Chapter 1: Review of Modern Physics

1.2. Quantum mechanics

$$E_{ph} = hn = \frac{hc}{l} \tag{1.2.1}$$

$$l = \frac{h}{p} \tag{1.2.2}$$

$$E_{ph} = hn = \hbar w \tag{1.2.3}$$

$$u_w = \frac{\hbar}{p^2 c^3} \frac{w^3}{\exp(\frac{\hbar w}{kT}) - 1} \tag{1.2.4}$$

$$E_n = -\frac{13.6 \text{ eV}}{n^2}, \text{ with } n = 1, 2, ... \tag{1.2.5}$$

$$E_{ph} = 13.6 \text{ eV}(\frac{1}{j^2} - \frac{1}{i^2}), \text{ with } i > j \tag{1.2.6}$$

$$2p\ r = n\,l \tag{1.2.7}$$

$$m\frac{v^2}{r} = \frac{q^2}{4pe_0 r^2} \tag{1.2.8}$$

$$a_0 = \frac{e_0 h^2 n^2}{p\, m_0 q^2} \tag{1.2.9}$$

$$E_n = -\frac{m_0 q^4}{8e_0^2 h^2 n^2}, \text{ with } n = 1, 2, ... \tag{1.2.10}$$

$$V(r) = -\frac{q^2}{4pe_0 r} \tag{1.2.11}$$

$$E = K.E. + V = \frac{p^2}{2m} + V(x) \tag{1.2.12}$$

$$E\Psi = \frac{p^2}{2m}\Psi + V(x)\Psi \tag{1.2.13}$$

$$-\hbar^2 \frac{\P^2 \Psi}{\P x^2} = \hbar^2 k^2 \Psi = p^2 \Psi \quad \text{for } \Psi = e^{i(kx - wt)} \tag{1.2.14}$$

$$-\frac{\hbar^2}{2m} \frac{d^2 \Psi(x)}{dx^2} + V(x)\Psi(x) = E\Psi(x) \tag{1.2.15}$$

$$E_n = \frac{h^2}{2m^*} \left(\frac{n}{2L_x}\right)^2 \text{, with } n = 1, 2, ... \tag{1.2.16}$$

1.3. Electromagnetic theory

$$\frac{dE(x)}{dx} = \frac{r(x)}{e} \tag{1.3.1}$$

$$E(x_2) - E(x_1) = \int_{x_1}^{x_2} \frac{r(x)}{e} \, dx \tag{1.3.2}$$

$$\vec{\nabla} \vec{E}(x, y, z) = \frac{r(x, y, z)}{e} \tag{1.3.3}$$

$$E \cdot A = \frac{Q}{e} \tag{1.3.4}$$

$$\frac{df(x)}{dx} = -E(x) \tag{1.3.5}$$

$$f(x_2) - f(x_1) = -\int_{x_1}^{x_2} E(x) \, dx \tag{1.3.6}$$

$$\frac{d^2 f(x)}{dx^2} = -\frac{r(x)}{e} \tag{1.3.7}$$

$$\vec{\nabla} f(x, y, z) = -\vec{E}(x, y, z) \tag{1.3.8}$$

$$\nabla^2 f(x, y, z) = -\frac{r(x, y, z)}{e} \tag{1.3.9}$$

1.4. Statistical Thermodynamics

$$dU = dQ + dW + m\,dN \tag{1.4.1}$$

$$f(E) = \frac{1}{1 + e^{(E - E_F)/kT}} \tag{1.4.2}$$