

Quantum Mechanics Formula Sheet

Stefan-Boltzmann Law for a blackbody

$$\frac{P}{A} = \sigma T^4$$

Wien's Displacement Law

$$\lambda_{\text{peak}} T = 2.898 \times 10^{-3} \text{ Km}$$

Planck's Formula for the average energy of cavity modes

$$\overline{E}(\lambda) = \frac{hc/\lambda}{\exp(hc/\lambda k_B T) - 1}$$

Einstein's Photoelectric Formula

$$\text{KE}_{\text{max}} = hf - \phi$$

Compton Shift Equation

$$\lambda_2 - \lambda_1 = \frac{h}{m_e c} (1 - \cos \theta)$$

Hydrogen Energy Levels

$$E_n = -\frac{13.6 \text{ eV}}{n^2}$$

Bragg's Law

$$2d \sin \theta = n\lambda$$

Moseley's Law

$$f_{K\alpha} = (2.48 \times 10^{15} \text{ Hz}) \times (Z - 1)^2$$

Heisenberg's Uncertainty Principle

$$\Delta p_x \Delta x \geq \frac{h}{4\pi}$$

Free-Particle Wave Function

$$\Psi(x, t) = A \exp(i(kx - \omega t))$$

Momentum Operator

$$\hat{p}_x = -i\hbar \frac{\partial}{\partial x}$$

Energy Operator

$$\hat{E} = i\hbar \frac{\partial}{\partial t}$$

Expectation Value

$$\langle O \rangle = \int_{-\infty}^{+\infty} \Psi^* \hat{O} \Psi dx$$

Time-Independent Schrödinger Equation

$$-\frac{\hbar^2}{2m} \frac{d^2 \psi(x)}{dx^2} + V(x) \psi(x) = E \psi(x)$$