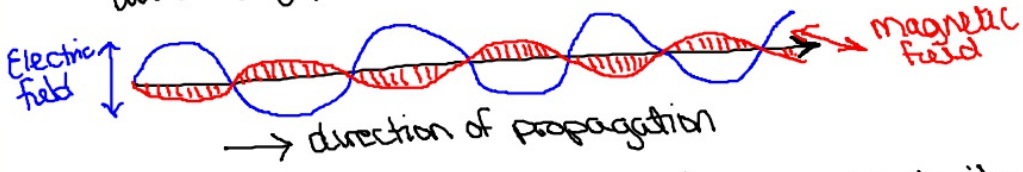
10/30/17 Spectroscopy

Spectroscopy is the study of the interaction of electromagnetic radiation (EMR) and matter. It's a tool that can be used to evaluate structure, concentration, composition and vibration. There are two main types of spectroscopy: absorption & emission. The signal for spectroscopy is the measurement in the change in # of photons reaching the detection device.

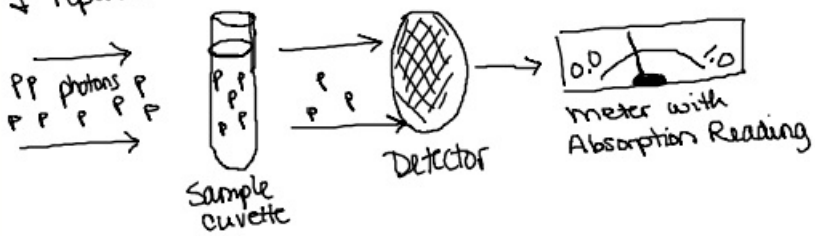
EMR - light in the form of photons that have both wave-like behavior and are particles (DeBroglie - Dual Nature). These photons move in 3 directions simultaneously: electric field - up/down, magnetic field - side to side, and the direction of propagation (forward progression).



Light moves through space w/ constant velocity, in a vacuum EMR travels at the speed of light, 3.0×10^8 m/s.

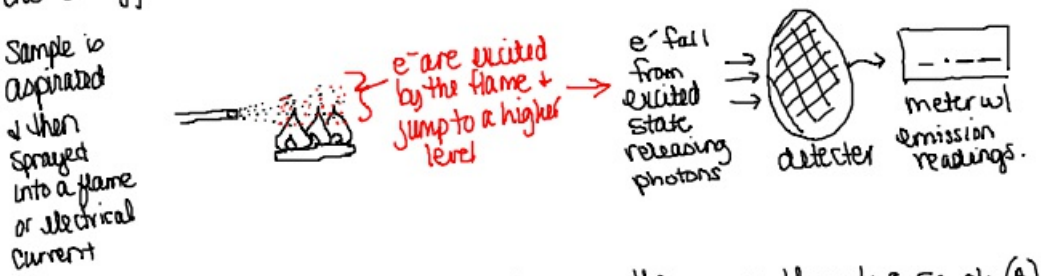
Absorption Spectroscopy

Light energy in the form of photons are used to excite the particles of a material, if the energy of the photon matches the energy for the e⁻ in the material to "jump" to a higher state the photon will be absorbed. The lack of photons returning to the detector is measured & reported as absorbance.



Emission Spectroscopy

Energy from a variety of possible sources, like flame or electricity, is used to excite the e⁻ in a material. Because e⁻ don't remain in the excited state energy is released when they return to a lower state, the energy released is measured & reported as emission.



Absorbance: the attenuation of photons as they pass through a sample. (A)

Absorbance spectrum: a graph of the sample's absorbance of EMR vs. wavelength (or frequency).

Emission - the release of a photon when an analyte's e⁻ return to a lower energy state after having been in an excited state.

Emission Spectrum - a graph of emission intensity vs. wavelength (or frequency).

$\lambda = \frac{c}{\nu}$ λ = wavelength, typically measured in meters or nanometers.

ν = frequency, hertz (cycles/sec), $\frac{1}{s}$ or s^{-1}

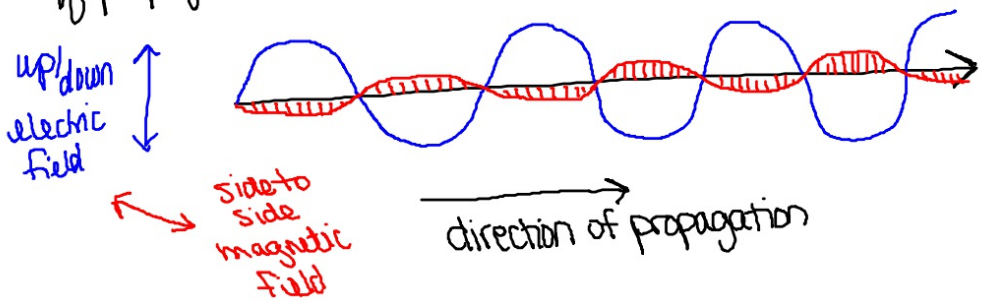
$C = 3.0 \times 10^{8}\ m/s$

Planck's Equation $E = h\nu$ h = planck's constant $6.626 \times 10^{-34}\ J \cdot s$

10/30/17 Spectroscopy

Spectroscopy is the study of the interaction of electromagnetic Radiation (EMR) and matter. It is a tool that can be used to evaluate structure, concentration, composition + vibration. There are two main types of spectroscopy: absorption + emission. The signal for spectroscopy is the measurement in change in the # of photons reaching the detection device.

Electromagnetic Radiation (EMR) - Light in the form of photons that behave both as waves and particles. (DeBroglie - Dual Nature) Photons move in 3 directions simultaneously: up/down representing the electrical field, side to side representing the magnetic field + direction of propagation (forward progression).



$\lambda = \frac{c}{\nu}$ λ = wavelength, typically measured in m or nm.

ν = frequency, hertz (hz), $\frac{1}{s}$ or s^{-1}

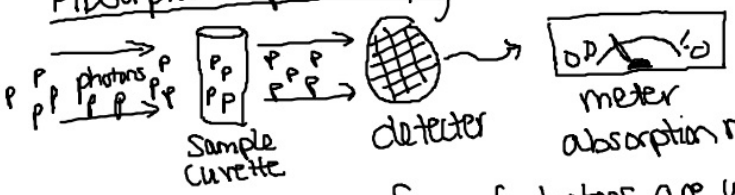
C = speed of light, $3.0 \times 10^{8} \frac{m}{s}$

Planck's Equation $E = h\nu$ E = energy

h = planck's constant 6.6626×10^{-34} J·s

ν = frequency

Absorption Spectroscopy:

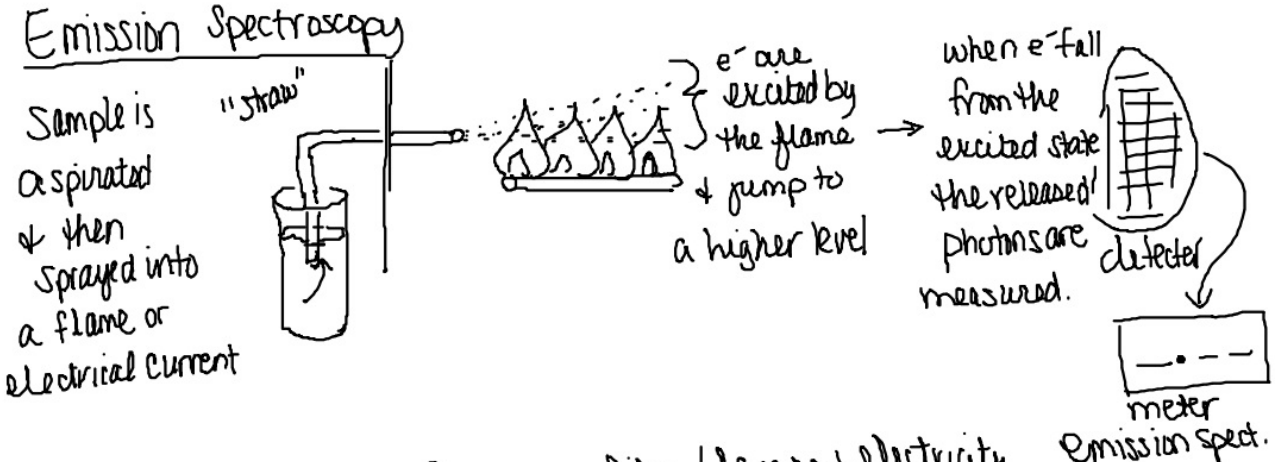


Light energy in the form of photons are used to excite the particles of materials, if the energy of the photon matches the energy required for the e^- to become excited the photon will be absorbed. The lack of the returning photon is measured + reported as absorbance.

Absorbance (A) - the attenuation of photons as they pass through a sample.

Absorbance Spectrum - a graph of a sample's absorbance of EMR vs. wavelength (or frequency).

Emission Spectroscopy



Energy from a variety of sources like flames & electricity used to excite e⁻ in the material. Because e⁻ will not stay excited energy is released when they return to a lower state, this energy is measured & reported as emission.

Emission - the release of a photon when an analyte's e⁻ return to a lower energy state after having been in a higher-excited state.

Emission Spectrum - a graph of emission intensity vs. wavelength (or frequency)