Exercises & Problems pp. 401-402

20. Electrolysis experiments provide one of the most accurate ways to determine Avogadro's number. Electrolysis of a $NiSO_4$ solution by a current of 1.02 A for 252 s yielded a deposit of 0.1531 g Ni. Use this information to calculate a value for Avogadro's number. Do not use the Faraday constant, but you will need the electron charge: 1.602×10^{-19} C.

$$\#\text{Ni atoms} = 1.02\ \text{A} \times 252\ \text{s} \times \frac{1\ \text{e}^-}{1.602\times10^{-19}\ \text{C}} \times \frac{1\ \text{Ni atom}}{2\ \text{e}^-} = 8.022\times10^{20}\ \text{Ni atoms}$$

$$\text{mol Ni} = 0.1531\ \text{g Ni} \times \frac{1\ \text{mol Ni}}{58.69\ \text{g Ni}} = 0.002609\ \text{mol Ni}$$

$$\text{Avogadro's \#} = \frac{\#\text{Ni atoms}}{\text{mol Ni}} = \frac{8.022\times10^{20}\ \text{Ni atoms}}{0.002609\ \text{mol Ni}} = 3.07\times10^{23}\ \text{mol}^{-1}$$

This value is off by a factor of 2. This error is probably due to the makers of the question mistakenly using a charge of 1+ for the Ni (if the current or time were doubled, the answer would be correct).