Spectroscopy Equations

Theory

$c = \lambda v$; $\lambda = c/v$; $\bar{\nu} = 1/v$;	Frequency, wavelength, wave number
$\lambda = h/mv$;	
$E = h\nu = hc/\lambda =$	Energy quanta
$T = \frac{P_{Solution}}{P_{Solute}} \approx \frac{P}{P_0}$	Transmittance (P is power)
$A = Log(\frac{P_{Solution}}{P_{Solute}}) \approx Log(\frac{P}{P_0})$	Absorbance
$A = Log\left(\frac{P}{P_0}\right) = \epsilon bc$	ε is consolidated constants, b = path length (cm), c=conc (M/L)
$-\frac{dP_x}{P_x} = \frac{dS}{S}$	Change in power vs change in cross-sectional area (S * dx)
$dS = adn$	Capture area is proportional (a) to number of particles
$n\lambda = d \sin(\theta)$	grating: n=order, d slit distance, θ max ang to maximum, λ is wavelength

Refraction/Reflection

$\lambda_{material} = \lambda_{vacuum} / n$ $n = c/v$	Snell's law
$\%loss = I_r/I_o = \frac{n_2 - n_1}{n_2 + n_1}$	Reflective loss
$n_1 \sin\theta_1 = n_2 \sin\theta_2$	Refraction

Critical angle $\theta_{critical} = \sin^{-1}(n_2/n_1)$

Legend

θ, Φ = angle	A = Absorption	T = transmittance
v = frequency	ω = angular frequency	I = Intensity (W/m^2)
h = Planck constant(6.626×10^{-34} j/Hz	λ = charge/wavelength	n = index of refraction

Identities

$x = \cos\theta$ $y = \sin\theta$ $\theta = \tan^{-1} y/x$

$\tan\theta = \sin\theta / \cos\theta$

$\sin 2\theta = 2\sin\theta \cos\theta$ p=sq

Other

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Constants

$\varepsilon = 8.55 \times 10^{-12}\ C^2/Nm^2$ $K = 1/2\pi\varepsilon = 8.99 \times 10^9\ Nm^2/C^2$ $I_0 = 1.0 \times 10^{-12}\ W/m^2$