Teacher Reference

**Introduction:**
In this exercise, students determine mathematically and experimentally the voltage of a parallel plate capacitor for various plate spacings at constant charge.

**Experimental goals:**
After completing this experiment, students will be able to explain the relationship between capacitance and voltage at constant charge. They will also be able to explain the increase of potential energy as capacitance is decreased.

**Equipment:**
Variable capacitor
Electrometer
Power Supply
Electrometer Leads
Power Supply Leads
Graph Paper

**Keywords:**
Capacitance, parallel plate capacitor, Voltage, Charge

**Notes:**
Caution students to move about the lab as little as possible, since their movements can affect other student’s readings. Readings should be taken with all group members standing away from the apparatus.

Note that the plates have three small bumpers that allow a minimum gap of about 1mm. Set the left hand plate support so that the scale reads 1mm on the left edge of the plastic protrusion of the right plate support when the plates are pushed together and aligned.

Students should read the introductory material in this lab and have the calculated values for capacitance, charge, and voltage completed before lab day.

**Answers:**
A. The agreement between the calculated and measured data will vary depending upon the care the student takes with the measurements. The plate spacing measurement is quite rough; so don’t expect the curves to match each other closely.

B. The two curves should have the same shape, which indicates that the voltage is inversely proportional to the capacitance, verifying the basic relationship as shown in the popular formulas.

C. The accuracy of the lab could be improved by having a more precise system of setting the plate spacing and by taking more measurements (perhaps at 1mm intervals) when the plates are between 1mm and 10mm.

D. The potential energy of the plates actually goes up as the plates are separated and the capacitance goes down. This is easy to explain if you realize that the plates have opposite charges and that the act of separating these charges further does work on the capacitor, opposing the electric force between the plates.