**Activity 3-1**

***CONCEPTUALLY UNDERSTANDING CONDUCTORS***

Part 1 – Conceptually Understanding Conductors

A coax cable is essentially one long conducting cylinder surrounded by a conducting cylindrical shell (the shell has some thickness). The two conductors are separated by a small distance. (Neglect all fringing fields near the cable’s ends).

Draw the charge distribution (little + and – signs) if the inner conductor has a total charge +Q on it, and the outer conductor has a total charge –Q. Be precise about exactly where the charge will be on these conductors, and how you know.

**Perspective view**: Gap (insulated or air)

Inner conductor Thin conducting shell **Top view**:

-Q

+Q

   

1. If you were calculating the potential difference, ΔV, (for the configuration in part (i.)) between the center of the inner conductor () and infinitely far away (), what regions of space would have a (non-zero) contribution to your calculation?
2. Now, draw the charge distribution (little + and – signs) if the inner conductor has a total charge +Q on it, and the outer conductor is electrically neutral. Be precise about exactly where the charge will be on these conductors, and how you know.

+Q

Next, determine the capacitance per unit length of the coaxial conductors.

1. Consider how the charge distribution would change if the inner conductor is shifted off-center, but still has +Q on it, and the outer conductor remains electrically neutral. Draw the new charge distribution (little + and – signs) and be precise about how you know.

+Q

1. How would you go about computing the electric field in the region between the conductors? Draw electric field lines in the region between the conductors.

1. How would you go about computing the electric field in the region outside the outer conductor? What is it?