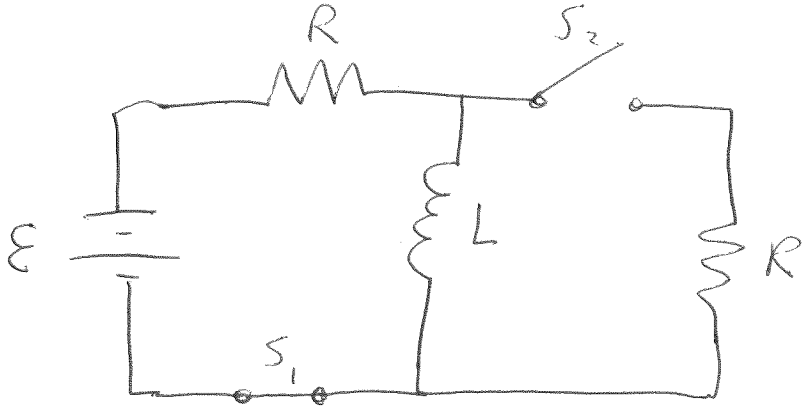
Ch. 14 Prob. 53

$\mathcal{E} = 20V$

$L = 4.0 mH$

$R = 5.0\Omega$



At $t=0$, S_1 is opened + S_2 is closed.

a) find current at $t=0$

Model for the $\frac{L}{R}$ circuit is $I = I_0 e^{-t/\tau}$ where $\tau = \frac{L}{R}$

$$I_0 = \frac{\mathcal{E}}{R} = \frac{20V}{5.0\Omega} = \boxed{4.0A}$$

b) Find the current at $t = 4.0\times10^{-4}s$

$$\tau = \frac{L}{R} = \frac{4.0\times10^{-3}H}{5.0\Omega} = 8\times10^{-4}s$$

$$I = I_0 e^{-t/\tau} = (4.0A)e^{-4.0\times10^{-4}s/8\times10^{-4}s} = (4.0A)e^{-0.5}$$

$$= \boxed{2.43A}$$

c) Find the voltage across L + R at $t = 4.0\times10^{-4}s$

since $I = 2.43A$, Then $V_R = I \cdot R = (2.43A)(5.0\Omega)$

$$\boxed{V_R = 12.15V}$$

By Kirchoff's Law the same voltage with opposite sign must drop across the inductor so

$$\boxed{V_L = 12.15V}$$

Textbook answer is wrong.