Experiment 3 Capacitors

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We used a phet to simulate various different experiments and using the data from those experiments we calculated various pieces of data and compared those to the values from the simulation. The results were all fairly accurate with none of the experiments exceeding a percent error of 5%.

**Results**

For each of the parts, how well do the mathematically determined total capacitance values compare to the “Total Capacitance” meter value. Use the percent error equation for these comparisons.

The mathematically determined total capacitance values all fell under a percent error of 5% with part 1a having an error of 1.124%, part 1b having an error of 0.847%, part 2 having an error of 3.148%, part 3a having an error of 0% for both charge and capacitance, part 3b having an error of 4.582% for charge and an error of 4.656% for capacitance, and part 3c with an error of 0.921%.

**Questions for Discussion**

1. In part 1 the capacitance of the capacitor was determined for a particular area of the plates, and again for an increased area of the plates. By what factor was the area increased, and how does this compare to the two capacitances found?

The area increased by a factor of 4, while the capacitance increased by a factor of just under 3.978 which can be rounded up to 4.

1. Capacitors are said to store electric charge. How do you determine the total charge, or net charge of the entire capacitor?

Q=CV, multiply the capacitance by voltage. If the capacitance is not given, use to calculate capacitance, and if there is more than one capacitor, use either or both (for capacitors in parallel) and (for capacitors in series) depending on the situation.

1. In part 3B, a series combination of 3 different capacitance capacitors show to have the same amount of charge upon them. In part 3A the 3 different capacitors in a parallel combination do not have the same charge upon them. Describe why this occurs for both setups.

In 3B the capacitors have the same number of electrons flowing through them because they are all in series causing the number of electrons to be the same between them all. In 3A it’s different because the capacitors are in parallel, so the number of electrons traveling through each one is not limited by any of the other capacitors.

1. In the online simulation you were able to fully place a dielectric material between the two plates of the capacitor. By placing the dielectric material between the two plates the capacitance of the capacitor changes. By keeping the distance between the two plates at 10 mm, the area of the plates at 100 mm2, and having the material of the dielectric to have a dielectric constant equal to 5 (the dielectric constant for air is ≈1), write an equation that shows by how much the capacitance will change if you only place the dielectric material halfway between the two plates.

K is the dielectric constant, it is divided by 2 with ½ added in the second half of the equation because having the material half way in is essentially having half the dielectric material with air being the remaining dielectric material (which gets divided by 2 because it is also only occupying half the space as a dielectric material).