1) $\mathfrak{I} = \Phi\mathfrak{R}$

2)
a) needed 2 sources (NI & P.Mag), and 3 reluctances (at least, bar, PM, and sides either separately or as one)
b) .608mWb; either needed to use the total gap area ($12 \times 10^{-4} m^2$) or half the Mg
c) Yes, since at .608 mWb the total HI drop is 390A-t and the P.M. will provide 500
d) there are 110 A-t too much mmf from the P.M., so the coil needs to "add" -110A-t; and since n = 100; I = -1.1A
e) 15.6 mH – could be found using either $L = N^2/\mathfrak{R}$ (preferred), or $L = N\Phi/I$, but using only the flux that the coil "produces" (a "negative" .172mWb).

3) .117ms

4) 100 turns (usually don't have a non-integer number of turns)

5)
a) $v_L = 0V$ (@ steady state, current is not changing, so no voltage across an inductor!)
$i_L = +75.2mA$ (10V/133Ω in the direction indicated, so positive)
b) .848 mJ ($.5LI^2$)

If you did this right with the wrong current from a), I'll give you the mark)

c) $\tau = 9.73ms$ ($L = .3H$, $R_{Th} = 30.835\Omega$)
d) -25.5mA (either E_{Th}/R_{Th} or simply 12V/470Ω(preferred), but in the direction *opposite* to that shown, so *negative*. This did not have to depend on previous answers!)
e) $i_L = (-25.5 + 100.7e^{-168t})mA$

The 1mark for the graph was based only on it matching your equation (right or wrong).
If you *only* had the current(s) wrong or the time constant wrong from a), d), or c) above, and did everything else right, I'll give you the other 2 marks for this question. BUT, not recognizing that the *final* current was in the *opposite* direction to the *initial* current is considered a separate error and will cost you *at least* 1 of those marks.

f) $v_L = (-3.1e^{-105t})V$

Again, the 1mark for the graph was based only on it matching your equation (right or wrong).
If you *only* had the time constant wrong from c) above and/or the final current from d) wrong, and did everything else right, I'll give you the other 2 marks. You *did* need E_{Th} and R_{Th} here, and making a mistake on that will cost you *at least* a mark. Otherwise the calculation of the initial voltage after the switches changed was independent of previous answers.

g) $t = 13.4ms$

If you *only* had the time constant wrong from c) above and/or the current(s) from a), d) wrong, and did everything else right, I'll give you full marks PROVIDED that your conclusion logically followed the data you worked with. E.g. if your equation and graph were such that the current was *never* zero, you shouldn't have given any time as an answer. Of course if your data should have had a zero-crossing time, it must be calculated correctly to get full marks. However, if your data suggested that i_L would never be zero, and you simply stated that, expect a 1 mark penalty to account for no calculation work.

6) iii) 3.8×10^{-4}

7)
a) right
b) 1.1T
c) 22.2A up
d) .17Ω
e) 27.8V
f) generator
g) 1667.7W (= Mg X vel)
h) 532.8W (to charge the battery)
i) 31.9%

8) iii) 100V
9) i) 1N