83. (Second problem of **Cluster**)

(a) The change (from the previous problem) is that the initial charge (before switch S is closed) is $Q + Q'$ where Q is as before but $Q' = C_2(10\text{ V}) = 600\,\mu\text{C}$. We assume the polarities of these capacitor charges are the same. With this modification, we follow steps similar to those in the previous solution:

$$\begin{aligned} Q + Q' &= q_1 + q_2 \\ &= q_1 + \left(\frac{3}{4}\, q_1\right) \end{aligned}$$

which yields $q_1 = 571\,\mu\text{C}$.

(b) The relation $\frac{3}{4}q_1 = q_2$ gives the result $q_2 = 429\,\mu\text{C}$.

(c) We apply Eq. 27-1: $V_1 = q_1/C_1 = 14.3$ V.

(d) Similarly, $V_2 = q_2/C_2 = 14.3$ V.

(e) The initial energy now includes $\frac{1}{2}C_2(20\text{ V})^2$ in addition to the $\frac{1}{2}C_1V_{\text{bat}}^2$ computed in the previous case. Thus, the total initial energy is 8.00×10^{-3} J. And the final stored energy is $\frac{1}{2}C_1V_1^2+\frac{1}{2}C_2V_2^2 = 7.14\times10^{-3}$ J. The *decrease* is therefore 8.6×10^{-4} J, as it was in the previous problem.