

4. (a) The magnitude of the current density vector is

$$J = \frac{i}{A} = \frac{i}{\pi d^2/4} = \frac{4(1.2 \times 10^{-10} \text{ A})}{\pi(2.5 \times 10^{-3} \text{ m})^2} = 2.4 \times 10^{-5} \text{ A/m}^2 .$$

- (b) The drift speed of the current-carrying electrons is

$$v_d = \frac{J}{ne} = \frac{2.4 \times 10^{-5} \text{ A/m}^2}{(8.47 \times 10^{28} / \text{m}^3)(1.60 \times 10^{-19} \text{ C})} = 1.8 \times 10^{-15} \text{ m/s} .$$