3. Suppose the charge on the sphere increases by Δq in time Δt. Then, in that time its potential increases by

$$\Delta V = \frac{\Delta q}{4\pi\varepsilon_0 r},$$

where r is the radius of the sphere. This means

$$\Delta q = 4\pi\varepsilon_0 r\,\Delta V\,.$$

Now, $\Delta q = (i_{\text{in}} - i_{\text{out}})\,\Delta t$, where i_{in} is the current entering the sphere and i_{out} is the current leaving. Thus,

$$\Delta t = \frac{\Delta q}{i_{\text{in}} - i_{\text{out}}} = \frac{4\pi\varepsilon_0 r\,\Delta V}{i_{\text{in}} - i_{\text{out}}}$$

$$= \frac{(0.10\text{ m})(1000\text{ V})}{(8.99\times10^{9}\text{ F/m})(1.0000020\text{ A} - 1.0000000\text{ A})} = 5.6\times10^{-3}\text{ s.}$$