Chapter 6, Solution 24.

Assume that all the capacitors were initially uncharged and that the 90 volt source starts at zero and gradually increases to 90 volts. What are the final voltages across each capacitor and the energy stored in each capacitor.

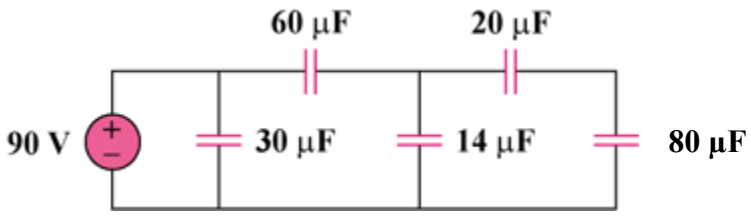

Figure 6.58
For Prob. 6.24.

Solution

20μF is series with 80μF = 20x80/(100) = 16μF
14μF is parallel with 16μF = 30μF

(a) $v_{30\mu F} = \mathbf{90V}$

$v_{60\mu F} = \mathbf{30V}$

$v_{14\mu F} = \mathbf{60V}$

$$v_{20\mu F} = \frac{80}{20+80} x60 = \mathbf{48V}$$

$v_{80\mu F} = 60 - 48 = \mathbf{12V}$

(b) Since $w = \frac{1}{2}Cv^2$

$w_{30\mu F} = 1/2 \times 30 \times 10^{-6} \times 8100 = \mathbf{121.5mJ}$

$w_{60\mu F} = 1/2 \times 60 \times 10^{-6} \times 900 = \mathbf{27mJ}$

$w_{14\mu F} = 1/2 \times 14 \times 10^{-6} \times 3600 = \mathbf{25.2mJ}$

$w_{20\mu F} = 1/2 \times 20 \times 10^{-6} \times (48)^2 = \mathbf{23.04mJ}$

$w_{80\mu F} = 1/2 \times 80 \times 10^{-6} \times 144 = \mathbf{5.76mJ}$