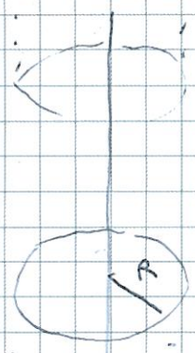
SOLUZIONI del 16/09/2016

$$\oint \vec{E}\cdot d\vec{S} = \frac{Q_{int}}{\varepsilon_0}$$

① per $r \le R$



$$E\,2\pi r \ell = \frac{\alpha \int_0^r r \cdot 2\pi r \ell \, dr}{\varepsilon_0} = \frac{\alpha}{\varepsilon_0}\frac{r^3}{3}$$

$$\Rightarrow E(r \le R) = \frac{\alpha}{3\varepsilon_0} r^2$$

per $r \ge R$

$$E\,2\pi r \ell = \frac{\alpha \int_0^R r\, 2\pi r \ell \, dr}{\varepsilon_0} = \frac{\alpha}{\varepsilon_0}\frac{R^3}{3}$$

$$\Rightarrow E(r \ge R) = \frac{\alpha}{3\varepsilon_0} R^3 \frac{1}{r}$$

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② $$\oint \vec{B}\cdot d\vec{\ell} = \mu_0 I_{conc}$$

per $r \le R$

$$B\,2\pi r = \mu_0 \int_{S_\ell} \vec{J}\cdot d\vec{S} = \mu_0 \int_0^r (\beta r)\, 2\pi r \, dr = \mu_0 \beta \frac{r^3}{3}$$

$$\Rightarrow B(r \le R) = \frac{\mu_0 \beta}{3} r^2$$

per $r \ge R$

$$B\,2\pi r = \mu_0 \int_0^R (\beta r)\, 2\pi r \, dr = \mu_0 \beta \frac{R^3}{3}$$

$$\Rightarrow B(r \ge R) = \frac{\mu_0 \beta}{3} R^3 \frac{1}{r}$$

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③ Il campo elettrico all'interno del mezzo 1,2 è $E_1 = \frac{\sigma}{\varepsilon_1}$, $E_2 = \frac{\sigma}{\varepsilon_2}$

$$\Rightarrow \Delta V_1 = \frac{\sigma}{\varepsilon_1} d_1 \quad \text{e} \quad \Delta V_2 = \frac{\sigma}{\varepsilon_2} d_2$$

$$\Rightarrow C = \frac{Q}{\Delta V} = \frac{Q}{\Delta V_1 + \Delta V_2} = \frac{\sigma S}{\sigma\left(\frac{d_1}{\varepsilon_1} + \frac{d_2}{\varepsilon_2}\right)} = \frac{S}{\frac{d_1}{\varepsilon_1} + \frac{d_2}{\varepsilon_2}}$$

④ $f.e.m. = -\frac{d\phi}{dt} \Rightarrow \frac{dQ}{dt} = I = \frac{f.e.m.}{R} = -\frac{1}{R}\frac{d\phi}{dt}$

$\Rightarrow \Delta Q = -\frac{1}{R}\Delta\phi \qquad \Delta\phi = \phi_{final} - \phi_{inicial} = -BSN - (BSN) =$

$= -2BSN$

$\Rightarrow \Delta Q = \frac{2BSN}{R} \Rightarrow B = \frac{R\,\Delta Q}{2SN} = \frac{(40\,\Omega)(4{,}5\cdot10^{-6}\,C)}{2(3\cdot10^{-6}\,m^2)60} = 0{,}5\,T$