UV- VISIBLE INTRODUCTION

Principle

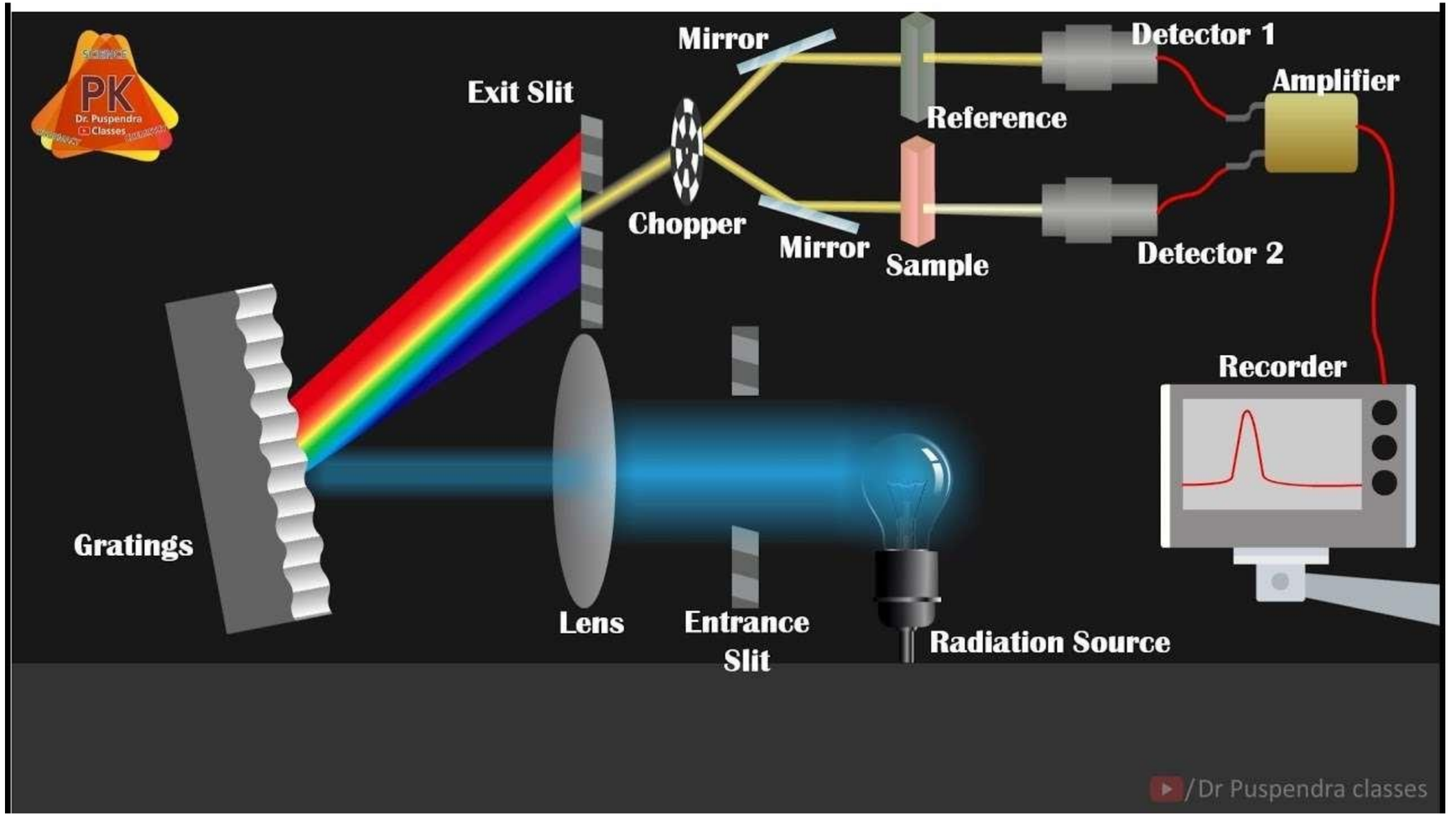
Ultraviolet (UV) & visible spectra arises from the transition of valency electrons within a molecule or ion from a lower electronic energy level (ground state E0) to higher electronic energy level (excited state E1).

This transition occurs due to the absorption of UV (wavelength 100-400 nm) or visible (wave length 400-750 nm) region of the electronic spectrum by a molecule (or) ion.

The actual amount of energy required depends on the difference in energy between the ground state and the excited state of the electrons.

$E1 - Eo = h\nu$.

SCHEMATIC REPRESENTATION UV SPECTR



Types of electrons

S. No	Electrons	Examples	Energy required to excite electrons	Present in
1.	σ-electrons	Saturated long chain hydrocarbons. (Paraffins) ($CH_3-CH_2-CH_2-CH_3$)		
2.	π-electrons	Unsaturated hydrocarbons like trienes and aromatic compounds.	UV (or) visible light	Double bond and triple bonds. (unsaturated bond)

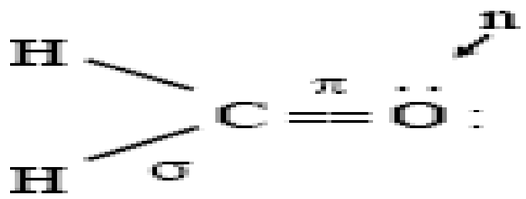
Types of electrons

3.	n-electrons	Organic compounds containing N, O (or) halogens.	UV radiation	Unshared (or) non bonded electrons.

Thus, the unsaturated hydrocarbons and compounds containing N, O, S may absorb visible (or) UV radiations.

Example

The three types of electrons are shown in the molecule (HCHO).



Electronic transitions

$n \rightarrow \pi^* < \pi \rightarrow \pi^* < n \rightarrow \sigma^* << \sigma \rightarrow \sigma^*$

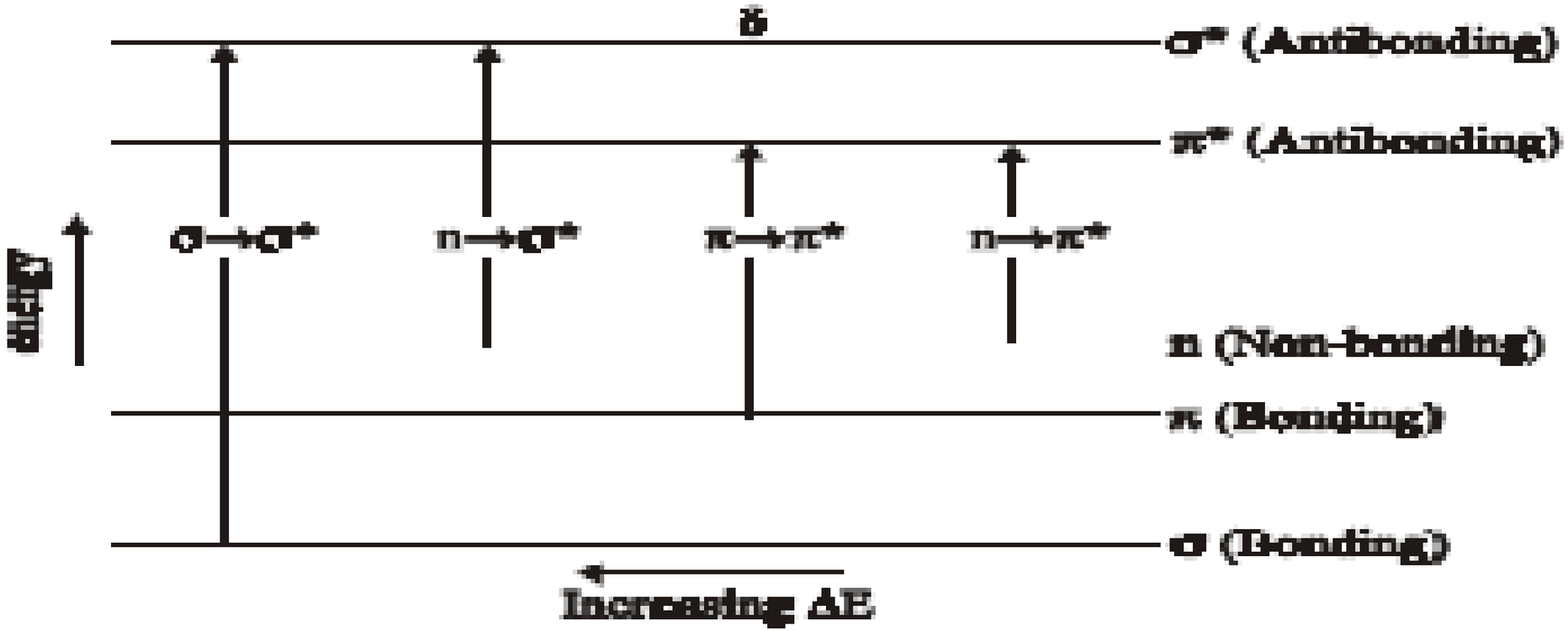


Fig. 8.8 Energy level diagram

8.7.5 Important terms used in UV-visible spectrascopy

1. Chromophores (Colour producing groups)

The presence of one or more unsaturated linkages (π electrons) in a compound is responsible for the colour of the compound, these linkages are referred to as chromophores.

Example

$$>C=C<;\ -C=C-;\ -C=N;\ -N=N-;\ >C=O;\ etc.,$$

Chromophores undergo $\pi \rightarrow \pi^*$ transitions in the short wavelength regions of UV-radiations.

2. Auxochrome (Colour intensifying groups)

It refers to an atom or a group of atoms which does not give rise to absorption band on its own, but when conjugate to chromophore will cause a red shift.

Example

$-OH, -NH_2, -Cl, -Br, -I$, *etc.*,

3. Some important definitions related to change in wavelength and intensity

1	**Bathochromic shift.** (**red shift**)	Shift to higher wave length (lower frequencies).
2.	**Hypsochromic shift.** (**blue shift**)	Shift to lower wavelength (higher frequencies).
3.	**Hyperchromic effect.**	An increase in intensity.
4.	**Hypochromic effect.**	A decrease in intensity.

Illustration

In chloroethylene, $CH_2 = CHCl$,