Homework #1

Due 2/11/2005, 4 PM in mailboxes outside Science Center 109

Read: Chapter 23
Instructions: Please box your solutions. The homework problems are graded out of 3 points, and then the total re-scaled to 30. For each problem, in order to get full credit, you must also include a sentence explaining the most important idea you used in order to solve it. Do not summarize the whole solution, simply the one most important idea.

Special Note for HW#1: This is a short set because we’ve done only half a lecture so far. The problems are on the easy side as well. I hope you aren’t too unhappy about this. Future sets will have 8 to 12 problems.

HW Problems

1. What is the single most important idea introduced in lecture 1? (Do not try to summarize the lecture! Pick only a single concept, law, or principle.)

   (a) Calculate the number of electrons in a small, electrically neutral silver pin that has a mass of 10.0 g. Silver has 47 electrons per atom, and its molar mass is 107.87 g/mol.
   (b) Electrons are added to the pin until the net negative charge is 1.00 mC. How many electrons are added for every $10^9$ electrons already present?

   (a) Two protons in a molecule are separated by $3.80 \times 10^{-10}$ m. Find the electric force exerted by one proton on the other.
   (b) How does the magnitude of this force compare to the magnitude of the gravitational force between the two protons?
   (c) What If? What must be the charge-to-mass ratio of a particle if the magnitude of the gravitational force between two of these particles equals to the magnitude of electric force between them?

   Two small beads having positive charges $3q$ and $q$ are fixed at the opposite ends of a horizontal, insulating rod, extending from the origin to $x = d$. As shown in the Figure below, a third small charged bead is free to slide on the rod. At what position is the third bead in equilibrium? Can it be in stable equilibrium?

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![Diagram of three charged beads on a rod](attachment:image.png)