Chapter 7, Solution 21.

In the circuit in Fig. 7.101, find the value of *R* for which the steady-state energy stored in the inductor will be 1 J.

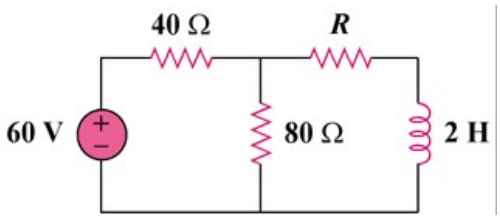
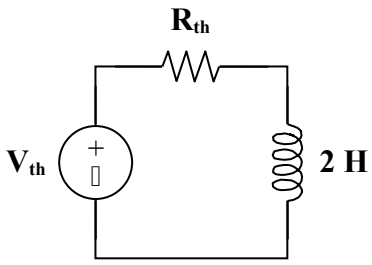


Figure 7.101
For Prob. 7.21.

Solution

The circuit can be replaced by its Thevenin equivalent shown below.



$$V_{th} = \frac{80}{80+40}(60) = 40\ \text{V}$$

$$R_{th} = 40 \,\|\, 80 + R = \frac{80}{3} + R$$

$$I = i(0) = i(\infty) = \frac{V_{th}}{R_{th}} = \frac{40}{80/3 + R}$$

$$w = \frac{1}{2} L I^2 = \frac{1}{2}(2)\left(\frac{40}{R + 80/3}\right)^2 = 1$$

$$\frac{40}{R + 80/3} = 1 \longrightarrow R = \frac{40}{3}$$

$$R = \mathbf{13.333\ \Omega}$$