

Useful Formulae:

Planck's Relationship: $E = h\nu = \frac{hc}{\lambda}$

Decay: $N = N_0 \exp^{-\frac{t}{\tau}}$

Wein's Law: $\lambda_{MAX} T = 2.897 \times 10^{-3} mK$

Cavity Radiation: $\rho = \frac{8\pi h \nu^3}{c^3} \frac{1}{e^{\frac{E}{kT}} - 1}$

Fresnel equation: $R = \left(\frac{n_1 - n_2}{n_1 + n_2}\right)^2$

Snell's Law: $\left(\frac{\sin \theta_1}{\sin \theta_2}\right) = \frac{n_2}{n_1}$

Linewidth: $\Delta\nu = 2\nu_0 \sqrt{\frac{2kT \ln(2)}{Mc^2}}$

Cavity Optics: $g = 1 - \frac{L}{r}$

Optical Density: *<conspicuously absent>*

EO Transmission: $T = T_0 \sin^2\left(\frac{\pi V}{2V_{1/2}}\right)$

Bragg Diffraction: $\theta_B = \frac{\lambda f}{2\nu}$

Boltzmann's Law: $N = N_0 e^{\frac{-E}{kT}}$

Basic Physics: $d = \frac{v}{t}$ $A_{circle} = \pi r^2$

Diffraction Grating: $d \sin \theta = m\lambda$

Saturation Intensity: $I_{sat} = \frac{h\nu}{\sigma_0 \tau}$

Saturated Gain: $g_{sat} = \frac{g_0}{1 + \frac{\rho}{\rho_{sat}}}$

Gain Coefficient: $g = \Delta N \times \sigma_0$

Atomic Mass: $M(g) = \frac{amu(g/mol)}{N_a(mol^{-1})}$

Threshold Gain: *(Simplified)* $g_{th} = \gamma + \frac{1}{2x} \ln\left(\frac{1}{R_1 R_2}\right)$

Interferometer Mode Spacing: $FSR = \frac{c}{2nt}$

Half-wave Voltage: $\frac{V_{\frac{1}{2}-\lambda_1}}{V_{\frac{1}{2}-\lambda_2}} = \frac{\lambda_1}{\lambda_2}$

Acoustic Wavelength: $\Lambda = \frac{v_{acoustic}}{f}$

Macroscopic Polarization: $P = a_1 E_0 \cos(\omega t) + \frac{1}{2} a_2 E_0^2 - \frac{1}{2} a_2 E_0^2 \cos(2\omega t) + \dots$

Linear Term: $a_1 = \epsilon_0 (n^2 - 1)$

AOM: $DE = P_{1st order RF on} / P_{0th order RF off}$ $IL = P_{Input} / P_{0th order RF off}$

Constants and Conversions:

1eV = 1.602E⁻¹⁹J

k = Boltzmann's constant (1.38 * 10⁻²³ J/K)

σ = Stefan-Boltzmann constant (5.67*10⁻⁸ Wm⁻²K⁻⁴)

N_a (Avogadro's number) = 6.02*10²³ atoms/molecules

Indices of Refraction: Quartz = 1.46, Glass = 1.51

0°C = 273.15 K

h = Planck's constant (6.626 * 10⁻³⁴ Js)

c = Speed of Light (3*10⁸ m/s)

ε₀ = permittivity (8.85*10⁻¹² F/m)

Dilated Pupil = 0.4cm²

Atomic masses: Neon = 20 amu, Argon = 38 amu, Helium = 4 amu, Cadmium=112 amu, CO₂ = 44 amu, Krypton = 83.8 amu