Waves and Fields (PHYS 195): Week 9

Spring 2009 v1.0

Intro:

This week we finish off a few topics in electrostatics - the situation when the charges that source the electric fields are static - with capacitors and energy in electric fields (how does the energy denisty scale with $\mathbf{E}$*?). Setting charges in motion we'll study circuits briefly then move on to magnetic fields which are created when charges move.*

Reminder*: We have Quiz II in lab starting April 8. The topics include, predominantly, the last part of waves and the electric field.*

Reading:

- Friday: HRW 26.1 - 26. 7
- Monday: HRW 27
- Wednesday: HRW 28

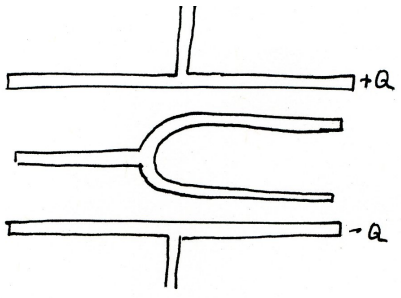
Physics Topics:

- Circuits - capacitors, resistors, and batteries
- Magnetic field
- The $I\ell \times \mathbf{B}$ force
- The Lorentz force $q\mathbf{v} \times \mathbf{B}$

Problems:

All these problems are optional.

(1) HRW 23.10
(2) HRW 23.25
(3) HRW 25.23
(4) HRW 25.30
(5) HRW 25.38
(6) A parallel plate capacitor with a conductor inside, shown below, is charged with $+Q$ on the top plate and $-Q$ on the bottom plate. Sketch the field lines and equipotentials between the plates of the capacitor and conductor shown. Include an explanation of the distribution of charge and the field lines.



(7) Suppose you have a dipole with $Q = 4.20$ nC, $|\mathbf{d}| = 1.00$ cm. This dipole is placed in an electric field of strength 201 N/C and is oriented 130.0 degrees from the direction of the field. What is the torque on the dipole?

(8) Find the electric field of a dipole at a point P located a distance z from the center of the dipole along its axis. Assume that $z >> d$ and that P is on the $+Q$ side of the dipole.
(9) Find the angular frequency of oscillation of a dipole in a uniform electric field when the angle between the dipole moment and the electric field is small. Assume the dipole has a moment of inertia I.

Lab:

Quiz II

A look ahead...

Next week we briefly study magnetic fields and the *dynamics* of magnetic and electric fields. This will lead us back to waves! And Jake will be pleased...