18.12 (a) This portion of the problem asks that we calculate, for silver, the number of free electrons per cubic meter (n) given that there are 1.3 free electrons per silver atom, that the electrical conductivity is 6.8 x 10^7 $(\Omega\text{-m})^{-1}$, and that the density (ρ'_{Ag}) is 10.5 g/cm^3. (Note: in this discussion, the density of silver is represented by ρ'_{Ag} in order to avoid confusion with resistivity which is designated by ρ.) Since $n = 1.3N_{Ag}$, and N_{Ag} is defined in Equation 4.2 (and using the atomic weight of Ag found inside the front cover—viz 107.87 g/mol), then

$$n = 1.3N_{Ag} = 1.3\left[\frac{\rho'_{Ag}N_A}{A_{Ag}}\right]$$

$$= 1.3\left[\frac{(10.5\ \text{g/cm}^3)(6.023\ \text{x}\ 10^{23}\ \text{atoms/mol})}{107.87\ \text{g/mol}}\right]$$

$$= 7.62\ \text{x}\ 10^{22}\ \text{cm}^{-3} = 7.62\ \text{x}\ 10^{28}\ \text{m}^{-3}$$

(b) Now we are asked to compute the electron mobility, μ_e. Using Equation 18.8

$$\mu_e = \frac{\sigma}{n|e|}$$

$$= \frac{6.8\ \text{x}\ 10^7\ (\Omega - \text{m})^{-1}}{(7.62\ \text{x}\ 10^{28}\ \text{m}^{-3})(1.602\ \text{x}\ 10^{-19}\ \text{C})} = 5.57\ \text{x}\ 10^{-3}\ \text{m}^2/\text{V-s}$$