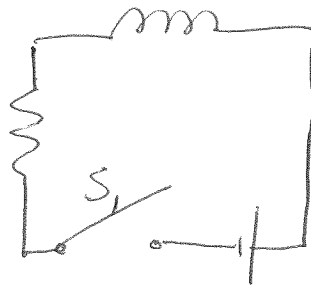


Ch. 14 Prob. 55



How long does it take the current to reach half the max value

for a ~~change~~ build up of current in an inductor

$$I = I_0(1 - e^{-t/\tau}) \quad \text{where } \tau = \frac{L}{R}$$

at half max value $I = \frac{I_0}{2}$, therefore,

$$\frac{I_0}{2} = I_0(1 - e^{-t/\tau})$$

$$\frac{I_0}{2} = I_0 - I_0 e^{-t/\tau}$$

$$I_0 e^{-t/\tau} = I_0 - \frac{I_0}{2} = \frac{I_0}{2}$$

$$e^{-t/\tau} = \frac{I_0}{2} \frac{1}{I_0} = \frac{1}{2}$$

$$\ln(e^{-t/\tau}) = \ln\left(\frac{1}{2}\right)$$

$$-\frac{t}{\tau} = -\ln(2)$$

$$\therefore t = \tau \ln(2) \quad \text{or}$$

$$t = \tau(0.69)$$

$$t = \frac{L}{R} \ln(2)$$