

P1320L, Coulomb's Law

Lab 3, Work Sheet

Submitted by: Mari Beltran Experiment's date: _____

Team members:

1.- Eliza 2.- _____
3.- Carlos 4.- _____

Instructor must initial: _____

Introduction

Write a short paragraph about the purpose of this lab.

Data

Instructions: Collect your data using your lab manual as a guide, unless directed to do otherwise by your lab instructor. Each measurement must have units. If a table is used, then it must have headers (for rows or columns) that include units

In this experiment, we control the distance between charges and observe the force between them. For each distance, record the torsion angle required to realign the marks on the vane and the index arm of the balance. Organize your data in the following table. The last column will be filled with results from the analysis section.

distance		Angle	X (averaged) [$1/m^2$]
20 cm	0.2 m	$10^\circ / 8^\circ$	25
14 cm	0.14 m	$20^\circ / 18^\circ / 18^\circ /$	51.02
10 cm	0.10 m	$33^\circ / 33^\circ$	100
8 cm	0.08 m	$59^\circ / 60^\circ$	156.25
6 cm	0.06 m	$99^\circ / 86^\circ / 85^\circ$	277.78

Analysis

1. Plot the torsion angle as a function of the separation distance between the charges. Call this Figure 1. The plot axes must include labels with appropriate SI units.

[illegible]

2. On the third column to your data table record the inverse square of the separation distance. Give an example of the calculation including the resultant SI units. Call this variable x ;
3. Make another graph of the torsion angle, but this time as a function of the x variable. Call this Figure 2. The plot axes must include labels with appropriate SI units.

[illegible]

4. If the data on Figure 2 looks like a straight line, use a straight edge to determine the line that best fit your data; draw this best-fit line on top of your data in Figure 2.

5. Determine the slope of the best-fit line, which is a good estimate for the constant in equation (3.5) of your lab manual.

6. Use the value of the best fit line's slope to determine the amount of the charge in each sphere, Q . Assume that every time you charge the spheres, they get the same amount of charge, Q . Take the accepted value for the Coulomb's constant in equation (3.1) of the lab manual as $k = 8.99 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$, and the value of the proportionality constant in equation (3.3) as $c = 1.448\,574 \times 10^{-6} \text{ N degree}^{-1}$

1 Questions

7. Some times the Coulomb's law is written as

$$F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{d^2}, \quad (1)$$

where ϵ_0 is the permittivity of free space. What are the SI units for ϵ_0 .

Conclusion

Summarize your results and write a brief reflection on the experiment; in particular, comment on whether the theory makes reasonable predictions despite the observed variability.

