

49. We substitute the classical relationship between momentum p and velocity v , $v = p/m$ into the classical definition of kinetic energy, $K = \frac{1}{2}mv^2$, to obtain $K = p^2/2m$. Here m is the mass of an electron. Thus $p = \sqrt{2mK}$. The relationship between the momentum and the de Broglie wavelength λ is $\lambda = h/p$, where h is the Planck constant. Thus,

$$\lambda = \frac{h}{\sqrt{2mK}} .$$

If K is given in electron volts, then

$$\begin{aligned} \lambda &= \frac{6.626 \times 10^{-34} \text{ J} \cdot \text{s}}{\sqrt{2(9.109 \times 10^{-31} \text{ kg})(1.602 \times 10^{-19} \text{ J/eV})K}} = \frac{1.226 \times 10^{-9} \text{ m} \cdot \text{eV}^{1/2}}{\sqrt{K}} \\ &= \frac{1.226 \text{ nm} \cdot \text{eV}^{1/2}}{\sqrt{K}} . \end{aligned}$$