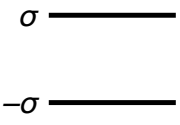
Physics 2140 Homework #6

4 problems

Complete by October 8

▷ **1.**

The electric field of an infinite plane with surface charge density σ, as we saw earlier, is $2\pi k\sigma$.

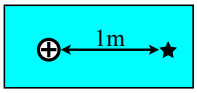


(a) Suppose we have two parallel infinite planes, the top one with surface charge density σ and the bottom with surface charge density $-\sigma$. What is the electric field (magnitude and direction) between the two planes?

(b) Find the potential difference between the two plates, as a function of σ, if the plates are a distance d apart.

▷ **2.**

A positive charge 2 mC sits in water ($\kappa = 80$). What is the magnitude of the electric field 1 m from the charge?

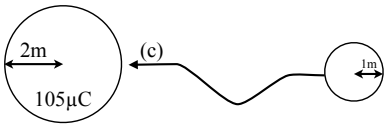


▷ **3.**

What is the net charge on a conducting sphere of radius $r = 0.15$ m if the potential of the sphere is 1500 V and $V = 0$ at infinity?

▷ **4.**

A sphere with radius 2 m has a total charge of 105 μC on it.



(a) What is the sphere's capacitance?

(b) What is the potential of the sphere, if $V_\infty = 0$ V?

(c) Now suppose a 1 m sphere is connected to the first sphere with a long wire as shown. The smaller sphere is initially neutral. Once the wire is connected and the system reaches equilibrium, how much charge ends up on the smaller sphere? (Or alternatively, what is the ratio of the final charge on the small sphere to the final charge on the big sphere?)