6.41 If the total energy stored in the circuit in Fig. P6.41 is 80 mJ, what is the value of L?

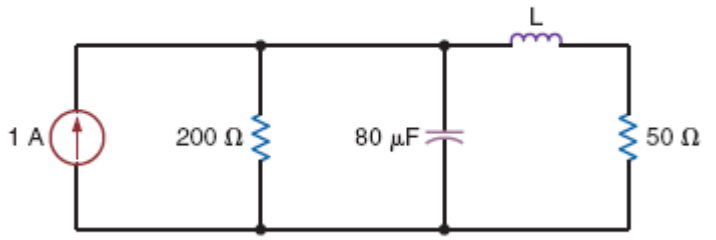
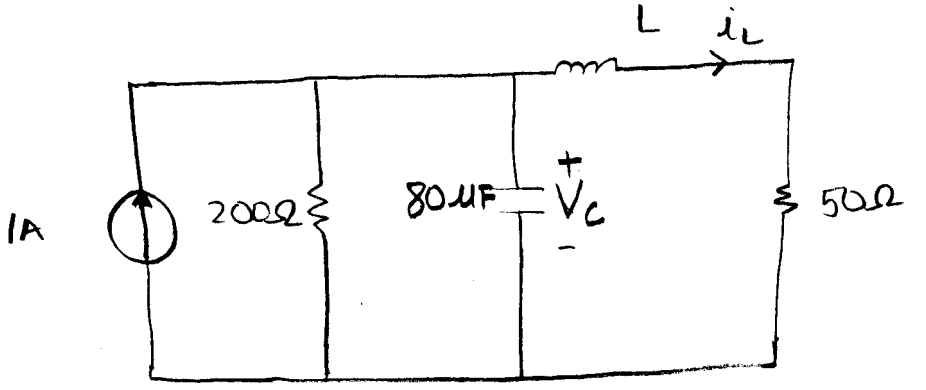


Figure P6.41

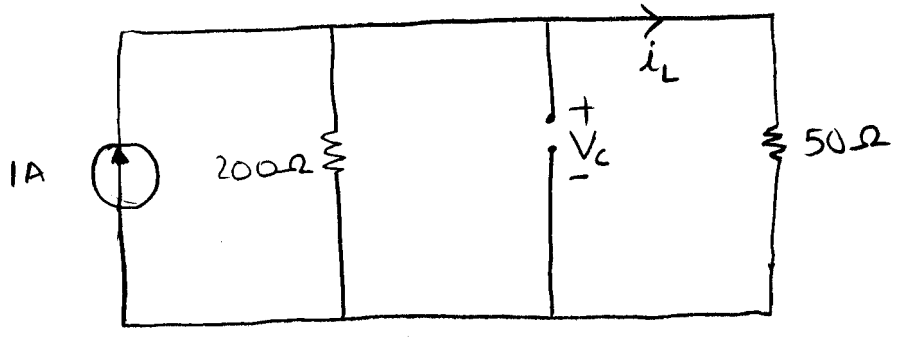
SOLUTION:



$$i_C = C\frac{dv_C}{dt} = 0 \text{ , } V_C \text{ is a constant}$$

$$V_L = L\frac{di_L}{dt} = 0, \quad i_L \text{ is a constant}$$

Redraw the circuit as:



$$R_{eq} = 200 \| 50 = \frac{200(50)}{200+50}$$

$$R_{eq} = 40\Omega$$

$$V_C = (1)(40) \qquad V_C = 40V$$

$$W_C = \frac{1}{2} C V_C^2$$

$$W_C = \frac{1}{2}(80\mu)(40)^2$$

$$W_C = 64mJ$$

$$i_L = \left(\frac{200}{200+50}\right)(1)$$

$$i_L = 0.8A$$

$$W_L = \frac{1}{2} L i_L^2$$

$$L = \frac{2W_L}{i_L^2}$$

$$W_{total} = W_L + W_C$$

$$W_L = 80m - 64m$$

$$W_L = 16mH$$

$$L = \frac{2(16m)}{(0.8)^2}$$

$$L = 50mH$$