state as shown below:-

Spin multiplicity = $2S + 1$.

In this case,

$S = \frac{1}{2} - \frac{1}{2} = 0$

$\therefore 2S + 1$

$= 2 \times 0 + 1$

$= 0 + 1$

$= (1)$

i.e. singlet-state.

* T_1 = 1st excited state, a triplet state as shown below:-

Here,

$$S = \frac{1}{2} + \frac{1}{2} = 1$$

i.e. $S = 1$.

$\therefore 2S + 1$

$= 2 \times 1 + 1$

$= 2 + 1$

$= 3$

i.e. triplet state.

⇒ $n - \pi^*$ EXCITATION OF CARBONYL ($>C=\ddot{O}$) :-