Chapter 6, Solution 32.

In the circuit in Fig. 6.64, let $i_s = 50e^{-2t}$ mA and $v_1(0) = 50$ V, $v_2(0) = 20$ V. Determine: (a) $v_1(t)$ and $v_2(t)$, (b) the energy in each capacitor at $t = 0.5$ s.

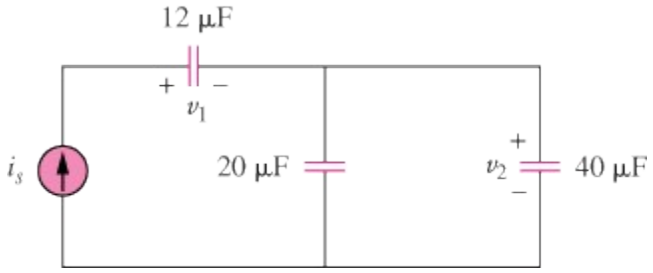

Figure 6.64
For Prob. 6.32.

Solution

(a) $C_{eq} = (12x60)/72 = 10\ \mu$F

$$v_1 = \frac{10^{-3}}{12x10^{-6}}\int_0^t 50e^{-2t}dt + v_1(0) = \underline{-2083e^{-2t}\Big|_0^t + 50} = \underline{-2083e^{-2t} + 2133V}$$

$$v_2 = \frac{10^{-3}}{60x10^{-6}}\int_0^t 50e^{-2t}dt + v_2(0) = \underline{-416.7e^{-2t}\Big|_0^t + 20} = \underline{-416.7e^{-2t} + 436.7V}$$

(b) At t=0.5s,

$$v_1 = -2083e^{-1} + 2133 = 1366.7, \qquad v_2 = -416.7e^{-1} + 436.7 = 283.4$$

$$w_{12\mu F} = \frac{1}{2}x12x10^{-6}x(1366.7)^2 = \underline{11.207\ \text{J}}$$

$$w_{20\mu F} = \frac{1}{2}x20x10^{-6}x(283.4)^2 = \underline{803.2\ \text{mJ}}$$

$$w_{40\mu F} = \frac{1}{2}x40x10^{-6}x(283.4)^2 = \underline{1.6063\ \text{J}}$$