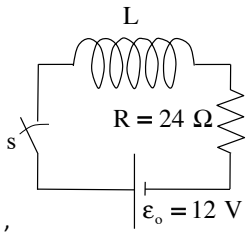
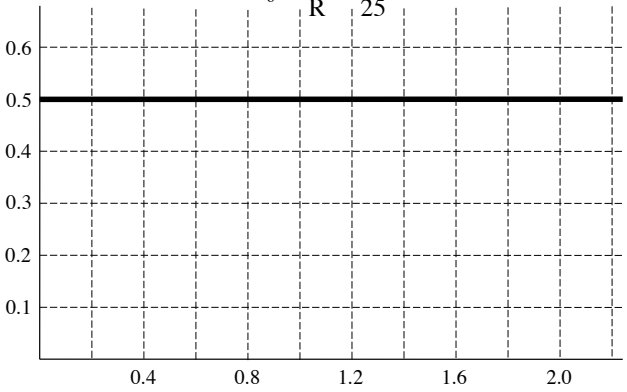
Problem 32.16

If the switch is thrown at t = 0, what does the *current versus time* graph look like for:



a.) L = 0 (i.e., the circuit with only the resistor in it)?

In this case, the current will jump to its maximum value essentially immediately. As $i_o = \frac{\varepsilon_o}{R} = \frac{12}{25} = .5A$, we get:



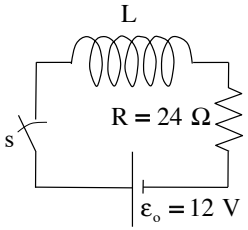
1.)

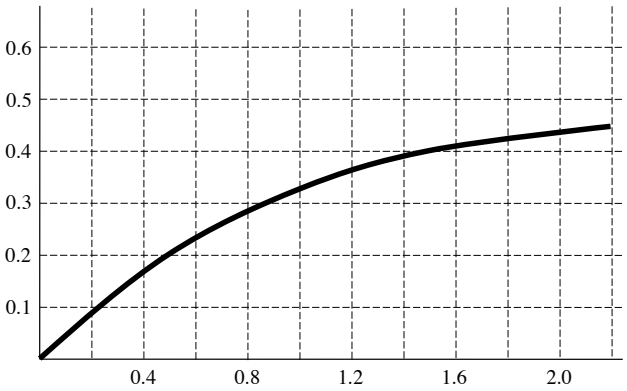
With inductance in the circuit:

$$i(t) = i_o\left(1 - e^{-t/\tau}\right) = i_o\left(1 - e^{-t(R/L)}\right)$$

b.) L = small (i.e., small time constant, say "1" for example):

$$i(t) = \frac{\varepsilon}{R}\left(1 - e^{-t/1}\right) = .5\left(1 - e^{-t}\right)$$





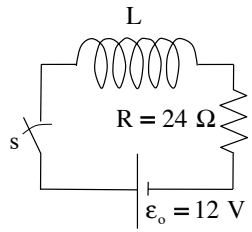
2.)

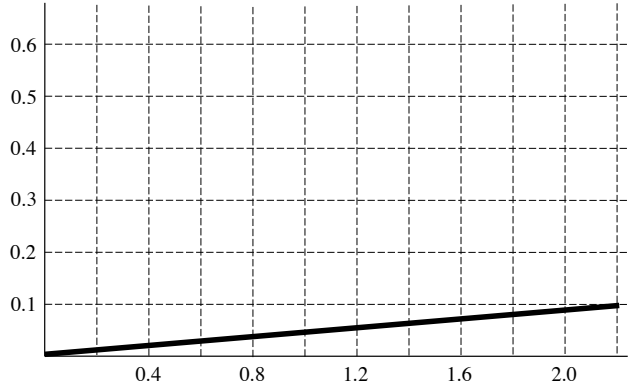
With inductance in the circuit:

$$i(t) = i_o\left(1 - e^{-t/\tau}\right) = i_o\left(1 - e^{-t(R/L)}\right)$$

b.) L = large (i.e., longer time constant, say "10" for example):

$$i(t) = \frac{\varepsilon}{R}\left(1 - e^{-t/10}\right) = .5\left(1 - e^{-.1t}\right)$$





3.)