Given a typical charged parallel-plate capacitor (with equal but opposite charges on the plates that do not vary during this exercise), what happens to the energy stored in it if the plates are pulled back to twice their original separation? If the energy changes, where does the difference come from/go to?

What did the question ask? What happens to the quantity of energy stored?

The amount of energy remains the same, but the energy density decreases since the volume is doubled. The energy doesn't change but the density does. The energy spreads out and takes up the space between the plates where there was no energy initially.

Always ask, what remains the same and what changes?

Using the equations for energy in a capacitor (U=1/2CV^2) and capacitance (C=EA/2d), where the plates were pulled back to twice their separation, it can be deduced that the energy is halved. The energy difference is due to the work done and is converted into potential energy.

A formula for capacitance is (permittivity of dielectric)(area)/(distance between plates). Using this formula, we can conclude that as distance increases, capacitance decreases. Capacitance will be half as much. The relationship between capacitance and energy stored is U = (1/2)CV^2. This means the energy stored will be half the original amount as well.

If the plates are pulled back twice their original separation, this will result in four times the energy. There is a quadratic relationship present here, so if it was pulled back 3 times the original length, then it would be 9 times the energy.

It's all about the energy needed to pull the plates apart

Work must be put in to separate the plates, since the field from the charges are trying to bring the plates closer to each other. If the plates were separated by double the original distance, then Delta V would double since Delta V is equal to Electric field times distance. Then, according to the equation Q(amount of charge)/Delta V(total potential difference)= Capacitance, the capacitance C would be halved. If C is halved, the equation Q^2/C= Stored Energy states that the stored energy will double. The energy is gained from an outside mechanical force, such as somebody's hands.

Capacitance is measured in farads, which is defined so that a 1 farad capacitor has ±1 Coulomb of charge on its plates when a potential difference of 1 Volts exists between them. In practice, typical capacitors are about a centimeter square and have capacitances of a few microfarads. If you wanted a 1 farad capacitor, about how big would if have to be? Compare your answer to the size of some familiar, tangible object.

Just about right!

A farad is 1,000,000 microfarads. A capacitor a cm^2 with a capacitance of ~2 microfarads is pretty small. For simplicity's sake, we will assume that farads and cm^2 are directly proportional. In this case, it is about the size of a garage, which is unlikely. Not knowing how one would calculate such things, I will assume that it is about the size of a small bag of chips from reading the textbook.

Another good response

If a typical capacitor is a centimeter squared that implies its mostly a flat structure
and if those capacitors are a few micro-farads, say 2 microfarads and I want a 1 farad capacitor
I would need one 500000 times larger than a 1 centimeter squared capacitors.
Thats like (700 cm)^2 which is like (7m)^2

thats roughly the size of a small classroom floor

Another good response

Assuming the Capacitor has a capacitance of 2 microfarads, we can cross multiply the capacitance and area we have with the capacitance we want and solve for the area. This looks as such:

2x10^-6 F/1cm^2 = 1F/x

2x10^-6 F * x cm^2 =1 F * cm^2

Dividing 1 F * cm^2 by 2x10^-6 F = 500000 cm^2.

Convert to m^2.

1 m^2 = 10000 cm^2.

500000/10000 = 50 m^2.

Therefore, the capacitor would have to be 50 square meters, or about the size of a small swimming pool.