



for $r > R$

$$B(r) = 0$$

for $r < R$

$$\mu_0 I(r) = B 2\pi r$$

$$I(r) = j \pi r^2 = \frac{I}{\pi R^2} \pi r^2 = I \frac{r^2}{R^2}$$

$$\mu_0 I \frac{r^2}{R^2} = B 2\pi r$$

$$B(r) = \frac{\mu_0 I r}{2\pi R^2}$$

$$P = \int_V \frac{B^2(r)}{2\mu_0} dV = \frac{\mu_0 I^2}{8\pi^2 R^4} \int_0^R \int_0^{2\pi} \int_0^h r^3 dz d\phi dr = \frac{\mu_0 I^2 h}{768\pi}$$

$$\frac{P}{h} = \frac{\mu_0 I^2}{768\pi} = \frac{\frac{1}{2} L I^2}{h} \Rightarrow \frac{L}{h} = \frac{\mu_0}{8\pi}$$