Experiment: Electric Potential

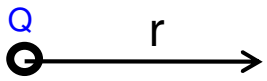
Preliminary Questions:

In this lab you will explore the relationship between electric potential (V) and separation distance for various charged objects.

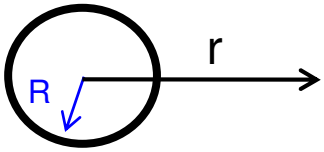
Preliminary Questions:

Write out the equation for the electric potential (as a function of separation distance) for the following charged bodies:

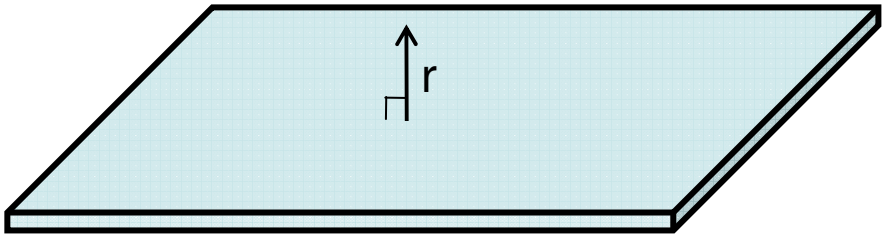
1) A Point Charge



2) A charged hollow non-conducting sphere (outside the sphere)



3) A charged flat surface (assume span of surface is >> than separation distance)



Set-up:

1) Connect a charge sensor to the LabPro interface and adjust setting to 10 V.
2) Attach the red lead to a metal canister, placed in a glass bowl.
3) Start the LoggerPro software and open the file "Electric Field" from the network drive.
4) Attach one end of a separate wire to the metal canister and the other end to ground. Press the "Reset" button to zero the sensor reading.

The Experiment:

1) Obtain and inflate a spherical balloon. Charge it as uniformly as possible.
2) Using LoggerPro, collect potential (V) vs separation distance (r) values for at least 10 points. *Be sure to the collect points over a range where you can effectively conclude something from them…*
3) Fit the resulting potential vs distance graph to an appropriate equation. *Be sure to set the curve fit window to display the standard deviation (uncertainty) of the fit values.*
4) Record the fit model and calculated constants in Table 1. *Note: The fit constants may use different letters in LoggerPro. If so, modify the table accordingly. Also, you may not need the "C" constant column.*

Table 1: Data

Charged Object	**Fit Eqn** (i.e.y=Ax+B)	**A ± δA**	**B ± δB**	**C ± δC**	**Expected Eqn. for V**	**Agree?** (yes or no)

5) Record the equation for the electric potential in Table 2.
6) Cut-and-paste the graphs (and fit) into Microsoft Word.
7) Repeat using a charged flat surface (a plastic transparency should work well).

Summary questions

1) During your experiment(s) did you attempt to insure uniform charge distribution on the surface of the objects? How?

2) Do your derived equations for the V vs distance graphs agree with the respective expected equations? Explain.

3) For each of the charged objects above, explain the physical significance of the calculated fit constants (A, B and C).
   - Charged balloon
   - Charged flat surface

4) Estimate the effective charge for the charged balloon using the fit constants for the V vs distance graph.

5) Estimate the effective charge for the charged flat surface using the fit constants for the V vs distance graph.

6) Describe any observations you made during this experiment that were unexpected, interesting or significant? Explain.