Due date: Wednesday, Jan. 30

Griffiths reading: 7.1

1. [5 points] We won’t have much in this course about RLC circuits, but you should know the basics from a previous course. Here is a check-up: The potential difference across the capacitors is $V_0$ when the switch is closed.

(a) Find the decay time $\tau$, such that the total current decays as $e^{-t/\tau}$.
(b) Find the charge on capacitor $C_1$ as a function of $t/\tau$.
(c) Find the current through $R_1$ as a function of $t/\tau$.


3. [4 points] Reconsider the previous problem (Griffiths 7.1) but for the case of a hemispherical shell extending from $a$ to $b$; that is, the bottom half of the spherical configuration has been cut away, so that the weakly conductive material also has a part of its surface in the $x$-$y$ plane. Is the electric field and current flow still exactly in the radial direction? Argue along the lines of Ex. 7.1.

4. [5 points] A wire of cross section $A$ and length $L$ stretches from $x = L$ to $x = 2L$ along the $x$ axis. The metal inside has a nonuniform conductivity $\sigma(x) = \sigma_0(x/L)$. That is, the conductivity changes smoothly from $\sigma_0$ at the left end to $2\sigma_0$ at the right end. What is the total resistance of the wire, measured from one end to the other?

(Hint: Assume a uniform current and compute the voltage difference from one end to the other. A definite integral is required.)