Spectroscopy

Electromagnetic spectrum (EM) \( \rightarrow \) Light

- Speed of light \( c = \lambda \cdot \nu \)
- Frequency \( (\text{Hz}, \text{s}^{-1}, \frac{1}{\text{s}}) \)
- Wavelength \( (\text{m}) \)

Energy per photon \( E = h \nu \) \( \triangleq \) Planck's constant

\[ \uparrow \]

In order for this energy gap to be crossed, light with the correct frequency (and therefore the correct energy per photon) must be used.

\[ \text{ultraviolet (UV)} \] \[ \text{visible} \] \[ \text{infrared (IR)} \] \[ \text{radio} \]

\[ \text{400 nm} \] \[ \text{violet} \] \[ \text{700 nm} \] \[ \text{red} \]

Higher \( E \) per photon \[ \text{lower } E \text{ per photon} \]
light source \[\rightarrow\] sample \[\rightarrow\] detector

transmittance - the % of light that passes through a sample

absorbance - how much light is absorbed by the sample

% T

\[\begin{array}{c}
7200 \\
-3600 \\
1800 - 1600 \\
\end{array}\] cm\(^{-1}\)

each peak corresponds to a specific change in energy states, which corresponds to a particular frequency of light, which corresponds to a certain energy per photon.

UV/Vis - ultraviolet / visible
  - electronic transitions \(\rightarrow\) electronic structure

IR - infrared
  - vibrational transitions \(\rightarrow\) bond types + functional groups

NMR - nuclear magnetic resonance - radio waves
  - allows for determination of the structure of organic molecules,