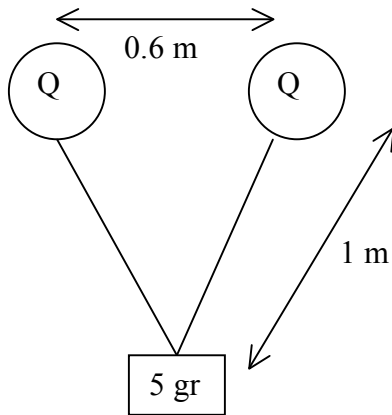


Homework 1  
Due September 11, 2009

272:

1.- What is the net electrical force on a unit positive charge placed at the center of a square of side  $b$  which has charges  $q$ ,  $2q$ ,  $-4q$ , and  $2q$  placed in order at the four corners?

2.- Two similar helium filled balloons, tied to a 5 g mass float in equilibrium as shown in the diagram, the separation between the balloons is 0.6 m. The length of the cables is 1 m. There is a charge  $Q$  on each balloon. Find the magnitude of  $Q$  in Coulombs.



272H (the two previous and the following ones):

3.- Charges  $(-e)$  are placed at the vertices of an equilateral triangle of side  $r$ , and charge  $Q > 0$  is placed at the center of gravity of the triangle. What must be the value of  $Q$  if the force on any of the negative charges is to be zero? The force on  $Q$  is always zero by symmetry. Is the system in stable equilibrium?

4.- An alpha particle passes rapidly through the exact center of a hydrogen molecule, moving on a line perpendicular to the internuclear axis. The distance between the nuclei is  $b$ . Where on its path does the alpha particle experience the greatest force? Assume that the nuclei do not move much during the passage of the alpha particle (The assumption is valid because of the high speed of the alpha particle.) Neglect the electric forces from the electrons in the molecule. (This is not a very good approximation, for in the  $H_2$  molecule there is a significant concentration of negative charge in the central region).

