Coulomb’s Law and Classical Mechanics: Don’t Panic, It’s Just a New Force.

Group Problems

1. A neutral helium-4 atom has two protons and two neutrons, bound together in its nucleus, and two electrons in its single electron shell. The electrons can be thought of as orbiting the nucleus. The average speed of the electrons in the atom is approximately 4.1x106m/s. Determine the average radius of the helium-4 atom. Assume the electrons do not interact with each other.

2. Consider the diagram below that shows a type of balance that can determine the mass of an object by measuring the amount of charge required to hold it in static equilibrium. The mass is suspended from the end of the beam while the conducting sphere is located at the centre of the beam. The beam is 125g and uniform. The upper sphere has a mass of 14.0g.

12.2mm

The charge on the lower sphere is fixed at 36.0μC, while the charge on the upper sphere and the gap between the two spheres are both adjustable. If the charge on the top sphere is 14.0μC and the gap is set at 12.2mm. Determine the hanging mass.

3. A charged sphere is held in equilibrium as shown below. The hanging sphere carries 2.947x109 excess electrons and a mass of 36.0g. Determine the amount and polarity (+ or -) of the charge on the standing sphere.

29o

4.04cm

4. Three charges are arranged as shown below. The rectangle measures 8.00cm by 5.00cm.

+225nC P

-0.112µC -140nC

Find the electro staticforce on the 225nC charge.