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.

Procedure A: Lighting an LED

How long did the LED remain lit when the capacitors were connected in series?

How long did the LED remain lit when the capacitors were connected in parallel?

How long did the LED remain lit when connected to the 1000 μF capacitor?

Which configuration held the most energy, series or parallel?

Which configuration should theoretically store more energy, and why?

<u>CHECKPOINT 1</u>: Ask your TA to check your work before proceeding.

Procedure B: Capacitors in Parallel

Complete the table below.

Data Table 1

	C_1 (larger capacitance)	C_2 (smaller capacitance)	C_p
C_meas (μF)			
ΔV_meas (V)			
Q_calc (μC)			
E_calc (μJ)			

Calculate the theoretical equivalent capacitance for the two capacitors in parallel.

What is the percent difference between your measured equivalent capacitance and the theoretical value of the equivalent capacitance?

Are the theoretical and measured values in close agreement? (Consider your percent difference exactly as you have entered it.)

Calculate the theoretical total charge. (Use the charges you calculated above for each capacitor.)

What is the percent difference between the theoretical total charge and the value calculated in the Data Table 1?

Are the theoretical and calculated values in close agreement? (Consider your percent difference exactly as you have entered it.)

Do the voltages on the individual capacitors and the parallel arrangement conform to the theoretical predictions of the equation $\Delta V_1 = \Delta V_2 = \Delta V$? (Compare the voltage on each capacitor to the voltage on the parallel arrangement. Calculate the percent difference for ΔV_1 and ΔV_{total}, and the percent difference for ΔV_2 and ΔV_{total}.)

CHECKPOINT 2: Ask your TA to check your table and calculations.

Procedure C: Capacitors in Series

Complete the table below.

Data Table 2

	C_1 (larger capacitance)	C_2 (smaller capacitance)	C_s
C_{meas} (μF)			
ΔV_{meas} (V)			
Q_{calc} (μC)			
E_{calc} (μJ)			

Calculate the theoretical equivalent capacitance for the two capacitors in series.

What is the percent difference between your measured equivalent capacitance and the theoretical value of the equivalent capacitance?

Are the theoretical and measured values in close agreement? (Consider your percent difference exactly as you have entered it.)

Calculate the theoretical value of total voltage. (Use the voltages you measured above for each capacitor.)

What is the percent difference between the theoretical value and the calculated value from Data Table 2?

Are the theoretical and calculated values in close agreement? (Consider your percent difference exactly as you have entered it.)

Do the charges on the individual capacitors and the series arrangement conform to the theoretical prediction of the equation $Q_{\text{total}} = Q_1 = Q_2$? (Consider the charges on each capacitor and the total charge exactly as you have entered them in Data Table 2. Calculate the percent difference for Q_1 and Q_{total}, and the percent difference for Q_2 and Q_{total}.)

Which circuit configuration held the most energy?

CHECKPOINT 3: Ask your TA to check your table and calculations.