SVOLGIMENTO DELLA PROVA 4/7/2017 (A)

2) $R, Q \quad \rho = cr^2$

$$Q = c\,4\pi \int_0^R r^4\,dr = \frac{4\pi c}{5} R^5$$

$$c = \frac{5Q}{4\pi R^5} \; ; \; E_{INT} = \frac{1}{4\pi\varepsilon_0}\frac{5Q}{4\pi R^5}\frac{r^5}{5}4\pi = \frac{Q}{4\pi\varepsilon_0}\frac{r^3}{R^5}$$

$$U = \frac{\varepsilon_0}{2}\frac{Q^2}{16\pi^2\varepsilon_0^2}\frac{1}{R^{10}}4\pi\int_0^R r^8\,dr + \frac{\varepsilon_0}{2}\frac{Q^2}{16\pi^2\varepsilon_0^2}4\pi\int_R^\infty \frac{dr}{r^2}$$

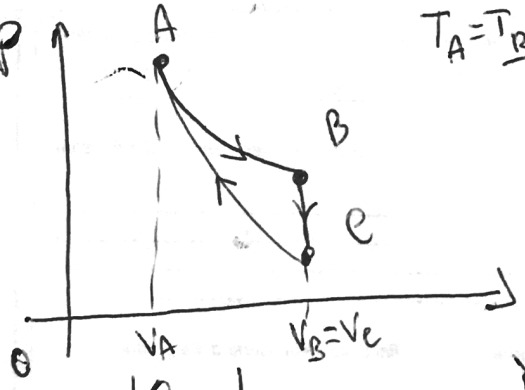
$$= \frac{Q^2}{8\pi\varepsilon_0}\frac{1}{R}\left(\frac{1}{9}+1\right) = \frac{5}{9}\frac{Q^2}{8\pi\varepsilon_0}\frac{1}{R} = \frac{5Q^2}{36\pi\varepsilon_0 R}$$

$\sim 2\cdot 10^{-13}$ J

$\downarrow$

1,25 MeV

1)



$T_A = T_B = T \qquad T_C = T/2$

$TV^{\gamma-1} = \text{costante}$

$$\eta = 1 - \frac{|Q_{CED}|}{|Q_{ASS}|} = 1 - \frac{nC_v(T_B - T_C)}{nRT\ln(V_B/V_A)} = 1 - \frac{C_v}{R}\frac{1/2}{\ln(V_B/V_A)}$$

$$\frac{V_B}{V_A} = \frac{V_C}{V_A} \qquad T_C V_C^{\gamma-1} = T_A V_A^{\gamma-1} \qquad \frac{V_C}{V_A} = \left(\frac{T_A}{T_C}\right)^{\frac{1}{\gamma-1}} = 2^{\frac{1}{\gamma-1}}$$

$$\eta = 1 - \frac{C_v}{R}\frac{1}{2}\frac{1}{\frac{1}{\gamma-1}\ln 2} = 1 - \frac{C_v}{R}\frac{\gamma-1}{2\ln 2}$$

gas monoatomico $C_v = \frac{3}{2}R \qquad \gamma = 5/3$

$$\eta = 1 - \frac{3}{2}\frac{\frac{5}{3}-1}{2\ln 2} = 1 - \frac{1}{2\ln 2} = 0{,}28 \rightarrow 28\,\%$$

$$\Delta S_{AB} = \int_A^B \frac{dQ}{T} = \frac{1}{T}\int_A^B dL = \frac{1}{T}nRT\ln\frac{V_B}{V_A} =$$

$= nR \frac{1}{\gamma-1} \ln 2 = nR \frac{1}{\frac{5}{3}-1} \ln 2 =$ (B)

$= nR \frac{3}{2} \ln 2 \rightarrow \Delta S_{AB} = 3R \ln 2 = 17{,}28$ J/on

---

8) $R = \rho \frac{l}{S'} = 4{,}2 \cdot 10^{-6} \cdot V = RI \quad I = \frac{V S'}{\rho l} = 2{,}38 \cdot 10^{6}$ A

$P = VI = V^2/R$; $U = \int_0^{\text{tutto}} P\,dt = P\Delta t$.

(energia dissipata)

$U = \frac{V^2 S'}{\rho l} \Delta t = 2{,}38 \cdot 10^{8}$ J

---

5) $|\vec{B}| = \mu_0 \frac{N}{l} I \qquad \Phi = \frac{\mu_0 N I}{l} N \pi R^2$

$f_{em}(t) = -\frac{d}{dt}\Phi = -\frac{\mu_0 N^2 \pi R^2}{l} \dot{I} = -\frac{\mu_0 N^2 \pi R^2}{l} 2\pi t$

$f_{em}(t=10s) = -6{,}31 \cdot 10^{-3}$ V (le polarità è tale da opporsi all'aumento della corrente)

$L = \Phi/I = \frac{\mu_0 N^2 \pi R^2}{l}$ (coefficiente autoinduzione) $\rightarrow 6{,}32 \cdot 10^{-5}$ H

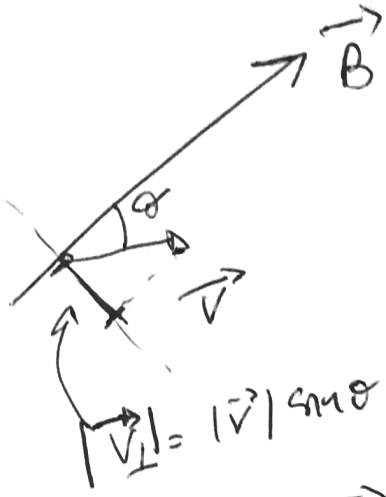
$L_f = \frac{\mu_0 N^2 \pi R^2}{\frac{80}{25} l} = \frac{5}{6} L$

$\Delta L_\% = \frac{|L_f - L|}{L} \cdot 10^2 = \left(1 - \frac{5}{6}\right) \cdot 10^2 = \frac{1}{6} \cdot 10^2 = 16{,}7\ \%$

---

e

④



$$m\vec{a} = q\,\vec{v}\times\vec{B}$$

$$m\frac{d\vec{v}}{dt} = q\,\vec{v}\times\vec{B}$$

$\vec{a} \perp \vec{v}$ sempre quindi è un moto circolare uniforme.

$$\frac{d\vec{v}}{dt} = (q/m)\,\vec{v}\times\vec{B}$$

$$\omega = |\vec{v}_\perp|/R$$

$$m\frac{|\vec{v}_\perp|^2}{R} = q|\vec{v}_\perp||\vec{B}|$$

$$\omega = \frac{q|\vec{B}|}{m} = 2{,}63\cdot10^{11}\ \frac{rad}{s}$$

$$p = |\vec{v}|\cos\theta\, T = \frac{|\vec{v}|\cos\theta\, 2\pi}{\omega} = 8{,}26\cdot10^{-6}\ m$$