B3. Calculate the separation of two slits that cause the second order maximum for light of wavelength 546 nm to occur at an angle of 0.600°.

$$\sin\theta = \frac{m\lambda}{d} \Rightarrow d = \frac{m\lambda}{\sin\theta} = \frac{2(546\,\text{nm})}{\sin(0.600°)}$$

$$d = 1.04 \times 10^{5}\,\text{nm} = 0.104\,\text{mm}$$

B4. Calculate the de Broglie wavelength of an electron moving with a speed of 7.50×10^{6} m/s.

$$p = \frac{h}{\lambda} \Rightarrow \lambda = \frac{h}{p} = \frac{h}{mv}$$

$$\lambda = \frac{6.63\times10^{-34}\,\text{J}\cdot\text{s}}{(9.11\times10^{-31}\,\text{kg})(7.50\times10^{6}\,\text{m/s})} = 9.70\times10^{-11}\,\text{m}$$

B5. Determine the energy of the photon emitted when an electron in the hydrogen atom undergoes a transition from the $n = 8$ level to the $n = 6$ level.

$$E_n = -E_1\frac{Z^2}{n^2} \quad \text{so} \quad E_8 - E_6 = -E_1 Z^2\left(\frac{1}{8^2} - \frac{1}{6^2}\right)$$

$$E_8 - E_6 = -13.6\,\text{eV}(1)^2\left(\frac{1}{64} - \frac{1}{36}\right) = 0.165\,\text{eV}$$