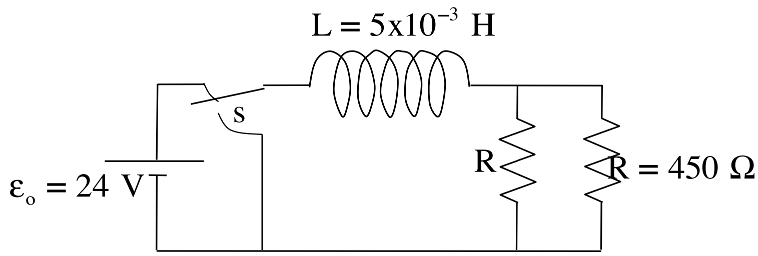
Problem 32.17

a.) With the switch as positioned, what R will give a time constant of 15 microseconds?

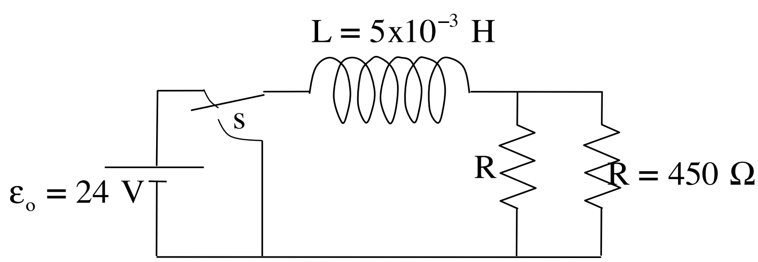


Remembering how to generate the equivalent resistance of a parallel combination of resistors, we can write:

$$\tau = \frac{L}{R_{equ}}$$

$$\Rightarrow \quad \left(15x10^{-6}\ s\right) = \frac{\left(5x10^{-3}\ H\right)}{\left(\frac{1}{R} + \frac{1}{450}\right)^{-1}}$$

$$\Rightarrow \quad R = 1286\ \Omega$$



b.) After a long period of time, there will be no changing current, hence no induced EMF across the inductor, hence there will be a steady-state current through the inductor and the resistors. As there is no induced EMF across the inductor, it will not be a player in impeding current flow and the net current will be:

$$i = \frac{\varepsilon_{battery}}{R_{equ}}$$

$$= \frac{(24\ V)}{\left(\frac{1}{1286} + \frac{1}{450}\right)^{-1}}$$

$$= .072\ A$$

Just after the switch is flipped, the inductor will fight any change in the system's current (that what inductors do), which means the current through the inductor at that point will STILL BE .072 amps.