

57. (a)  $i = (n_h + n_e)e = (2.25 \times 10^{15}/\text{s} + 3.50 \times 10^{15}/\text{s})(1.60 \times 10^{-19} \text{ C}) = 9.20 \times 10^{-4} \text{ A}$ .  
(b) The magnitude of the current density vector is

$$|\vec{J}| = \frac{i}{A} = \frac{9.20 \times 10^{-4} \text{ A}}{\pi(0.165 \times 10^{-3} \text{ m})^2} = 1.08 \times 10^4 \text{ A/m}^2 .$$