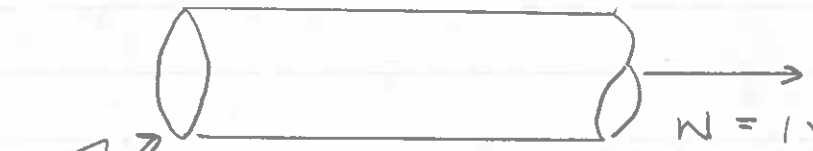
Iron wire



Cross section, $A = \pi r^2 = 3.142 \times 10^{-6}\ m^2$

Electron current, $i_e = \frac{N}{\Delta t} = 2 \times 10^{19}\ s^{-1}$

For Iron: (Table 27-1) number density of electrons, $n_e = 17 \times 10^{28}\ m^{-3}$

So: $i_e = n_e A v_d$

$$v_d = \frac{i_e}{n_e A} = 3.744 \times 10^{-5}\ \frac{m}{s}$$

NOTE: electrons in a metal move like molecules in a gas; i.e. they have a Maxwell-Boltzmann distribution of speeds with:

$$v_{rms} = \sqrt{\frac{3 k_B T}{m_e}} = 1.17 \times 10^{5}\ \frac{m}{s}$$

for $T = 300K$.