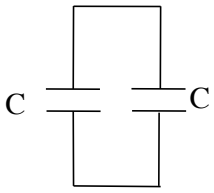
Problem 26.37

a.) Because the caps are at the same voltage, no charge flow will occur when the two are connected in parallel. The energy involved is:

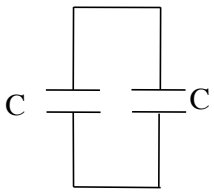


$$U = 2\left[\frac{1}{2}CV_C^{\,2}\right]$$
$$= 2\left(\frac{1}{2}\right)\left(10.0\text{x}10^{-6}\text{ F}\right)\left(50.0\text{ V}\right)^2$$
$$= 2.50\text{x}10^{-2}\text{ J}$$

b.) Doubling the plate distance will halve the capacitance. Additionally, the charge will redistribute until the voltage is again the same. Calling this new voltage V_{new} and noting that the *total* charge in the system hasn't changed, we can write:

$$Q_{initial} = 2CV_C \quad \text{and}$$
$$Q_{final} = CV_{new} + \frac{C}{2}V_{new} = \frac{3}{2}CV_{new}$$
$$\Rightarrow \quad 2\cancel{C}V_C = \frac{3}{2}\cancel{C}V_{new}$$
$$\Rightarrow \quad \frac{4}{3}V_C = V_{new}$$

Putting in the numbers yields:



$$V_{new} = \frac{4}{3}V_C$$
$$= \frac{4}{3}\left(50.0\text{ V}\right)$$
$$= 66.7\text{ V}$$

The new energy is:

$$U = \frac{1}{2}CV_{new}^{\,2} + \frac{1}{2}\left(\frac{C}{2}\right)V_{new}^{\,2}$$
$$= \frac{3}{4}CV_{new}^{\,2}$$
$$= \left(\frac{3}{4}\right)\left(10.0\text{x}10^{-6}\text{ F}\right)\left(66.67\text{ V}\right)^2$$
$$= 3.30\text{x}10^{-2}\text{ J}$$

c.) There is more energy in the system afterward. Where did it come from? It came from the work required to physically pull the plates apart.