(1) Q in $a<z<b$ e^- :

$$Q = q + \int \rho \, dV = q + \int_a^z \frac{A}{z} 4\pi r^2 \cdot dz =$$

$$= q + 4\pi A \left. \frac{r^2}{2} \right|_a^z = q + 2\pi A (r^2 - a^2)$$

Per la simmetria centrale ed il teorema di Gauss:

$$\Phi_E = E_r \cdot 4\pi r^2 = \frac{1}{\varepsilon_0} [q + 2\pi A (r^2 - a^2)]$$

$$E_r = \frac{1}{4\pi\varepsilon_0} \left[\frac{q}{r^2} + 2\pi A \left(1 - \frac{a^2}{r^2}\right) \right]$$

$$\frac{dE_r}{dr} = 0 \iff -2q r^{-3} + 4\pi A a^2 r^{-3} = 0$$

$$A = \frac{q}{2\pi a^2} \Rightarrow E_r = \frac{q}{4\pi\varepsilon_0 a^2}$$

(2)

Legge di Ampere $\qquad 2\pi a H = I$

$$H = \frac{I}{2\pi a}$$

$$\vec{J}_{ms} = \vec{M} \times \hat{n}$$

$$J_{ms} = M = \chi_m H = (\mu_2 - 1)\frac{I}{2\pi a} \simeq 30 \frac{A}{m}$$

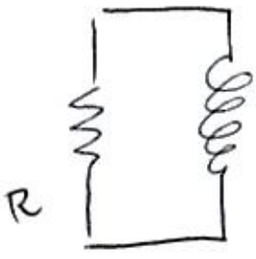
$$\chi_m \frac{B}{\mu_0 \mu_2} = \frac{(\mu_2 - 1)}{\mu_0 \mu_2}$$

(3)

$t < 0$

$$I_0 = \frac{f}{3R}$$

$t > 0$



$$L = \mu_0 \frac{N^2 S}{e}$$

$$U_R = \frac{1}{2} L I_0^2 = \frac{\pi}{2} \frac{N^2 a^2}{e} \frac{f^2}{9R^2} \mu_0$$

(4)

S → solenoide infinito

$$B = \mu_0 n i$$

$$\Phi_c = \pi \frac{d_c^2}{4} B = \pi \frac{d_c^2}{4} \mu_0 n i$$

$$|f.e.m.| = \frac{d\Phi}{dt} = N \frac{\Delta\Phi}{\Delta t} = \mu_0 n \pi N \frac{d_c^2}{4} \frac{\Delta i}{\Delta t}$$

$$\simeq 15\ mV$$

(5)

$$\Delta S = \Omega R^2$$

$$\bar{I} = \frac{P}{\Delta S} = \frac{P}{\Omega R^2} = 10 \frac{W}{m^2}$$

$$\bar{I} = \frac{1}{2} \frac{E_M^2}{Z_0} \Rightarrow E_M = \sqrt{2 Z_0 \bar{I}} \simeq 87 \frac{V}{m}$$

$$H = \frac{E_M}{Z_0} \simeq 0{,}23 \frac{A}{m}$$