

### Constants and Conversion Factors

$$\begin{aligned}
 c &= 2.998 \times 10^8 \text{ m/s} & e &= 1.602 \times 10^{-19} \text{ C} & k &= 1.381 \times 10^{-23} \text{ J/K} = 8.617 \times 10^{-5} \text{ eV/K} \\
 h &= 6.626 \times 10^{-34} \text{ J}\cdot\text{s} = 4.136 \times 10^{-15} \text{ eV}\cdot\text{s} & hc &= 1240 \text{ eV}\cdot\text{nm} = 1240 \text{ MeV}\cdot\text{fm} & \hbar &= h/2\pi \\
 &1 \text{ eV} = 1.602 \times 10^{-19} \text{ J} & 1 \text{ u} &= 931.50 \text{ MeV}/c^2 = 1.6605 \times 10^{-27} \text{ kg} \\
 m_e &= 9.11 \times 10^{-31} \text{ kg} = 0.511 \text{ MeV}/c^2 & m_p &= 938.3 \text{ MeV}/c^2 & m_n &= 939.6 \text{ MeV}/c^2 \\
 \hbar/m_e c &= 0.002426 \text{ nm} & \sigma &= 5.67 \times 10^{-8} \text{ W/m}^2\cdot\text{K}^4 & 1 \text{ nm} &= 10^{-9} \text{ m} & 1 \text{ fm} &= 10^{-15} \text{ m} \\
 N_A &= 6.02 \times 10^{23} & R &= 8.314 \text{ J/mole}\cdot\text{K} & e^2/4\pi\epsilon_0 &= 1.44 \text{ eV}\cdot\text{nm} \\
 a_0 &= 4\pi\epsilon_0\hbar^2/me^2 = 0.0529 \text{ nm} & R_\infty &= me^4/64\pi^3\epsilon_0^2\hbar^3c = 1.097 \times 10^7 \text{ m}^{-1} & \mu_B &= e\hbar/2m = 9.274 \times 10^{-24} \text{ J/T}
 \end{aligned}$$

### Important Formulas

$$\begin{aligned}
 \Delta t &= \frac{\Delta t_0}{\sqrt{1-u^2/c^2}} & L &= L_0\sqrt{1-u^2/c^2} & v &= \frac{v'+u}{1+v'u/c^2} \\
 p &= \frac{mv}{\sqrt{1-v^2/c^2}} & K &= E - E_0 & E &= \frac{mc^2}{\sqrt{1-v^2/c^2}} & E_0 &= mc^2 & E &= \sqrt{(pc)^2 + (mc^2)^2} \\
 PV &= nRT & PV &= NkT & v_{rms} &= \sqrt{3P/\rho} = \sqrt{3kT/m} & \frac{1}{2}m\langle v^2 \rangle_{av} &= \frac{3}{2}kT & v_{av} &= \sqrt{8kT/\pi m} \\
 n(v) &= 4\pi N(m/2\pi kT)^{3/2} v^2 e^{-mv^2/2kT} & N(v_1|v_2) &= \int_{v_1}^{v_2} n(v)dv & f(v_1|v_2) &= \frac{1}{N} \int_{v_1}^{v_2} n(v)dv \\
 N(E) &= 2N\pi^{-1/2}(kT)^{-3/2} E^{1/2} e^{-E/kT} & E_{int} &= \frac{3}{2}nRT \text{ (monatomic gas)} & C_V &= \Delta E_{int}/n\Delta T \\
 E &= h\nu & c &= \lambda\nu & K_{max} &= eV_s = h\nu - \phi & p &= h/\lambda & I &= \sigma T^4 & \lambda_{max} T &= 2.898 \times 10^{-3} \text{ m}\cdot\text{K} \\
 R(\lambda) &= \frac{2\pi hc^2}{\lambda^5 (e^{hc/\lambda kT} - 1)} & \lambda' - \lambda &= \frac{h}{m_e c} (1 - \cos\theta) & \frac{1}{E'} - \frac{1}{E} &= \frac{1}{m_e c^2} (1 - \cos\theta) & \lambda_{min} &= \frac{hc}{eV} \\
 \Delta x \Delta p_x &\sim \hbar & \Delta y \Delta p_y &\sim \hbar & \Delta E \Delta t &\sim \hbar & v_{phase} &= \omega/k & v_{group} &= d\omega/dk \\
 \frac{-\hbar^2}{2m} \frac{d^2\psi}{dx^2} + U(x)\psi(x) &= E\psi(x) & P(x)dx &= |\psi|^2 dx & P &= \int_{x_1}^{x_2} |\psi(x)|^2 dx & \int_{x_1}^{x_2} |\psi(x)|^2 dx &= 1 \\
 [f(x)]_{av} &= \int_{x_1}^{x_2} |\psi(x)|^2 f(x)dx & \text{Inf. well: } \psi_n(x) &= \sqrt{\frac{2}{L}} \sin \frac{n\pi x}{L} & E_n &= \frac{\hbar^2 \pi^2 n^2}{2mL^2} \quad (n=1,2,3,\dots) \\
 \Psi(x,t) &= \psi(x)e^{-iEt/\hbar} & e^{i\theta} &= \cos\theta + i\sin\theta & \text{Osc.: } \psi_0(x) &= Ae^{-\alpha x^2} & E_n &= (n+\frac{1}{2})\hbar\omega_0 \quad (n=0,1,2,\dots)
 \end{aligned}$$