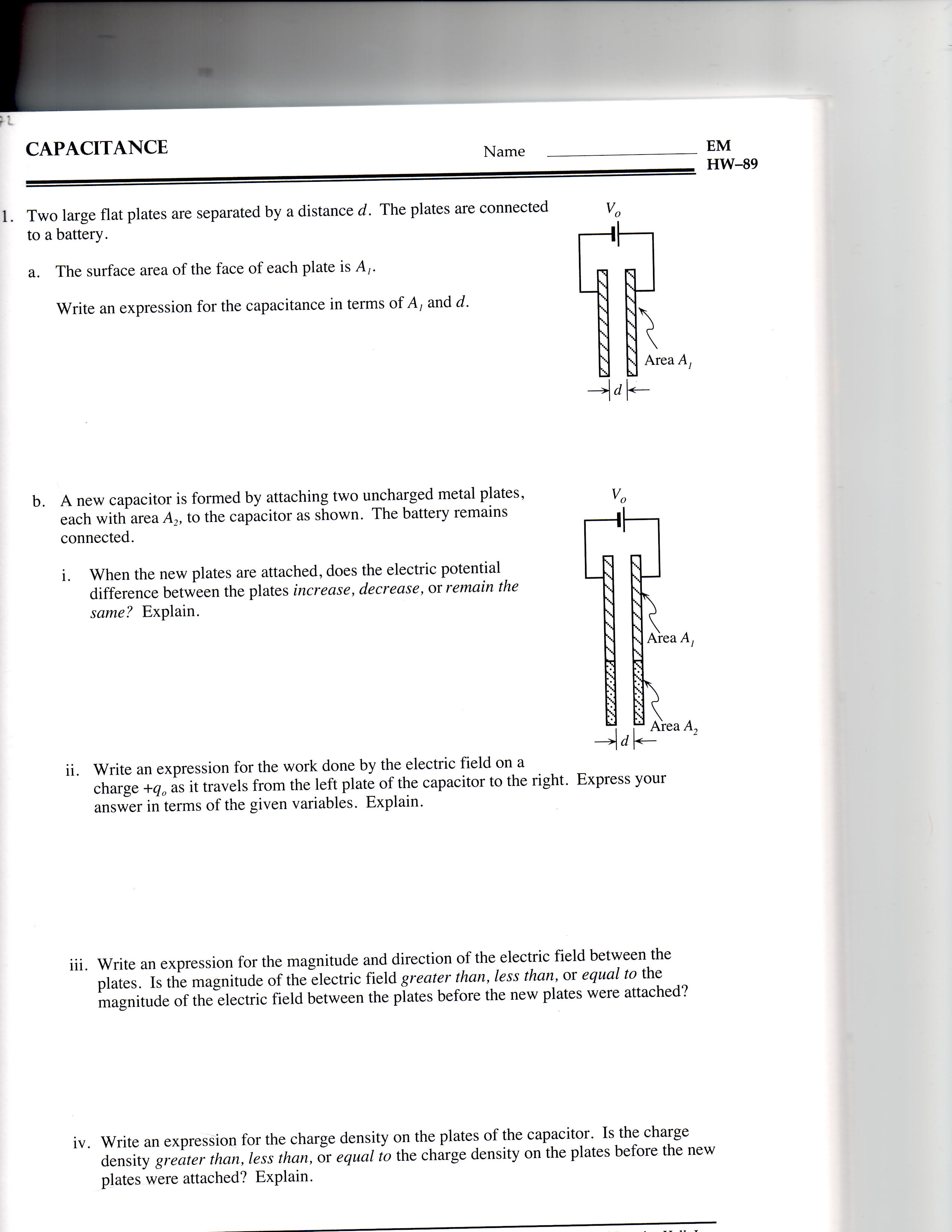
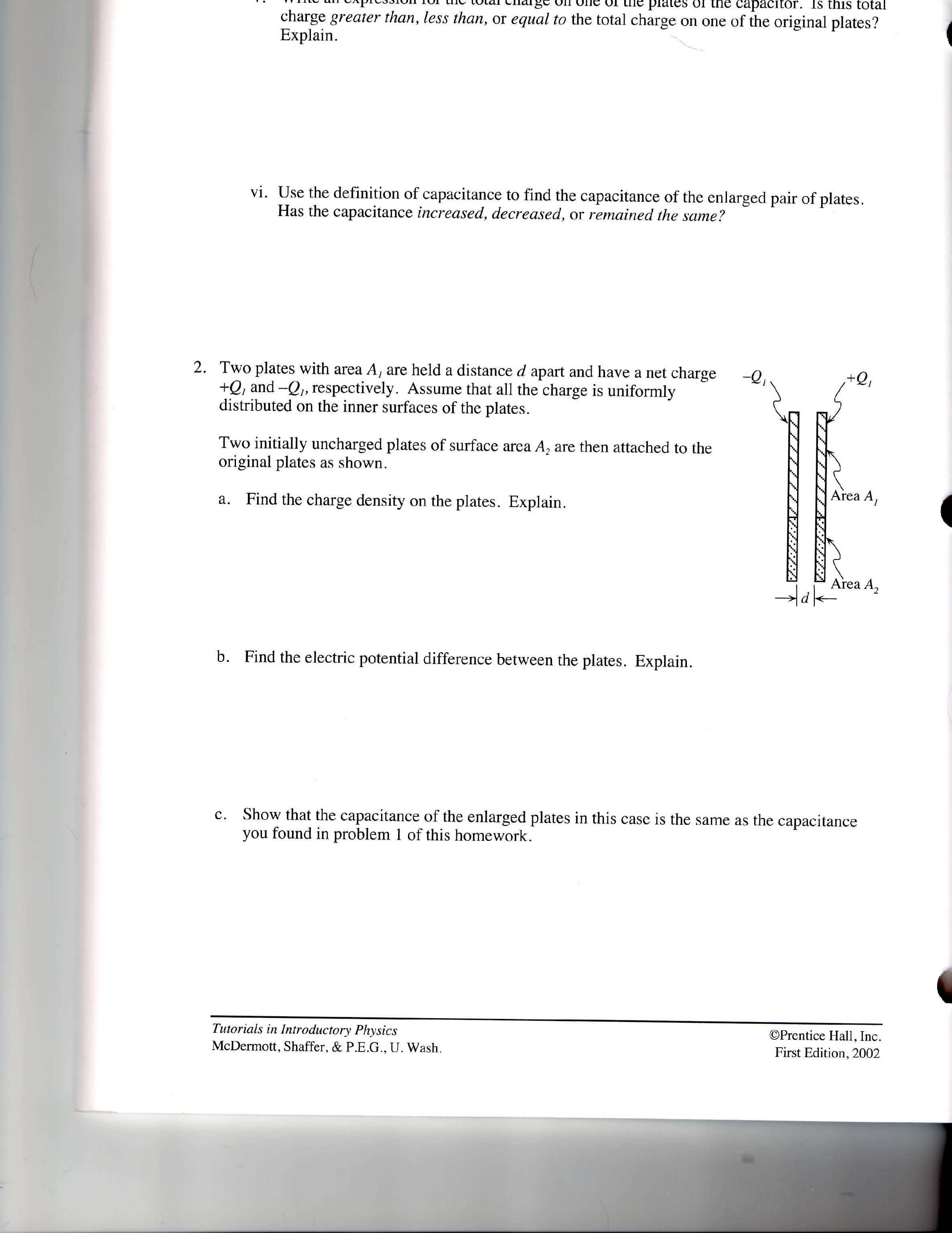
PY212

**Discussion Worksheet 4**

Please work with your partners on the following exercises.

1. Two large flat plates are separated by a distance *d*. The plates are connected to a battery.
2. The surface area of the face of each plate is. Write an expression for the capacitance in terms of  and *d*.
3. A new capacitor is formed by attaching two uncharged metal plates, each with area , to the capacitor as shown. The battery remains connected.
   1. When the new plates are attached, does the electric potential difference between the plates *increase*, *decrease*, or *remain the same*? Explain.
   2. Write an expression for the work done by the electric field on a charge  as it travels from the left plate of the capacitor to the right. Express your answer in terms of the given variables. Explain.
   3. Write an expression for the magnitude and direction of the electric field between the plates. Is the magnitude of the electric field *greater than*, *less than*, or *equal to* the magnitude of the electric field between the plates before the new plates were attached? Explain.
   4. Write an expression for the charge density on the plates of the capacitor. Is the charge density *greater than*, *less than*, or *equal to* the charge density on the plates before the new plates were attached? Explain.
   5. Write an expression for the total charge on one of the plates of the capacitor. Is this total charge *greater than*, *less than*, or *equal to* the total charge on one of the original plates? Explain.
   6. Use the definition of capacitance to find the capacitance of the enlarged pair of plates. Has the capacitance *increased*, *decreased*, or *remained the same*?

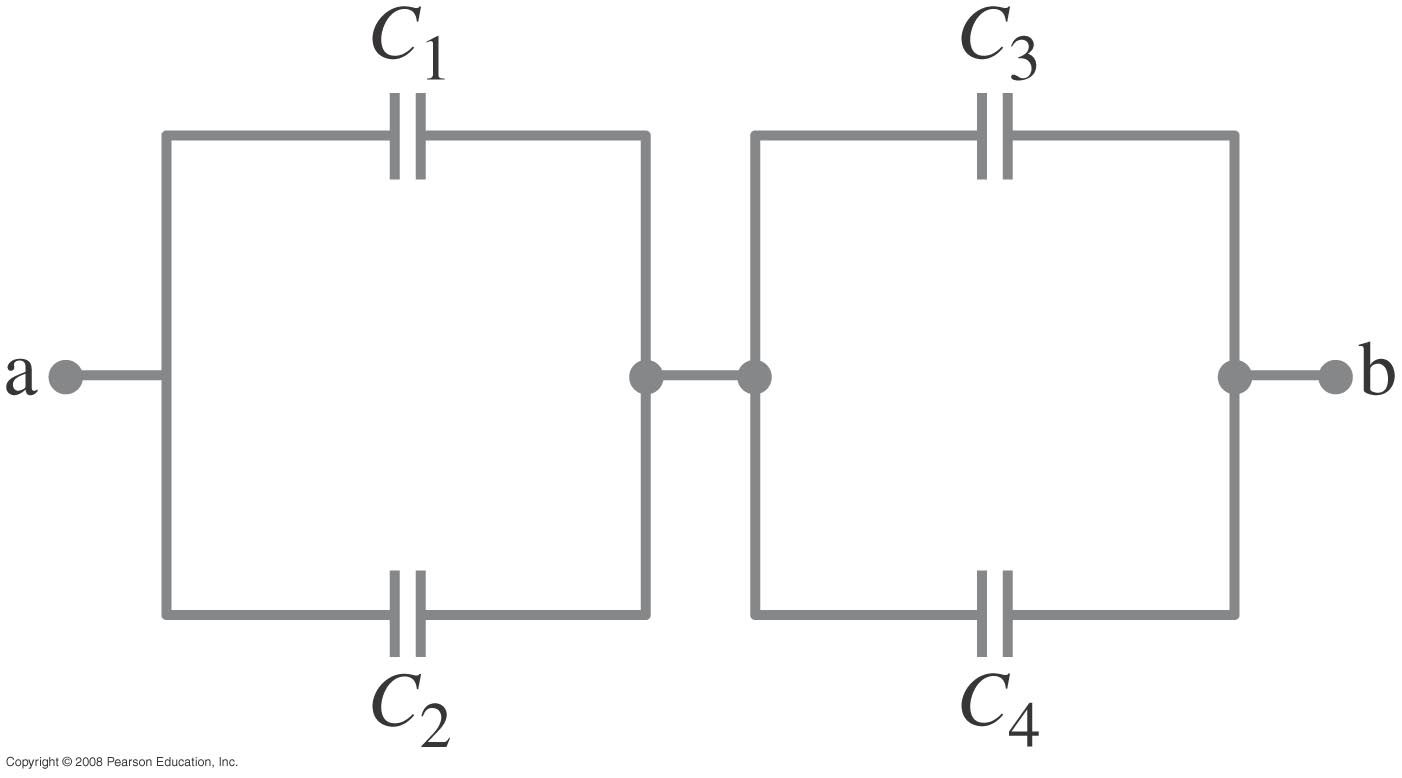


1. Two plates with area are held a distance *d* apart and have a net charge of and , respectively. Assume that all the charge is uniformly distributed on the inner surfaces of the plates.

Two initially uncharged plates of surface area are then attached to the original plates as shown.

1. Find the charge density of the plates. Explain.
2. Find the electric potential difference between the plates. Explain.
3. Show that the capacitance of the enlarged plates in this case is the same as the capacitance you found in problem 1 of this worksheet.

3.

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1. What is the equivalent capacitance between points a and b for the combination of capacitors shown in the above figure ?
2. Determine the charge on each capacitor and the voltage across each if 
3. A parallel plate capacitor is made from two plates of area *A* that are separated by a distance *d*. Half of the space between these plates contains only air, but the other half is filled with a dielectric material with dielectric constant. A battery of voltage  is connected across the plates.



1. How is this similar to two capacitors in parallel?

Dielectric

1. What is the capacitance of this combination?
2. How much energy is stored in the capacitor?
3. If we remove the dielectric material but change nothing else, how much energy will be stored in the capacitor? Explain.