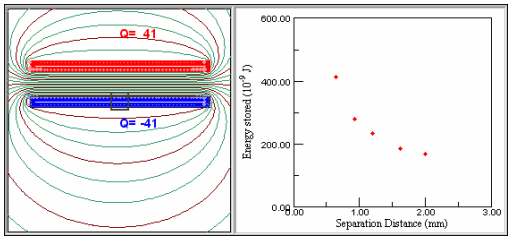
Worksheet for Exploration 26.1: Energy



Wait for the calculation to finish. As you move the bottom capacitor plate (and allow the applet to finish calculating after each move), the graph shows the stored energy as a function of separation distance between the plates **(position is given in millimeters, charge is given in nanocoulombs, and energy is given in nanojoules)**.

a. Given that the stored energy (the potential energy) is $Q\Delta V/2$, what is the voltage difference between the plates?
   i. Measure Q, stored energy, and calculate ΔV for several cases.

Q	Energy	ΔV

b. Does the voltage difference between the plates change?
   i. The answer to this should indicate whether, as the plates were moved, a battery was connected or not. Also this must be consistent with what happens to the amount of charge. Discuss.

c. How does the capacitance change as you move the plates?
   i. Be specific and consider what happens as the spacing is doubled or cut in half.

d. What is the area of the plates for this capacitor?
   i. You do not know how far into the page the plate extends. You should assume that the plate acts as a good parallel plate capacitor. Then you should determine the capacitance, and then A. Note the units given in the intro. paragraph.

e. Why does the charge change as you move the plates?

f. As you move the plates closer together, does the stored energy increase or decrease?

g. Does that mean you would need to do positive work to push the plates together or pull them apart? Explain.
   i. Think carefully about all the charges that you have. The two plates get closer together, but also consider what is happening on an individual plate.

h. Since potential energy $U = Q\Delta V/2$, if ΔV is kept constant, what is U (potential energy) as a function of the separation distance? Verify that this is the relationship shown on the plot.