

Chapter 34 Problem 30 †

Given

$$\lambda = 1 \text{ mm} = 1.0 \times 10^{-3} \text{ m}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$$

Solution

Find the speed of the electron that gives a wavelength of 1 mm.

The De Broglie wavelength is given by

$$\lambda = \frac{h}{p} = \frac{h}{m \cdot v}$$

Solving for velocity gives

$$v = \frac{h}{m \cdot \lambda}$$

Substituting in the provided values gives

$$v = \frac{6.63 \times 10^{-34} \text{ J} \cdot \text{s}}{(9.11 \times 10^{-31} \text{ kg}) \cdot (1.0 \times 10^{-3} \text{ m})} = 0.728 \text{ m/s}$$

†Problem from Essential University Physics, Wolfson