

Act 3: Matter Wavelengths

What size wavelengths are we talking about? Consider a photon with energy 3 eV, and therefore momentum $p = 3 \text{ eV}/c$.^{*} Its wavelength is:

$$\lambda = \frac{h}{p} = \frac{4.14 \times 10^{-15} \text{ eV} \cdot \text{s}}{3 \text{ eV}} \times c = (1.4 \times 10^{-15} \text{ s}) \times (3 \times 10^8 \text{ m/s}) = 414 \text{ nm}$$

What is the wavelength of an electron with the same momentum?

a) $\lambda_e < \lambda_p$

b) $\lambda_e = \lambda_p$

c) $\lambda_e > \lambda_p$

^{*}It is an unfortunate fact of life that there is no named unit for momentum, so we're stuck with this cumbersome notation.