Massachusetts Institute of Technology
Department of Physics
8.022 Fall 2004
Assignment 1: Electric forces and electric fields
Due date: Friday, September 17th

1. Purcell 1.4: Charges on corners of a square

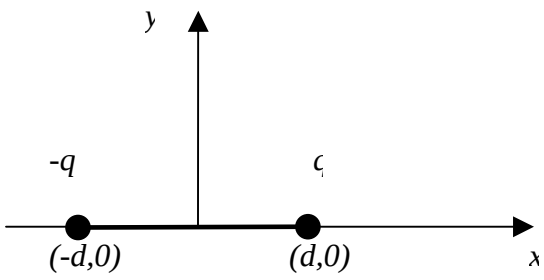
2. Purcell 1.9: Potential energy of a sphere of charge

3. Purcell 1.16: Sphere of charge with a spherical hollow

4. Purcell 1.17: Flux and cube

5. Purcell 1.26: Electric field from continuous charge distribution (hairpin)

6. Electric Dipole: a pair of charges lies in the *x-y* plane. The charge +q is at coordinate *x = d, y = 0*; the charge -q is at coordinate *x = -d, y = 0*.

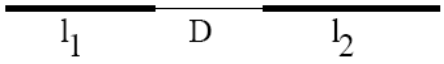


(a) Evaluate the electric field (magnitude and direction) at point *(0,a)*. Show that for *a>>d*, $\left|\vec{E}\right| \propto 1/a^3$. What is the direction in this limit? (suppose *a>0*)

(b) Evaluate the electric field at the point *(a, 0)*. Find also the magnitude and direction for *a>>d* (suppose *a>0*)

(c) How much work does it need to move a particle with charge *q'* from *(a, 0)* to *(0, a)*. (Do not assume *a>>d*)

7 Coulomb force between line charges: a rod of length l1 with line charge density λ_1 and a rod of length l_2 with line charge density λ_2 lie on the *x* axis. Their ends are separated by a distance *D* as shown in the figure.



(a) What is the force $\vec{F}$ between these charges?

(b) Show that for $D>>l_1$ and $D >> l_2$, this force reduces to the Coulomb forces between a pair of point charges, $q_1 = l_1\lambda_1$, $q_2 = l_2\lambda_2$.