Physics 4B: Problem Set 2

1. A rod of length L and total charge Q is a distance D from a point charge q which lies along the perpendicular bisector of the rod. Find the force of the rod on the point charge.

2. Find the electric field at the center of a hemispherical shell of charge Q and radius R.

3. Two identical rods each of length L and charge Q are perpendicular to each other and separated by a distance D, where the distance D is from the middle of one rod to the nearest tip of the other. Find the force between them.

4. Find the torque on a charged rod of length L and charge Q when placed in a uniform E field where the rod makes an angle θ to the field. The rod is hinged on a pivot at one end.

5. Find the period of oscillation, T, of a little charged ring that is free to move along a vertical wire when placed equi-distant between two like charges above and below it. Small displacement only. Treat the "little" ring like a point charge and use the binomial expansion (http://en.wikipedia.org/wiki/Binomial_series) for small "x" to reduce the net force on the ring to a linear Hooke's law style force.

6. Find the electric field at the top point of a right circular solid cone of charge Q, uniform density. The cone has a radius a and a height h.

7. Show that for a charged circular ring of radius a and total charge Q, the electric field anywhere inside the plane of the ring would be zero if the electric field was inversely proportional to r not r^2. Your answer is partly verbal and graphical.