Capacitors

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

Voltage versus Inverse Distance (for fixed charge)

Vary the separation of the capacitor plates, starting when they are close and then increasing their separation, and note how the voltage varies with plate separation. Does the voltage increase and then reach some limiting value as the plates are farther separated?

Measure and record the area of the capacitor plates.

Estimate and record the offset of the scale from a true reading.

Complete the table.

Table 1

Plate Separation (mm)	Plate Voltage (V)			
	Set 1	Set 2	Set 3	Average
2				
3				
4				
5				
6				
7				
8				
9				
10				
15				
20				
25				
30				
35				
40				
45				
50				
130				

Is the relationship $\frac{\Delta V_{130}}{\Delta V} \sim 1 + \frac{\varepsilon_o A}{C_s d}$ approximately true for some range of distances?

Enter the range of data that you will use in your graph from the smallest plate separation to the largest.

Upload your graph as a file with maximum size of 1 MB. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

From your data, estimate C_s.

Derive $\frac{\Delta V_{130}}{\Delta V} \sim 1 + \frac{\varepsilon_o A}{C_s d}$.

Capacitance vs. Inverse Distance (using the multimeter)

Complete the table.

Table 2

Plate Separation (mm)	Plate Capacitance (nF)
2	
3	
4	
5	
6	
7	
8	
9	
10	
15	
20	
25	
30	
35	
40	
45	
50	

Does the capacitance decrease as the plates are further separated?

Upload your graph as a file with maximum size of 1 MB. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

Find the slope and intercept of this graph.

Find the value of $\kappa\varepsilon_o$ for air.

Does your measurement agree with the accepted value for this constant? (Answer yes if your measurement is within 20% of the accepted value.)

Does the value for your intercept agree with the stray capacitance found in the previous set of measurements? (Answer yes if the value for your intercept is within 20% of the accepted value.)