

52. (a) Using Table 38-3 and the result of problem 3, we obtain

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2m_e K}} = \frac{hc}{\sqrt{2m_e c^2 K}} = \frac{1240 \text{ eV} \cdot \text{nm}}{\sqrt{2(511000 \text{ eV})(1000 \text{ eV})}} = 0.039 \text{ nm} .$$

(b) A photon's de Broglie wavelength is equal to its familiar wave-relationship value. Using the result of problem 3,

$$\lambda = \frac{hc}{E} = \frac{1240 \text{ eV} \cdot \text{nm}}{1.00 \text{ keV}} = 1.24 \text{ nm} .$$

(c) The neutron mass may be found in Appendix B. Using the conversion from electronvolts to Joules, we obtain

$$\lambda = \frac{h}{\sqrt{2m_n K}} = \frac{6.63 \times 10^{-34} \text{ J} \cdot \text{s}}{\sqrt{2(1.675 \times 10^{-27} \text{ kg})(1.6 \times 10^{-16} \text{ J})}} = 9.1 \times 10^{-13} \text{ m} .$$