**Electrostatics:** Introduction to Electric Forces and Fields.

Makes Gravity Look Like a Pathetic Chump.

1. a. Find the electrostatic and gravitational force between two electrons separated by 10.0cm.

 b. Find the electrostatic and gravitational force between two protons separated by 10.0cm.

 c. Find the electrostatic and gravitational force between an electron and a proton separated by 10.0cm.

2. Find the electric field strength 1.0mm from an electron.

3. An electron and a proton are placed into a uniform electric field, **E**=1600N/C East. Find the acceleration of each.

4. A conducting sphere has 5.00x1013 excess electrons. It s placed near a second conducting sphere with a mass of 0.600kg. The second mass is suspended, by an insulated string, from the ceiling. The system reaches equilibrium as shown. Find the charge on the second sphere (indicate polarity!)

 53o

 0.30m

5. Find the electric field at points A and B.

- 2.5μC

 A

 + 4.0μC

B

 0.20m

 0.10m

6. An alpha particle (Helium nucleus; 2 protons and 2 neutrons) is fired into a uniform electric field of 1400N/C North. The particle is initially travelling at 5.6x105m/s south. How much time is required for its velocity to change to 6.0x106m/s north?

7. Two charges are arranged on a line as shown below. Q1=-6.0μC, Q2=+9.0μC. Locate any points on the line where the electric field is zero. (Give answer relative to Q1)

 Q1 Q2

 0.20m

8. Two charges are arranged on a line as shown below. Q1=+6.0μC, Q2=+9.0μC. Locate any points on the line where the electric field is zero. (Give answer relative to Q1)

 Q1 Q2

 0.20m

9. A neutral conducting sphere is placed into the space between two oppositely charged parallel plates. Show how the charges on the sphere will arrange themselves and sketch the electric field between the plates.

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10. 5.0cm

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 A B

 12cm

 D C

The field between the plates is 44000N/C.

 A. Find the work to move a proton from A to B at constant speed.

 B. Find the work to move a proton from B to C at constant speed.

 C. Find the work to move a proton from C to D at constant speed.

 D. Find the work to move a proton from A to B to C to D at constant speed.

` E. Find the work to move a proton directly from A to D at constant speed.

 F. Find the work to move a proton diagonally from A to C at constant speed.

 G. Find the work to move an electron from A to B at constant speed.

 H. Find the work to move an electron from B to C at constant speed.

 I. Find the work to move an electron from C to D at constant speed.

11. A conducting sphere is given a charge of +12μC by removing electrons. How many electrons must have been removed?

12. A solid conducting sphere with r=22.0cm and a hollow conducting sphere with r=44.0cm are each charged to -14mC. Which sphere has more excess electrons on its outer surface?

 A. The hollow sphere

 B. The solid sphere

 C. They have the same number of excess electrons on their outer surface.

 D. Must know the thickness of the walls of the hollow sphere

 E. Must know the density of each sphere.