

विचार संगम

भारतीय दर्शन, विज्ञान, साहित्य-कला और
तकनीकी के विशेष संदर्भ में

सम्पादक

डॉ. दिनेश चन्द्र शर्मा

विचार संगम

भारतीय दर्शन, विज्ञान, साहित्य-कला और तकनीकी
के विशेष संदर्भ में

सम्पादक :

डॉ. दिनेश चन्द्र शर्मा

Ph.D., D.Lit. (Sub.)

निदेशक, कॉम्पिटिशन प्लस ग्रुप ऑफ इन्स्टीट्यूशन,
अजमेर

Books n Books

51/1509, आचमन, वेदविहार,
लोहाखान, अजमेर-305001

प्रकाशक :

पुष्पा शर्मा

Books n Books

51/1509, आचमन, वेदविहार,

लोहाखान, अजमेर-305001

ई-मेल : bnbajmer@gmail.com

संस्करण

प्रथम 2025

ISBN : 978-81-993854-0-5

मूल्य - 400/-

रचना - विचार संगम-भारतीय दर्शन, विज्ञान, साहित्य-कला और तकनीकी
के विशेष संदर्भ में

सम्पादक - डॉ. दिनेश चन्द्र शर्मा

मुद्रक - श्रीनिवास प्रिन्टोग्राफिक्स, अजमेर

PHOTOCHEMICAL REACTION

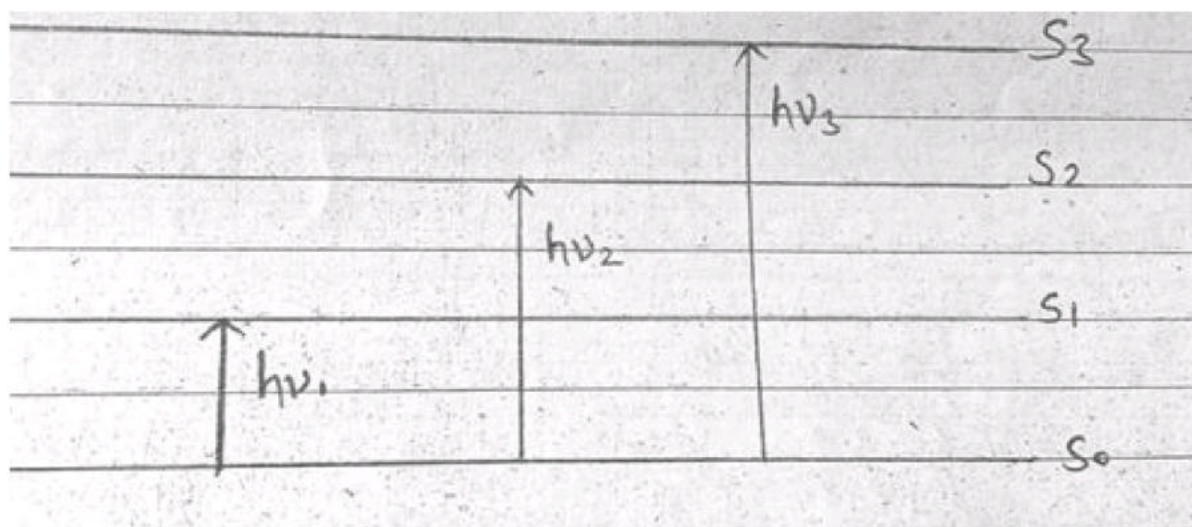
Dr. Nidhi Sharma

HOD (Department of Science and Technology)

Hukumchand Noble Institute of Science and Technology, Ajmer

These type of reaction exhibit by photoon these reactions are different from thermal reaction because in thermal reaction; the absorption of energy is in continuous manner photochemical reaction & energy is while in supply in single instalment.

Absorption: When the molecule absorb electromagnetic radiation (visible or ultraviolet) then the molecules of electron jump into higher energy level. and molecule gets excited this phenomena known as absorption.



* When the energy of molecule increase then e^- promote to higher energy level.

* The molecules in higher energy level are known as excited molecule . Which are very unstable and highly reactive.

Excitation- The absorption of light energy in visible and ultraviolet region then the electrons promoted bonding orbital to anti bonding orbital. This phenomena known as Excitation.

* When the molecule excited then triple bond become, double bond, double bond, become single bond and single bond disturb.

* Bond length may be increase about 15% of more.

* Bond angle is also change because hybridization is change in molecule.

Types of excitation

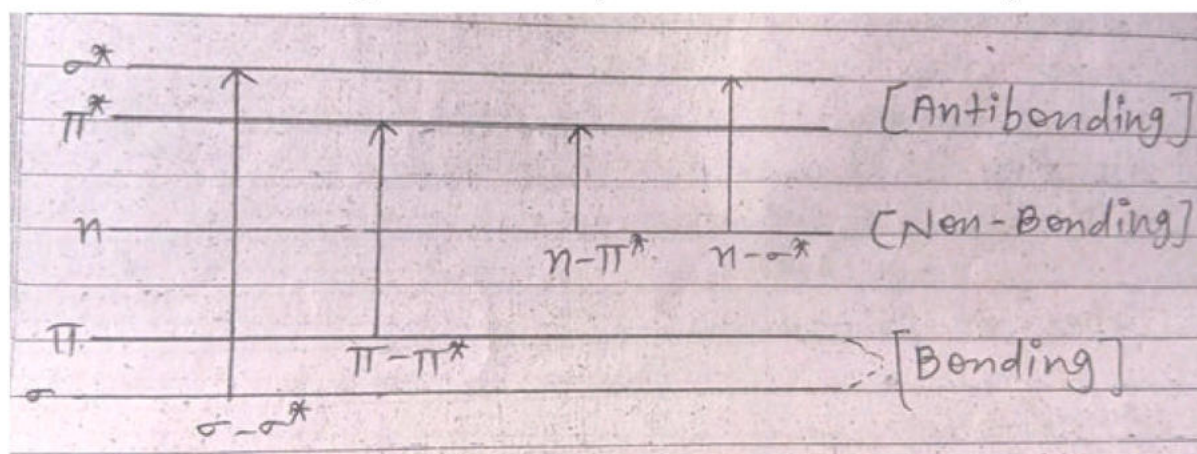
There is mainly 4 types of excitation

1. $\pi^* - \pi^*$:- Alkane contain only sigma bond. they don't have π & n (non bonding). Hence they can be excited by $\pi^* - \pi^*$.

2. $n - \pi^*$:- Oxygen atom and N atom alcohol and amine or either contain nonbonding 1° P. e-. they can be excited by $n - \pi^*$ excitation.

3. $\pi^* - \pi^*$ **excitation** :- Compound such as alkene ketone, aldehyde and ester etc. have unsaturated π bond e- they can excited by $\pi - \pi^*$ excitation.

4. $n - \pi^*$ **excitation** :- Aldehyde, ketone are also have unusual 1° P in non-bonding orbital. They also can be excited by $n - \pi^*$



Photophysical Process :- There is Many e- present in the molecule. They absorb correct energy light and go excited state.

This excited state mainly two type :-

1. **Singlet(s)** :- when e- comes into excited state then spin of e- remain same (Do not Change)

* This excited state does not split in external magnetic field so it collect singlet

* Less stable

2. **Triplet (T)** :- In this excited state occur spin inversion at e- Change spin

* This excited state split in three possible energy state so it call triplet

* More stable

* The fate of excited molecule can be explain by joblanski diagram.

* When the molecule absorbed uv light radiation, it get excited

to a singlet electronic state S_1 , S_2 or S_3 .

* In above state (S_1 , S_2) molecules collides with neighbouring molecules. after some time (10^{-13} to 10^{-11} sec.) it comes back. rapidly to the so state and release energy. this entire process is called energy cascade.

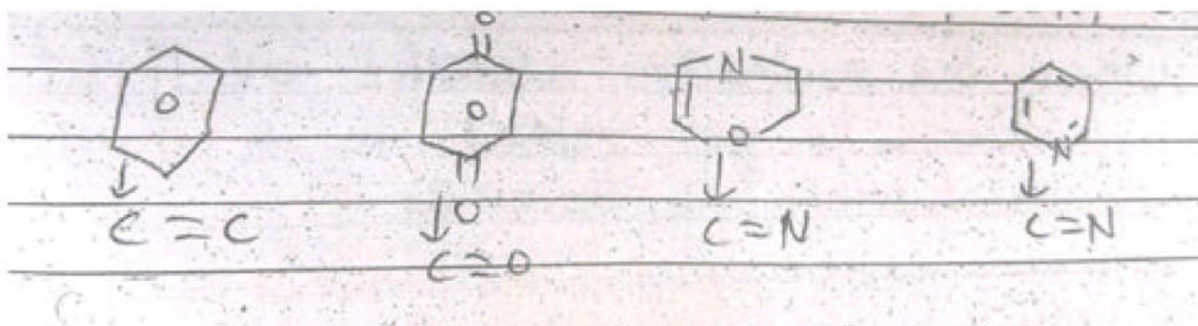
* The life time of singlet excited state (S_1) is long. hence this state can undergo different physical and chemical. process.

* The molecule return to ground state (S_0) from excited state (S_1 or S_2) by emitting energy. this process is called internal conversion (IC)

* If molecule return in ground state within 10^{-9} sec. then this process known as Fluorescence

* The fluorescence is generally observe in ridge molecule (Aromatic compound).

* The fluorescence generally show by those molecule which have conjugated system of double bond. ex.- $C=C$, $N=O$, $-N=N$, $-C=O$, $-C=N$, $-C=S$



* The emitted energy during fluorescence is lower than absorb light. Hence it have longer wavelength.

* Most molecule in S_1 state can undergo an intersystem crossing to triplet state. this state is more stable then singlet state because it have lowest energy than singlet, state (S_1).

* After some time (10^{-4} min.) the triplet state also drops into singlet ground. state (S_0) by emitting of photon (e). this process known as phosphorescence

* Quantum efficiency of phosphorescence.

$$Q_p = \frac{\text{No. of Quantum emitted as phosphorescence in / sec.}}{\text{No. of Quanta absorb for transition}}$$

* The energy of both fluorescence and phosphor compare to absorb light because some energy is loss during the different process.

Photochemical formation of smog :-

* Photochemical smog is an oxidising smog having high concentration oxidant such as ozone and NO_2 .

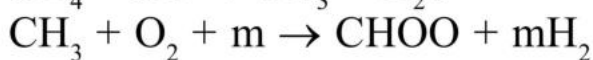
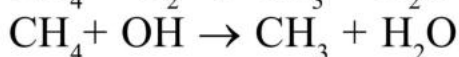
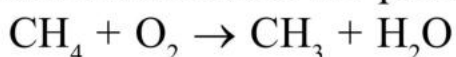
* Hydrocarbon & other organic compound present in the atmosphere. they are oxidize steps by steps of chemically photochemically reaction.

* It is observed that automobile contribute in large number of hydrocarbon emitted to the atmosphere per year. These hydrocarbon such as methane, ethane, ethyne, propane, n-butane, isopentane, isobutane, toluene & m-xylene.

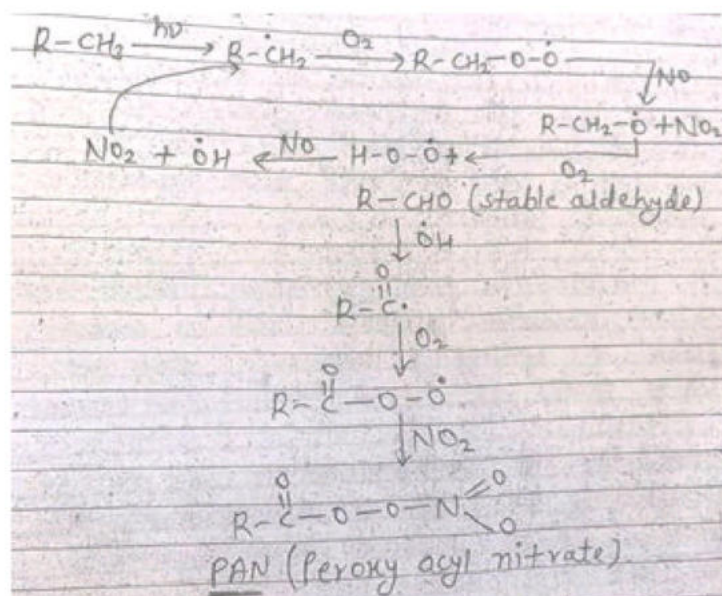
* By oxidation process they give CO_2 , acid & aldehyde as and product. which wash away by rain.

* If the sunlight irradiate on hydrocarbon then they form photochemically oxidant in atmosphere. This give the phenomena of photochemical smog.

* During the formation of smog, various type of secondary pollutant intermediate are produce.



Reaction of smog formation:-



Effects of smog :-

* Damage to material such as rubber, vegetation and cause many respiratory problem.

* PAN produce in atmosphere which is phototoxic substance and highly toxic for plants herbs and trees.

Photochemistry of vision :-

The eye of vertebrate consist of lens & retina. In Retina two types of cells are present

(1) Rode's.

(?) Cones

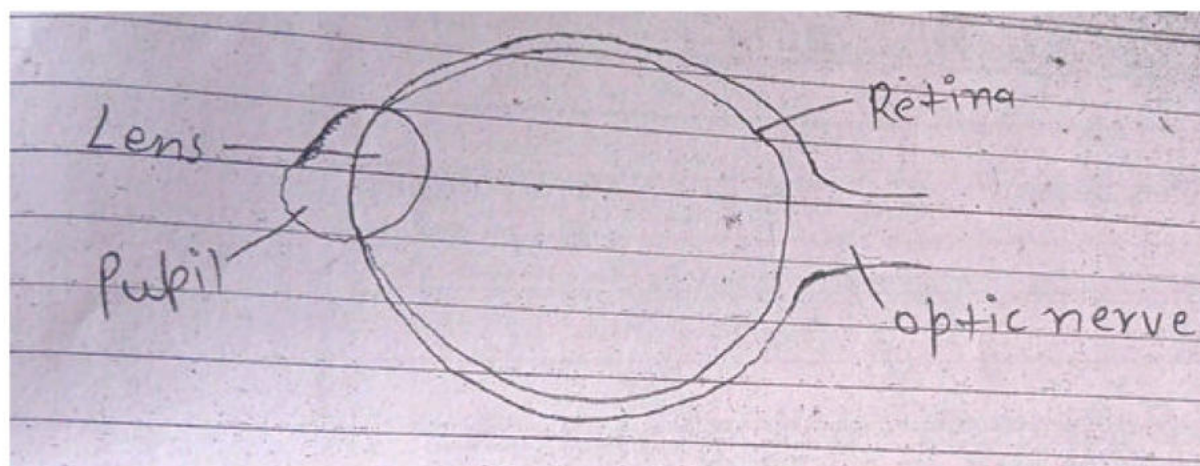
There cells are acts as receptor of eye. These cells are sensitive cells.

Rode's cells : These cells are very sensitive to light, and they can function at low light intensity. so rode's are responsible for vision in low light & dark night.

In the rode's cells rhodopsin pigment present. This pigment is responsible for vision in dim light this pigment also known as visual purple and this vision known as scotopic vision.

Cones cells : These cells have low sensitivity to the light, these cells are responsible for vision in high intensity light.

In the cones cell Iodeosin pigment present this type of vision is called phototropic vision.



Chemistry of vision :

Redopsin made by two compound.

(i) Protein part opine

(ii) Pigmented part retinal (aldehyde)

In the low light/night opine and retinal are combine and form rhodopsin which is responsible for vision in night but light of day time rhodopsin is degradation.

Retinal is derivative of vitamin A. so. vit. A deficiency then retinal decrease and rhodopsin are not form and resulting we are not seen in night this disease is called night blindness.

Steps of photo transduction in rode's :-

