

## Chapter 32 Problem 48 †

### Given

$$E_F = 11.6 \text{ eV}$$

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

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

$$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$$

### Solution

Find the density of conduction electrons in aluminum.

First convert the energy into joules

$$E_F = (11.6 \text{ eV}) \left( \frac{1.6 \times 10^{-19} \text{ J}}{1 \text{ eV}} \right) = 1.86 \times 10^{-18} \text{ J}$$

The density of conduction electrons is given by

$$n = \left( \frac{2^{9/2} \pi m^{3/2}}{3h^3} \right) E_F^{3/2}$$

$$n = \left( \frac{2^{9/2} \pi (9.11 \times 10^{-31} \text{ kg})^{3/2}}{3(6.63 \times 10^{-34} \text{ J} \cdot \text{s})^3} \right) (1.86 \times 10^{-18} \text{ J})^{3/2}$$

$$n = 1.79 \times 10^{29} \text{ e}^- / \text{m}^3$$

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†Problem from Essential University Physics, Wolfson