Instrumental Methods of Analysis

• UNIT - I

Wavelength - length of individual wave

Frequency - no. of waves per second

* Range of all Rays - (↑ wavelength → ↓ frequency

- Shortwave, AM - 10^2 to 10^4 m
- FM, TV - 1 m to 10^2 m
- Radar - 1 mm to 1 m (10^{-3} to 1 m)
- Infrared rays - 700 nm - 1 mm
  - Near IR - 0.8 - 2.5 μ
  - Mid IR - 2.5 - 15 μ
  - Far IR - 15 - 25 μ
- Visible range - 380 nm - 700 nm

{Violet - 380 - 450 nm, Blue - 450 - 495 nm, Green 495 - 570 nm, Yellow - 570 - 590 nm, Orange - 590 - 620 nm, Red 620 - 750 nm}

- UV rays - 100 - 400 nm

{UVA - 315 - 400 nm, UVB - 280 - 315 nm, UVC - 100 - 280 nm}

- X - rays - 0.01 to 10 nm
- γ - rays - 0.01×10^{-12} m to 10×10^{-12} m

(0.01 to 10 pm) (< 0.001 nm)

* Electronic transitions and its types:

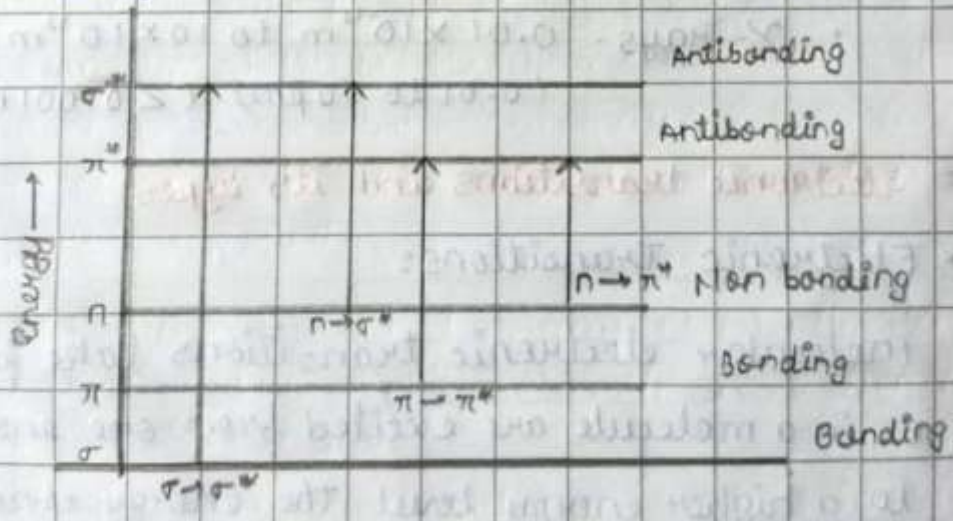
* Electronic Transitions:

Molecular electronic transitions take place when e^- in a molecule are excited from one energy level to a higher energy level. The energy change associated with this transition provides information on the structure of a molecule and determines many molecular properties such as colour.

- In ground state, spins of electrons in each molecular orbital are paired.
- In higher energy state, if spins are paired → excited singlet state
  if spins are parallel → excited triplet state
- Triplet state is more stable as it is lower in energy than corresponding singlet state.
- An excited singlet state can be converted to triple state with emission of energy as light. This transition is symmetry forbidden.

- TYPES OF ELECTRONIC TRANSITIONS:

Acc. to the MOT, when a molecule is excited by the absorption of energy (UV or visible light), its e^- are promoted from a bonding to antibonding orbital.



Increasing order of energy requirement for various transitions:

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