Chapter 6, Solution 23.

Using Fig. 6.57, design a problem to help other students better understand how capacitors work together when connected in series and parallel.

Although there are many ways to work this problem, this is an example based on the same kind of problem asked in the third edition.

Problem

   For the circuit in Fig. 6.57, determine:

   (a) the voltage across each capacitor,
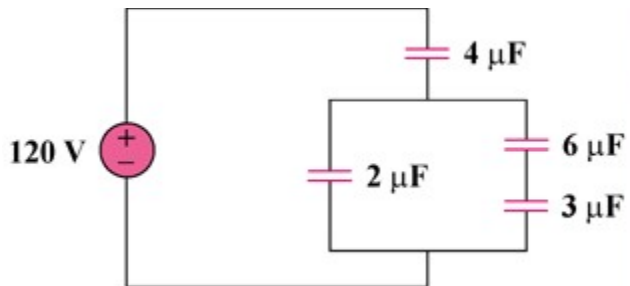   (b) the energy stored in each capacitor.

   Figure 6.57

Solution

   (a) $3\mu F$ is in series with $6\mu F$ $3\times6/(9) = 2\mu F$
         $V_{4\mu F} = 1/2 \times 120 = \mathbf{60V}$
         $V_{2\mu F} = \mathbf{60V}$
         $V_{6\mu F} = \dfrac{3}{6+3}(60) = \mathbf{20V}$
         $V_{3\mu F} = 60 - 20 = \mathbf{40V}$

   (b)   Hence w = $1/2\ Cv^2$
         $W_{4\mu F} = 1/2 \times 4 \times 10^{-6} \times 3600 = \mathbf{7.2mJ}$
         $W_{2\mu F} = 1/2 \times 2 \times 10^{-6} \times 3600 = \mathbf{3.6mJ}$
         $W_{6\mu F} = 1/2 \times 6 \times 10^{-6} \times 400 = \mathbf{1.2mJ}$
         $W_{3\mu F} = 1/2 \times 3 \times 10^{-6} \times 1600 = \mathbf{2.4mJ}$