

Walking your town's commercial district one Saturday, a large poster in a hobby shop window catches your eye:

WANTED: A simple method for measuring electric charge, using only these materials: Rubber balloons, string, and fur cloth. Mass and distance measuring devices are allowed. **PRIZE:** \$500 for the first successful method submitted.

Materials:

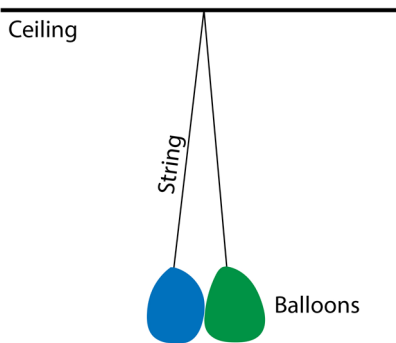
- Rubber balloons (2)
- String
- Fur cloth
- A ruler with centimeters and millimeters marked
- A scale for weighing the balloon and string

Procedure:

- Inflate both balloons to roughly three-quarters capacity.
- Cut two pieces of string, each a few meters long
- Pair each of the strings with one of the balloons, and weigh them, balloon and string together, on a mass balance. Record the values below:

	Balloon/String Pair 1	Balloon/String Pair 2
Mass (grams):		

- Fasten one end of each string to the ceiling; the other end to a balloon, so that the balloons hang about shoulder-height, touching one another (see diagram).



- Using the fur cloth, rub each balloon 10 times

1. What will the balloons do after being rubbed by the fur? Why?

Name:

Date:

f. Using the ruler, measure the distance from the center of one balloon to the center of the other. Next, measure the vertical distance from the ceiling to the center of either balloon (they should be at the same height). Record both measured distances here:

	Center-to-Center of Balloons	Ceiling to Balloon Center
Distance (meters):		

g. In the space below, draw a free body diagram of one of the balloons after it is rubbed by the fur, making sure to include all the forces acting on it:

2. What is the gravitational force acting on the balloon? Give your answer in Newtons.

h. Draw a diagram of the two balloons that includes the angle formed by the two strings hanging from the ceiling. Give the angle a name (theta (θ) is one option) and label it in the diagram:

Name:

Date:

i. Considering this diagram along with the free body diagram, write an equation for the vertical forces acting on the balloon:

j. Use the two distances measured to write out the length of each leg of the right triangle whose hypotenuse is the string. What is the angle formed at the top corner of the triangle? Give your answer in degrees.

k. Now that we know the angle, write out an equation for the horizontal forces acting on the balloon. Assuming the charge on each balloon is the same, what is that charge?

questions continued on next page

Unit 5C_Coulomb's Law Lab STUDENT

Name:

Date:

- l. Rub each of the balloons 10 more times with the fur cloth**
- m. Measure the new distance from the center of one balloon to the center of the other, and the distance from the ceiling to the center of the balloon, recording the values here:**

	Center-to-Center of Balloons	Ceiling to Balloon Center
Distance (meters):		

- n. Solve for Q, the charge on each of the balloons, using these new measurements.**

- 3. Was the new value of Q twice the old value? Why or why not?**

- 4. Confident of your idea, to enter to win the \$500 prize you must now write up your method findings. Assuming the reader has no background in physics, explain your method and how you were able to solve for the charge on each balloon, using only the materials allowed.**
