The purpose of this lab activity is to become familiar with capacitors and the electrostatic theory associated with them. Today we will measure capacitors in series and parallel. We will also charge them up so that we can associate the capacitance with the voltage across each.

1. Equivalent Capacitance
You have several homework problems involving equivalent capacitance. This exercise should give you experience with both the homework-style calculations as well as measuring the equivalent capacitance to verify that the calculations are accurate. **For each circuit: Sketch, build, measure, calculate.**

A. Two capacitors: Equivalent capacitance between the black dots.

- Are the capacitors in series or parallel? How do you know?
- Measure the actual capacitance of your 2 capacitors using the Capacitance meter. They will different somewhat from their labeled values. Be careful to discharge all the capacitors before measuring them.
- Use the measured capacitance to calculate the equivalent capacitance.
- Now measure the combined capacitance and compare it to your calculation. Be careful to discharge all the capacitors one at a time before measuring the combined capacitance. Discuss whether they agree or disagree.

B. Two capacitors: Equivalent capacitance between the black dots.

- Are the capacitors in series or parallel? How do you know?
- Measure the actual capacitance of your 2 capacitors using the Capacitance meter. They will different somewhat from their labeled values. Be careful to discharge the capacitors before measuring them.
- Use the measured capacitance to calculate the equivalent capacitance.
- Now measure the combined capacitance and compare it to your calculation. Be careful to discharge all the capacitors one at a time before measuring the combined capacitance. Discuss whether they agree or disagree.
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C. Three capacitors: Equivalent capacitance between the black dots.

![Image of a circuit diagram with three capacitors: 22 µF, 33 µF, and 47 µF.]

- Which of the capacitors are in series and which are in parallel? How do you know?
- Measure the actual capacitance of your 3 capacitors using the Capacitance meter. Be careful to discharge the capacitors before measuring them.
- Use the measured capacitances to calculate the equivalent capacitance.
- Now measure the combined capacitance and compare it to your calculation.

2. Voltage and Charge
You should also understand the voltages in your circuit. Attach a power supply with 5 V at the black dots for the 3rd circuit above (part C). Be careful to discharge all the capacitors before attaching the power supply.
- Use a voltmeter to measure the voltage across each capacitor. Record your values in a neatly organized table.
- Verify that the voltage across the 47 µF capacitor is equal to the sum of the voltages across the other two capacitors. Explain why you expect this to be the case.
- Verify that the charge on the capacitors in series are equal. (You’ll have to calculate the charge from your measured information.) Explain why you expect the charge to be equal.
- How much charge is on the 47 µF capacitor?