

Ch. 9 Prob 33

$$I = 4.00 \text{ A}$$

$$n = 8.48 \times 10^{28} \frac{e^-}{\text{m}^3}$$

$$D = 2.588 \text{ mm}$$

$$r = \frac{D}{2} = 1.294 \text{ mm}$$

a) Find The current density

$$J = \frac{I}{A} = \frac{I}{\pi r^2} = \frac{4.00 \text{ A}}{\pi (1.294 \times 10^{-3} \text{ m})^2}$$

$$J = 7.60 \times 10^5 \text{ A/m}^2$$

b) Find The drift velocity

$$v_d = \frac{I}{nqA} = \frac{J}{nq}$$

The charge of each electron is  $1.6 \times 10^{-19} \text{ C}$

$$\text{so } v_d = \frac{J}{nq} = \frac{7.60 \times 10^5 \text{ A/m}^2}{(8.48 \times 10^{28} \frac{e^-}{\text{m}^3})(1.6 \times 10^{-19} \frac{\text{C}}{e^-})}$$

$$v_d = 5.6 \times 10^{-5} \text{ m/s}$$
$$= 0.056 \text{ mm/s}$$