Problem Set 2: More Electrostatics

Instructions:

1. Answer all questions below. Show your work for full credit.
2. Due before 5pm, 5 September 2008
3. Email: pleclair@ua.edu; hard copies: Gallalee 206 or Bevill 228
4. You may collaborate, but everyone must turn in their own work

1. The sphere of radius a was filled with positive charge at uniform density ρ. Then a smaller sphere of radius $a/2$ was carved out, as shown in the figure, and left empty. What are the direction and magnitude of the electric field at A? At B?
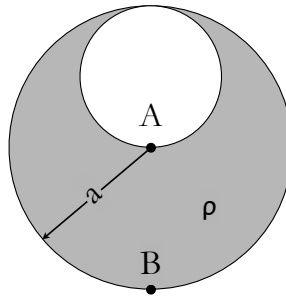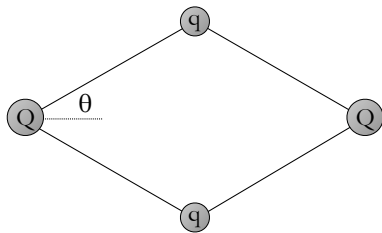

Figure 1: *Problem 1*

2. Imagine a sphere of radius a filled with negative charge $-2e$ of uniform density. Imbed in this jelly of negative charge two protons and assume that in spite of their presence the negative charge remains uniform. Where must the protons be located so that the force on each of them is zero?

3. Four positively charged bodies, two with charge Q and two with charge q, are connected by four unstretchable strings of equal length. In the absence of external forces they assume the equilibrium configuration shown in the diagram. Show that $\tan^3\theta = q^2/Q^2$. This can be done in two ways. You could show that this relation must hold if the total force on each body, the vector sum of string tension and electrical repulsion, is zero. Or you could write out the expression for the energy U of the assembly and minimize it.