PHY140Y

Spring Term – Week 4 Discussion

January 25, 1999

1. Suppose we have a parallel plate capacitor formed from two plates of area A and separated by a distance d. You can assume that the width and length of the plates are much larger than the separation d.

   (a) We start by putting a charge $+Q$ on the top plate and a charge $-Q$ on the bottom plate. What is the electric field between the plates? What is the electric field outside the plates?

   (b) The electric potential between the two plates is defined as the work per unit charge required to transfer a charge from the bottom to the top plate. What is this potential?

   (c) What is the force acting on each plate?

   (d) Calculate the capacitance, $C \equiv Q/\Delta V$, of this system.

2. Suppose we have a charge $+q$ located on the $\hat{z}$ axis at $d/2$ and a charge $-q$ located on the same axis at $-d/2$. This is called a dipole.

   (a) Sketch the field lines for this charge distribution.

   (b) At a point z along the $\hat{z}$ axis, calculate the electric field. Assume that $|z| \gg d$. How fast is it falling off? Does this make sense?

3. Three charges, two with magnitude $+4q$ and one with magnitude $-q$, are placed on a line. Is there a configuration in which the forces on all three are zero?