#5 Physics 2220 SP 2000 FINAL P5

a) $J = \frac{I}{A} = \frac{I_0}{\pi R_0^2}$ +10

$J = \frac{I}{V} = \frac{I_0}{\pi R_0^2 \ell}$ -4 for dividing by ℓ

-2 for $J = \frac{I_0}{2\pi R_0^2}$

b) $\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{in}$ $\frac{B 2\pi R_0}{3} = \mu_0 \pi R_0^2 J = \frac{\mu_0 \pi R_0^2 I_0}{9 \pi R_0^2}$

$B = \frac{\mu_0 I_0 3}{9 \cdot 2\pi \cdot R_0} = \frac{\mu_0 I}{6\pi R_0}$ +10

calculating I_{enc} wrong -7

not squaring 3 -2

the amperian loop having a different value $\Rightarrow \frac{R_0}{3}$ -6

not doing $\oint B \cdot d\vec{l}$ -7

c) $B = \frac{\mu_0 I_0}{2\pi r}$ outside using $B = \frac{\mu_0 I}{6\pi R_0}$ -10

$u = \int \frac{1}{2\mu_0} B^2 dV = \int_{R_0}^{3R_0} \frac{\mu_0^2 I_0^2}{4\pi^2 r^2 \mu_0} \ell 2\pi r \, dr = \frac{\mu_0 I_0^2 \ell}{4\pi} \int_{R_0}^{3R_0} \frac{1}{r} dr = \frac{\mu_0 I_0^2 \ell}{4\pi} \ln 3$

$\frac{u}{\ell} = \frac{\mu_0 I_0^2}{4\pi} \ln 3$ +10 different r's -6

forgetting to take B^2 -5