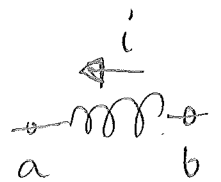
WHW15 solutions

29.36 a) $j_D = \frac{i}{A} = \frac{0.28\text{ A}}{\pi (0.04\text{ m})^2} = 55.7\text{ A/m}^2$.

b) $j_D = \varepsilon_0 \frac{dE}{dt}$ so $\frac{dE}{dt} = 6.3\times 10^{12}$ V/m·s

c) $\oint \vec{B}\cdot d\vec{l} = \mu_0 \varepsilon_0 \frac{dE}{dt} = \mu_0 j_D A = \mu_0 j_D \pi r^2$

$B \cdot 2\pi r = \mu_0 j_D \pi r^2 \quad B = \frac{\mu_0 j_D r}{2} = 7\times 10^{-7}$ T.

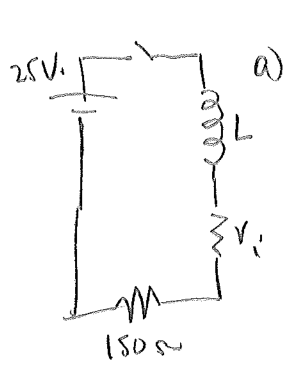
30.10) a) 

$V_a > V_b$.

looks like:  so current must be decreasing.

b) $V = 1.04\text{V} = L\frac{di}{dt}$ with $L = 0.26$ H, $\left|\frac{di}{dt}\right| = 4$ A/s.

Current after 2 seconds $= 12\text{ A} - 4\cdot 2\text{ A} = 4\text{ A}$.

30.60) 

a) Since $i(0) = 0$, inductor opposes change, V_L starts high → ends low. Graph must be V_R.

b) $r_i = 0$ as $V(\infty) = 25$ V. If $r_i \neq 0$, there would be a ΔV across r_i.

$V_R = V_{max}(1 - e^{-t/\tau})$ At $t = \tau$, $V_R \approx 0.63 V_{max} = 16$ V.

so $\tau = 0.5$ ms $= L/R = L/150\,\Omega$ $L = 0.075$ H.

c)