ROTO-VIBRATIONAL SPECTRA

HO $\quad E_n = h\nu\,(n + 1/2) \quad n = 0, 1, 2, \ldots$

RR $\quad E_J = h B J(J+1) \quad J = 0, 1, 2, 3, \ldots$

SELECTION RULES

$$\left.\begin{aligned} \Delta n &= \pm 1 \\ \Delta J &= \pm 1 \end{aligned}\right\} \text{HIGH PROBABILITY}$$

IR EXCITES MOLECULES IN THEIR GROUND STATE (ELECTRONIC) FROM $n = 0 \longrightarrow n = 1$ (VIBRATION) COMBINED WITH A CHANGE IN ROTATIONAL LEVEL.

$$(n=0, J) \rightleftarrows (n=1, J \pm 1)$$

UV – Vis ⟷ Electronic transitions

EXCITATION OF e^- FROM LOWER ENERGY LEVELS (MOLECULAR) TO A HIGHER MOLECULAR ENERGY LEVEL.

Fluorescence (Singlet → Singlet)

Phosphorescence (Triplet → Singlet)

↑ ↑ ↑↓

PHOTOELECTRON SPECTROSCOPY

PES

$$h\nu_{PHOTON} = BE_i + \frac{1}{2} m_e v^2$$

$$h\nu_{PHOTON} = BE_i + E_i^{vib} + \frac{1}{2} m_e v^2$$

Nuclear Magnetic Resonance

NUCLEI HAVE SPIN THAT CAN INTERACT WITH EXTERNAL MAGNETIC FIELDS.

a) RADIATE A SAMPLE WITH RADIO WAVES AND VARY AN EXTERNAL MAGNETIC FIELD

b) FIX AN EXTERNAL MAGNETIC FIELD, H, AND IRRADIATE THE SAMPLE WITH WAVES OF DIFFERENT FREQUENCIES.