Inductors

4. The circuit below had been energized since before dinosaurs roamed the earth. At some later point in time however, a 50-ton titanosaur Argentinosaurus huinculensis steps on the 2mA current source, instantaneously removing it from the circuit at time $t = 0$.

(a) What is the value of I_L at time t_{0-}? (t_{0^-} is 'just before the current source gets stepped on.')

(b) What is the value of I_R at time t_{0-}?

(c) What is the value of V_L at time t_{0-}?

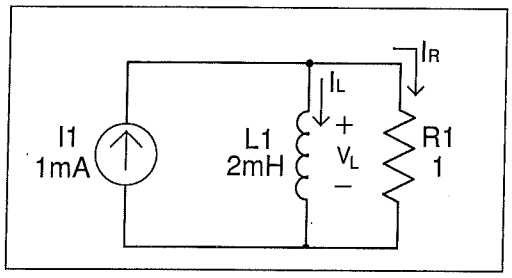
(d) What is the value of I_L at time t_{0+}? (current source has 'just been removed')

(e) What is the value of I_R at time t_{0+}?

(f) What is the value of V_L at time t_{0+}?

(g) What is the value of I_L at time $t = \infty$?

(h) What is the value of I_{R1} at time $t = \infty$?



a. I_L @ $t=t_{0^-}$ is 1mA, All the current is flowing through the DC short circuit provided by L1.

b. I_R @ $t=t_{0^-}$ is zero, See (a)

c. Since L1 is A DC short circuit, $V_L = 0$

d. Since current cannot change instantaneously through L1, At $t=t_{0^+}$ it continues to flow through L1 As before. (1mA)

e. I_R @ t_{0^+} will be -1mA. Current flows out of bottom of L1 And into bottom of R1.

f. @ $t=t_{0^+}$, $V_L = V_{R1} = -0.001V$. See (e)

g. @ $t=\infty$, the inductor will have dissipated All its stored energy in R1, thus $I_L = 0$ @ $t=\infty$.

h. I_{R1} @ $t=\infty$ will be zero. See (g)