373.

Problem 31.35 (RHK)

One capacitor is charged until its stored energy is 4.0J, *the charging battery is then being removed. A second uncharged capacitor is then connected to it in parallel.* (a) *If the charge distributes equally, we have to find now the total energy stored in the electric fields.* (b) *We have to answer where the excess energy has gone to.*

Solution:

(a)

Let the capacitance of the capacitor be C. By connecting it to a battery it is charged to potential *V*. From the definition of capacitance we know that the charge on the capacitor will be

$q = CV$.

Electric energy in a capacitor charge to potential V is

$U = \frac{1}{2} CV^2$.

It is given that

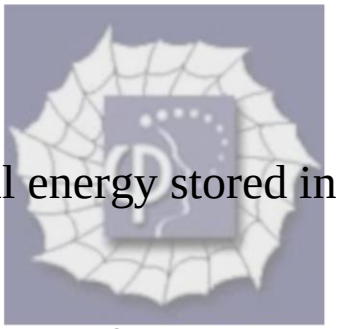
$U = 4.0$ J.

Therefore,

$CV^2 = 8.0$ J.

A second capacitor is connected in parallel to the capacitor after it has been disconnected from the charging battery and it is given that the charge distributes itself equally on the two capacitors. Therefore, the capacitance of the second capacitor should also be *C*. Then the potential difference across each of the two capacitors will be

$$V' = \frac{q}{2C} = \frac{V}{2}.$$



Therefore, the total energy stored in the electric fields will be

$$U' = 2 \times \left(\frac{1}{2} C V'^2 \right) = C \frac{V^2}{4} = 2.0 \text{ J}.$$

(b)

Therefore, 2.0 J of energy has disappeared as heat and some of it might have been radiated away.