FORMULE FISICA 1.1

• CINEMATICA

$$\begin{bmatrix} V = cost \\ x(t) = x_0 + V(t - t_0) \end{bmatrix} \text{MOTO R.U.}$$

$$\begin{bmatrix} a = cost \\ V(t) = V_0 + a(t - t_0) \\ x(t) = x_0 + V_0(t - t_0) + \frac{1}{2} a (t - t_0)^2 \end{bmatrix} \text{MOTO U.A.}$$

$$\begin{bmatrix} V(t) = V_0 - gt \\ y(t) = y_0 + V_0 t - \frac{1}{2} g t^2 \\ t_c = \sqrt{\frac{2h}{g}} \ (\text{con } V_0 = 0) \end{bmatrix} \text{MOTO VERTICALE}$$

$$\begin{bmatrix} V_f^2 = V_i^2 - gh \end{bmatrix}$$

$$\begin{bmatrix} T = \frac{2\pi}{\omega} & a_n = \frac{V^2}{R} = \omega^2 R \\ \omega = 2\pi\nu & \\ V = \frac{2\pi R}{T} = \omega R & F_n = m a_n \end{bmatrix} \text{MOTO CIRCOLARE}$$

$$\begin{bmatrix} F_{AS} = \mu_S N & F_{AD} = \mu_D N \\ F_{AV} = b\vec{V} \text{ con } b = mK \end{bmatrix} *$$

URTO ANELASTICO
- MASSIMA PERDITA DI E_K
- $\vec{V}_f = \frac{m_1 \vec{V}_1 + m_2 \vec{V}_2}{m_1 + m_2} = \vec{V}_{cm}$
- SI CONSERVA LA QUANTITÀ DI MOTO

URTO ELASTICO
- SI CONSERVA SIA LA QNT DI MOTO CHE L'EN. CINETICA
- $V_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) V_0 + \left(\frac{2m_2}{m_1 + m_2}\right) V_2$
- $V_2 = \left(\frac{2m_1}{m_1 + m_2}\right) V_0 + \left(\frac{m_2 - m_1}{m_1 + m_2}\right) V_{02}$

MOTO PARAB.

$$\begin{bmatrix} x(t) = V_0 \cos\theta\, t & y(t) = V_0 \sin\theta\, t - \frac{1}{2} g t^2 & x_G = \frac{2V_0^2 \cos\theta \sin\theta}{g} = 2x_M \\ V_x(t) = V_{0x} = V_0 \cos\theta & V_y(t) = V_{0y} = V_y \sin\theta - gt & y(x_M) = y_M = \frac{V_0^2 \sin^2\theta}{2g} \\ y(x) = x \tan\theta - \frac{g}{2V_0^2 \cos\theta} x^2 \ \text{TRAIETTORIA} & & t_G = \frac{2V_0 \sin\theta}{g} \end{bmatrix}$$

$$\begin{bmatrix} F = ma & J = m\Delta V \ * \\ p = mV & F_{AS} = \mu_S N \\ F_{A-B} = -F_{B-A} & F_{AD} = \mu_D N \end{bmatrix}$$

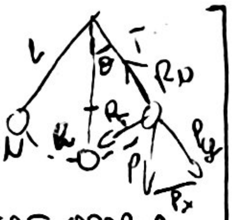
$$\begin{bmatrix} F_e = -Kx = K\Delta l & V = \omega A \cos(\omega t + \phi) & \text{N.B.} \\ a = \frac{F}{m} = -\frac{K}{m} x & \omega = \sqrt{\frac{K}{m}} & A = \pm x_0 \\ x = A \sin(\omega t + \phi) & T = \frac{2\pi}{\omega} \quad x_0 = \frac{V}{\omega} & \phi = \frac{\pi}{2} / \frac{3\pi}{2} \\ W_e = -\Delta E_p & E_{Pe} = \frac{1}{2} K x^2 & \end{bmatrix} F_e$$

$$\begin{bmatrix} -\frac{E_p}{dx} = F \\ W = \Delta E_K \end{bmatrix}$$

FORZE ORTOGONALI ALLA TRAIETTORIA HANNO LAVORO NULLO

$W = -\Delta E_p$ se le forze sono conservative

$$\begin{bmatrix} R_T = -P \sin\theta = m a_T \\ R_N = T - mg\cos\theta = m a_N \\ \theta = \theta_0 \sin(\omega t + \phi) \ \text{LEGGE ORARIA} \\ T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{L}{g}} \ \text{PERIODO} \\ a_N = \frac{V^2}{l} \qquad a_T = l\frac{d^2\theta}{dt} \\ h = L(1 - \cos\theta) \end{bmatrix}$$



$$E_K = \frac{1}{2} m V^2 = \frac{J^2}{2m}$$

$$\left[\begin{array}{l} \vec{P} = m v_{CM} \qquad E_K = \frac{1}{2} m v_{CM}^2 \\ \vec{L} = r_{CM} \times m v_{CM} \rightsquigarrow \text{MOM. QUT. DI MOTO} \\ \vec{V} = \omega \times r \rightsquigarrow L = (m r^2) \vec{\omega} \end{array}\right]$$

MOTO TRASLATORIO CORPO RIGIDO

I eq. CARDINALE	II eq. CARDINALE
$\vec{F}^{est} = \frac{dP}{dt}$	$M_a^{est} = \frac{dL_a}{dt}$
$\vec{F} = m a$	$M_a^{est} = I_a \cdot \alpha$
$\vec{I}^{est} = \Delta \vec{p}_{sist}$	$\vec{J}_a^{est} = \Delta L_a$
$P_{sist} = cost (I = 0)$	$L_a = cost (J_a^{est} = 0)$

$$\left[\begin{array}{l} I = \sum m_i r_i^2 \rightsquigarrow I = \int \rho r^2 dV \text{ con } r \text{ dist. dall'asse} \\ L_a = I\omega \rightsquigarrow \text{MOM. ASSIALE DELLA QUT DI MOTO} \\ M = \frac{dL}{dt} = I \frac{d\omega}{dt} = I\alpha \qquad E_K = \frac{1}{2} I \omega^2 \\ I_a = I'_a + m a^2 \text{ con } I_a = \text{momento passante per il c.m} \end{array}\right]$$

MOTO ROTATORIO

	PER IL CENTRO	PER IL BORDO
ANELLO	$I = m r^2$	$I = 2 m r^2$
DISCO	$I = \frac{1}{2} m r^2$	$I = \frac{3}{2} m r^2$
SFERA	$I = \frac{2}{5} m r^2$	$I = \frac{7}{5} m r^2$
ASTA	$I = \frac{1}{12} m d^2$	$I = \frac{1}{3} m d^2$

MACCHINA ATWOOD

$$a = g \left(\frac{M_A - M_B}{M_A + M_B + \frac{M_C}{2}} \right)$$

$\frac{I_C}{r^2}$ se messa prima va bene

$$T_A = M_A g \left(\frac{2 M_B + M_C/2}{M_A + M_B + M_C/2} \right)$$

$$\left[\begin{array}{l} L = I\omega + r_{CM} \times m V_{CM} \\ E_K = \frac{1}{2} I \omega^2 + \frac{1}{2} m v_{CM}^2 \end{array}\right] \text{Teor. König}$$

URTI CORPO RIGIDO (CON VINCOLO PERF. ANAELASTICO)

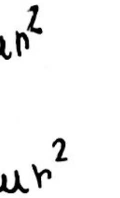
SI CONSERVA IL MOMENTO DELLA QUT. DI MOTO

$$L_{PRIMA} = m V_0 x = L_{DOPO} = I_C^{TOT} \cdot \omega \rightsquigarrow I^{TOT} = \underset{m x^2}{I_p} + \underset{\frac{1}{3} M L^2}{I_s}$$

$$\Rightarrow \omega = \frac{m V_0 x}{I_{SBARRA} + I_{PROIET.}}$$

$$\rho = \frac{dm}{dV} \rightsquigarrow m = \int \rho \, dV$$

PICCOLE OSC.



$$T = 2\pi \sqrt{\frac{I_a}{mg \cdot CG}}$$

$$\frac{d^2\theta}{dt^2} + \left(\frac{mg \cdot CG}{I_a} \right) \sin\theta = 0$$

PENDOLO SEMPLICE

$$T = 2\pi \sqrt{\frac{L}{g}}$$

$$\frac{d^2\theta}{dt^2} + \left(\frac{g}{L} \right) \sin\theta = 0$$

GRANDI OSC.

$$\left.\begin{array}{l} E_K = \frac{1}{2} I \omega^2 \\ U = M g \frac{L}{2} \end{array}\right| \Rightarrow \text{VALE LA CONS. DELLA } E_M$$

$$\omega_{MAX} = \sqrt{\frac{M g L}{I_C}} \rightsquigarrow \text{CARDINE}$$

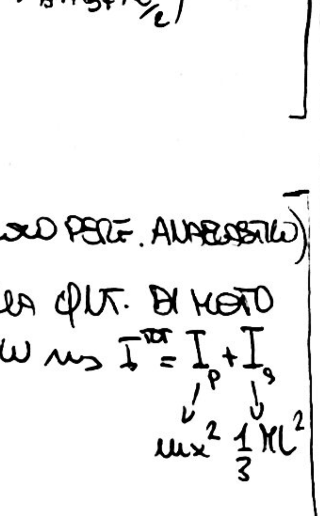
VELOCITÀ AL CARDINE $V_C = 0$

VELOCITÀ NEL BARICENTRO $V_G = \left(\sqrt{\frac{MgL}{I_C}} \right) \frac{L}{2}$

VELOCITÀ ESTREMO $V_E = \left(\sqrt{\frac{MgL}{I_C}} \right) L$

IN GENERALE

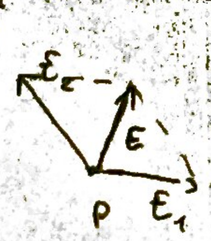
$V(r) = \omega_h \cdot r$

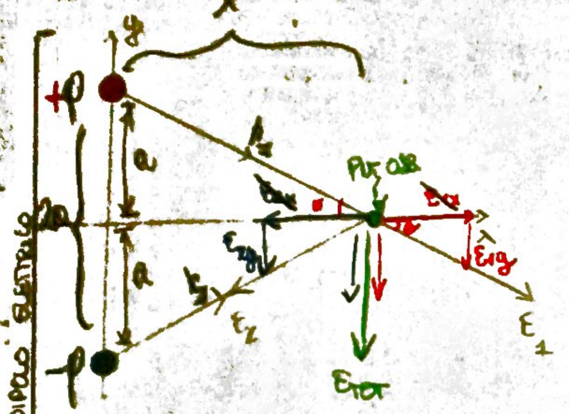


FORMULE FISICA 2

$$F_E = K_0 \frac{Q \cdot q_0}{r^2}$$

$$E = \frac{F}{q_0} = \frac{K_0 Q}{r^2}\hat{n} = K_0 Q \frac{(x-x_0)\hat{x} + (y-y_0)\hat{y} + (z-z_0)\hat{z}}{\left[(x-x_0)^2+(y-y_0)^2+(z-z_0)^2\right]^{3/2}} = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$$

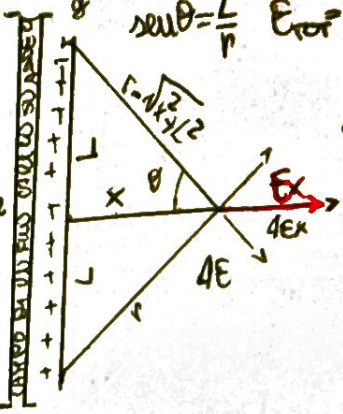




$$E_{1y} = E_1 \sin\theta = E_1\left(\frac{a}{r_1}\right) = k_0 q \frac{a}{r^3} = k_0 q \frac{a}{(x^2+a^2)^{3/2}}$$

$$E_{2y} = E_{1y}$$

$$E_{tot} = 2 k_0 q \left(\frac{a}{(x^2+a^2)^{3/2}}\right)$$



$\sin\theta = \frac{L}{r}$ $\quad E_{tot} = E_x = \frac{\lambda}{2\pi\varepsilon_0 x}\sin\theta$

$$dE_x = dE\cos\theta = \frac{\lambda}{4\pi\varepsilon_0 x}\cos\theta\, d\theta$$

$\lambda = \frac{dq}{dl}$ DENSITÀ DI CARICA LINEARE

$\sigma = \frac{dq}{dS}$ " SUPERFICIALE

$\rho = \frac{dq}{dV}$ " VOLUMETRICA

IN UN SIST. DI CARICHE

$$\vec{E}_{tot} = \int d\vec{E} = K_0 \int dq \frac{(x-x_0)\hat{x} + \dots + (z-z_0)\hat{z}}{\left[(x-x_0)^2 + \dots + (z-z_0)^2\right]^{3/2}}$$

con dq che vale

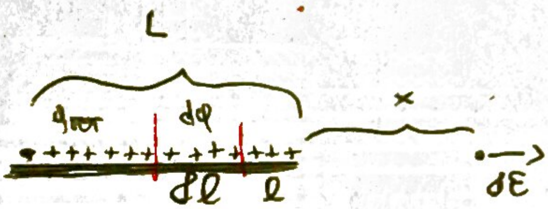
$\rightarrow dq$: $\lambda\, dl$ 1D $\int$; $\sigma\, dS$ 2D $\iint$; $\rho\, dV$ 3D $\iiint$

x DISTANZA DAL DISCO

$$E_{tot}^{\text{DISCO UNIF}} = \frac{\sigma}{2\varepsilon_0}\left(1 - \frac{x}{\sqrt{R^2+x^2}}\right)$$

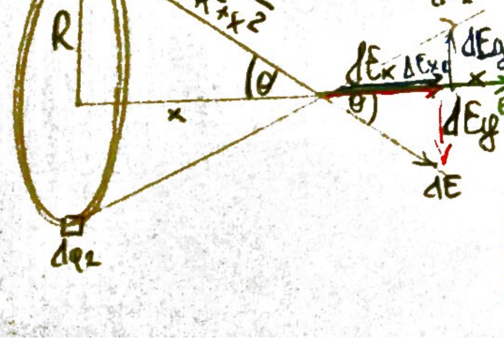
$$E_{tot}^{\text{PIANO UNIF}} = \frac{\sigma}{2\varepsilon_0}$$

CAMPO FILO UNIFORM. CARICO SU x



$$\lambda = \frac{dq}{dl} = \frac{q_{tot}}{l_{tot}} \qquad dE = k_0 \frac{\lambda\, dl}{(x+l)^2} \rightsquigarrow E = \int dE = \frac{q_{tot}}{4\pi\varepsilon_0 x (x+l_{tot})}$$

CAMPO SU ANELLO UNIF. CARICO



$$\lambda = \frac{dq}{dl} = \frac{q_{tot}}{2\pi R}$$

$$dE_x = dE\cos\theta = dE\left(\frac{x}{r}\right)$$

$$dE_y = dE\sin\theta = dE\left(\frac{R}{r}\right) = 0$$

$$dE = \frac{dq}{4\pi\varepsilon_0 r^2}$$

$$E_{tot} = \frac{q_{tot}}{4\pi\varepsilon_0}\frac{x}{(x^2+R^2)^{3/2}}$$

$$d\phi = \vec{E}\cdot\hat{u}\,d\Sigma$$

$$d\phi = E\cos\theta\, d\Sigma$$

$$\phi(\vec{E}) = \int_\Sigma E\cos\theta\, d\Sigma$$

$$d\phi^{\text{sup. chiusa}} = \frac{q}{4\pi\varepsilon_0}\cdot d\Omega$$

$$\Phi_\Sigma(\vec{E}) = \frac{q_{int}}{\varepsilon_0} \text{ (GAUSS)}$$

(→ 4.5)

$\Sigma = \int E\, d\Sigma \rightsquigarrow E\Sigma$ — SUP SFERICA

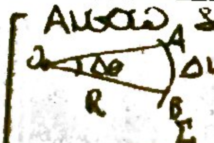
$$\Phi_\Sigma(E) = E\,4\pi r^2 \quad \Sigma = \frac{q_{int}}{\varepsilon_0}$$

$$E_{EST} = \frac{Q_{TOT}}{4\pi\varepsilon_0 r^2} \quad \text{con } R<r \ (*)$$

se $r<R$ allora $E_{INT}=0$

SFERA CONDUTTRICE

ANGOLO SOLIDO



$$\Delta\theta : \Delta L = 2\pi : 2\pi R \rightsquigarrow \Delta\theta = \frac{\Delta L}{R} \quad \text{ANGOLO PIANO}$$

(angolo giro; circ.)

$$\Delta\Omega : \Delta\Sigma = 4\pi : 4\pi R^2 \rightsquigarrow \Delta\Omega = \frac{\Delta\Sigma}{R^2} \quad \text{ANGOLO SOLIDO}$$

(angolo tot; sup. sferica)

SE LA SUP. È SFERICA!

ALTRIMENTI SE $\Delta\Sigma$

$$\Delta\Omega = \frac{\Delta\Sigma_n}{r^2} = \frac{\Delta\Sigma\cos\theta}{r^2}$$

$$\cos\theta = \hat{u}\cdot\hat{r}_0 \rightsquigarrow \hat{r}_0 = \frac{\vec{r}}{r}$$

$$\rightsquigarrow \Delta\Omega = \Delta\Sigma\,\frac{\hat{u}\cdot\vec{r}}{r^3}$$

N.B. se $\hat{u} \perp \vec{E}$ $\Phi(E) = 0$!

$$\Phi_\Sigma(E) = E\,4\pi r^2 = \frac{Q_{int\,\Sigma}}{\varepsilon_0} = \frac{\int_0^r \rho(4\pi r^2)\,dr}{\varepsilon_0} \Rightarrow E_{INT} = \frac{\rho}{3\varepsilon_0}\, r \quad \text{se } r<R$$

con $\rho = \text{cost} = \dfrac{Q_{TOT}}{\frac{4}{3}\pi R^3}$

$$\Phi_\Sigma(E) = E\,4\pi r^2 = \frac{Q_{TOT}}{\varepsilon_0} \Rightarrow E_{EST} = \frac{Q_{TOT}}{4\pi\varepsilon_0 r^2} \quad \text{se } r>R$$

SFERA UNIF. CARICA

$$\Phi_{\Sigma_L}(E) = E\cdot\Sigma_L = E\cdot 2\pi r h$$

→ SUP CILINDRICA LATERALE

$$E = \frac{Q_{int}}{\varepsilon_0} \rightsquigarrow E_L = \frac{\lambda\cdot h}{2\pi r h\varepsilon_0}$$

FILO RETTILINEO INDEF.

$$\Phi_\Sigma(\vec{E}) = \frac{q_{int}\Sigma}{\varepsilon_0} = E(x)\Sigma_A + E(x)\Sigma_B = \frac{\sigma\Sigma}{\varepsilon_0}$$

$$E = \frac{\sigma}{2\varepsilon_0}$$

PIANO INDEF. CARICO

$$\Phi^{EST}_{\Sigma_L}(\vec{E}) = E\cdot(2\pi r h) = \frac{\int_0^R \rho\, d\tau}{\varepsilon_0} \quad r>R$$

$$\text{SE } \rho = \text{cost} \rightsquigarrow E_{EST} = \frac{\rho}{2\varepsilon_0}\frac{R^2}{r}$$

$$\Phi^{INT}_{\Sigma}(\vec{E}) = E(2\pi r\cdot h) = \frac{q_{int}}{\varepsilon_0} = \frac{\int_0^r \rho\, dr}{\varepsilon_0} \quad r<R$$

$$\text{SE } \rho = \text{cost} \rightsquigarrow E_{INT} = \frac{\rho}{2\varepsilon_0}\, r$$

CILINDRO UNIF. CARICO

$$\nabla\cdot\vec{E} = \frac{\rho}{\varepsilon_0}$$

$$W_{AB} = \int_A^B F_E\, ds = q\int_A^B E\, ds = U(A) - U(B) \rightsquigarrow \oint_A^B F_E\, ds = 0$$

$$\frac{W}{q} = \int_A^B E\, ds = \frac{U(A)-U(B)}{q} = V(A) - V(B) \rightsquigarrow \oint_A^B E\, ds = 0$$

$$-dU = F_x dx + F_y dy + F_z dz \rightsquigarrow F = -\nabla U$$

$$-dV = E_x dx + E_y dy + E_z dz \rightsquigarrow E = -\nabla V$$

$$V = \sum_i V_i = \frac{1}{4\pi\varepsilon_0}\sum_i \frac{q_i}{r_i} = \frac{1}{4\pi\varepsilon_0}\sum_i \frac{q_i}{\sqrt{(x-x_i)^2 + \dots + (z-z_i)^2}}$$

$$V = \int dV = \frac{q_{TOT}}{4\pi\varepsilon_0\sqrt{R^2+z^2}} \quad \text{POT. DI UN ANELLO CARICO UNIF.}$$

$$V_{EST}(P) = \int_r^\infty \frac{Q_{TOT}}{4\pi\varepsilon_0 r^2}\, dr = \frac{Q}{4\pi\varepsilon_0 r}$$

$$V_{INT}(P) = \int_r^R E_{int}\cdot dr + \underbrace{V(B)}_{=0}\,* = V_{INT}(P) - V(B) = \frac{Q}{4\pi\varepsilon_0 R}$$

SFERA COND.

$$V(P) = \frac{Q}{4\pi\varepsilon_0 r}$$

I metodo

$$E_A = U_A + E_{K_A} = qV_A + \frac{1}{2}mv_A^2 \quad \text{N.B. Em si conserva}$$

$$qV_A + \frac{1}{2}mv_A^2 = qV_B + \frac{1}{2}mv_B^2 \longrightarrow v_B = \sqrt{\underbrace{\frac{2q}{m}(V_A - V_B)}_{\text{SE}<0\ \nexists\text{ non arriva in B}} + v_A^2}$$

II

$$F_{EST} = -F_{ele}$$

$$W^{EST}_{AB} = \int_A^B qE\, ds = q(-V_B + V_A) = q(-V_A + V_B)$$

MOTO DI UNA CARICA

*r distanza da punto di osservazione

* PUNTO DI FRONTIERA DOVE V È NOTO

FORMULE FISICA 2.2

$C = \frac{Q_{tot}}{\Delta V}$ SE IL CONDUTTORE È SFERICO ISOLATO $V = \frac{q}{4\pi\varepsilon_0 R} \rightsquigarrow C = 4\pi\varepsilon_0 R$

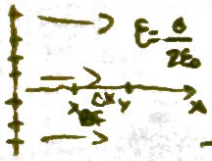
$r<R$ $\quad E_{int} = \frac{Q_{tot}}{4\pi\varepsilon_0}\frac{r}{R^3}$ $\quad V_{int} = \frac{Q_{tot}}{4\pi\varepsilon_0}\frac{3R^2-r^2}{2R^3}$

$r>R$ $\quad E_{est} = \frac{Q_{tot}}{4\pi\varepsilon_0 r^2}$ $\quad V_{est} = \frac{Q_{tot}}{4\pi\varepsilon_0 r}$

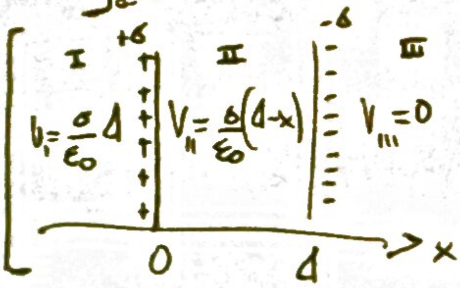
POT. SFERA CARICA

$E_{tot} = \frac{\sigma}{2\varepsilon_0}$

$V(x) = \frac{\sigma}{2\varepsilon_0}(\Delta x)$



POTENZIALE STRATO PIANO



POTENZIALE TRA 2 STRATI PIANI

$r<R_1$ $\quad E_1 = 0$

$R_1<r<R_2$ $\quad E_2 = \frac{Q}{4\pi\varepsilon_0 r^2}$ $\quad \Delta V_{A-B} = \frac{Q}{4\pi\varepsilon_0}\frac{R_2-R_1}{R_1R_2}$

$r>R_2$ $\quad E_3 = 0$

$C_{sfera} = \frac{Q_{alloggiata}}{V_A-V_B} = 4\pi\varepsilon_0\frac{R_1R_2}{R_2-R_1} = \varepsilon_0\frac{\sqrt{\Sigma_1\Sigma_2}}{d}$ TRA R_1 ed R_2

CONDENSATORE SFERICO

$V_A - V_B = \int_0^d E\,dx \rightsquigarrow E\cdot d = \frac{\sigma}{\varepsilon_0}d$ $\quad C_{piano} = \frac{\cancel{\sigma} S}{\frac{\cancel{\sigma} d}{\varepsilon_0}} = \frac{\varepsilon_0\Sigma}{d}$

$C_{cilindro} = \frac{Q}{\Delta V} = \frac{2\pi\varepsilon_0 d}{\ln\frac{R_2}{R_1}}$

TEMPO*

$v_d^{(-)} = \left(\frac{q}{2m}\right)E\tau$ (VEL. DI DERIVA)

$F = qE = ma \rightsquigarrow a = \frac{q}{m}E$

$v(t) = v_0 + \left(\frac{q}{m}\right)\vec{E}\cdot t$

$C_{eq} = C_1 + C_2 + \dots + C_n$ //

$C_{eq} = \frac{C_1C_2\dots C_n}{C_1+C_2+\dots+C_n} \rightsquigarrow \frac{1}{C_{eq}} = \frac{1}{C_1} + \dots + \frac{1}{C_n}$ SERIE

$v_d^{(-)} = \mu E$ con $\mu = \frac{q}{2m}\tau$

$\vec{J} = \frac{dq}{dS\,d\tau} = \left[\frac{A}{m^2}\right]$

$I = \frac{dq}{d\tau} = [A]$

LEGGI DI OHM

1. $I = \frac{V_A - V_B}{R}$ ($R \rightsquigarrow$ RES.) $\rightsquigarrow V_A - V_B = RI$
2. $R = \rho\frac{L}{S}$ → RESISTIVITÀ

1.1 $dV = (J\,dS)\,dR = E\,dL$

2.1 $dR = \rho\cdot\frac{dL}{dS}$

$\rightsquigarrow E\,\cancel{dL} = (J\,\cancel{dS})\left(\rho\frac{\cancel{dL}}{\cancel{dS}}\right)$

$E = J\rho \rightsquigarrow \sigma\vec{E}$

$\vec{J}_e = n(-e)\vec{v}_d^{(-)}$

(sta sempre verso $= E$)

$I = \int_S \vec{J}\cdot\hat{u}\,dS = \Phi_S(\vec{J})$

$\Phi_\Sigma(\vec{J}) = 0$

$N = n\cdot d\tau$ → CONCENTRAZIONE · VOLUME

$= n\cdot dL\cdot dS$ con $dL = v_d\,dt$

$dq = N\cdot q = n\cdot q\cdot v_d\cdot dt\,dS$

$\Rightarrow |\vec{J}| = \frac{n\cdot q\cdot v_d\cdot\cancel{dt}\cdot\cancel{dS}}{\cancel{dS}\,\cancel{dt}}$

$\vec{J} = \frac{n q^2 l}{2 m v_T}\vec{E}$

* l → CAMMINO LIBERO
v_T → VEL. TERMICA

$$\Delta E_{k_{JOULE}} = q(V_A - V_B) \quad \text{EFF. JOULE}$$

$$P_{JOULE} = \frac{dE_{k\,JOULE}}{dt} = \frac{dq}{dt}(V_A - V_B) = I \cdot (V_A - V_B) \text{ POT} = I^2 R = \frac{\Delta V^2}{R}$$

$$V_A - V_B = \mathcal{E}$$

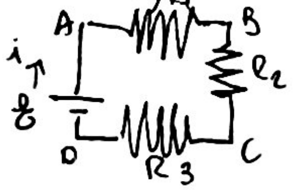
$$P_{DISS} = I^2 R$$

$$\mathcal{E}_{DISS} = P\Delta t = I^2 R \Delta t$$

Pot. dissipata sulle R

$$P_g = \mathcal{E} I \rightsquigarrow P_g = P_R \Rightarrow \mathcal{E} I = I^2 (R_1 + R_2 \ldots) \rightsquigarrow I = \frac{\mathcal{E}}{\sum_i R_i}$$

$$\left.\begin{aligned} \cancel{V_A} - \cancel{V_B} &= I \cdot R_1 \\ \cancel{V_B} - \cancel{V_C} &= I R_2 \\ \cancel{V_C} - \cancel{V_D} &= I R_3 \\ \cancel{V_D} - \cancel{V_A} &= -\mathcal{E} \end{aligned}\right\} \quad I(R_1 + R_2 + R_3) - \mathcal{E} = 0 \rightsquigarrow I = \frac{\mathcal{E}}{\sum R_i}$$



CALCOLARE CORRENTE IN CIRCUITO

RES IN // (STESSA ΔV) $\frac{1}{R_{eq}} = \frac{1}{R_1} + \ldots + \frac{1}{R_n} \rightsquigarrow P_{TOT} = R_{eq} I^2$

RES IN SERIE (STESSA I) $R_{eq} = R_1 + \ldots R_n \rightsquigarrow V_{TOT} = R_{eq} I$

$$\vec{B} = \left(\frac{\mu_0}{4\pi}\right)(q\vec{v}) \times \left(\frac{\vec{r}}{r^3}\right) \quad \text{(II FORMULA DI LAPLACE)}$$

$$F_L = q\vec{v} \times \vec{B} \quad \text{(I \quad " \quad ")}$$

$$F_L = qvB\sin\theta \rightsquigarrow \text{MASSIMA SE } \perp \rightsquigarrow F = ma_N \rightsquigarrow a_N = \frac{v^2}{\rho} \rightsquigarrow \rho = \frac{m \cdot v}{qB} = R_{circ.}$$

θ: angolo tra v e B; ρ: raggio curv.

$W_{FL} = 0$ (F_L sempre $\perp$ spostamento) $\rightsquigarrow \Delta E_K = 0 \rightsquigarrow v = \text{cost}$

$$\vec{\omega} = \frac{v}{R} = -\left(\frac{q}{m}\right)\vec{B}$$

q senso orario − q antiorario

$$\left\{\begin{aligned} v_x &= v\cos\theta \rightsquigarrow \text{RET. UNIF.} \\ v_y &= v\sin\theta \rightsquigarrow \text{CIRC. UNIF.} \rightsquigarrow \omega = \left(\frac{q}{m}\right)B \end{aligned}\right. \quad \Bigg| \quad d = v_x T = vT\cos\theta \; \boxed{\text{PASSO}}$$

CARICHE IN MOTO NEL B

$$F_E = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2} \quad F_L = \left(\frac{\mu_0}{4\pi}\right)\frac{q_1 q_2 v_2 v_1}{r^2} \quad \text{FORZE TRA 2 CARICHE IN MOTO}$$

$$\left.\begin{aligned} F_L &= q v_d \times B \\ N &= n\,d\tau = nS\,dl \end{aligned}\right\} N \cdot \vec{F}_L = (\underbrace{nqv_d S}_{J})\, dl \times \vec{B} \rightsquigarrow d\vec{F} = I \cdot d\vec{l} \times \vec{B} \quad \text{(II eq. LAPLACE)}$$

$\vec{F}_L$ su tutto un volume

$$d\vec{B} = \left(\frac{\mu_0}{4\pi}\right)(I\,d\vec{l}) \times \left(\frac{\vec{r}}{r^3}\right) \quad \text{(I eq. LAPLACE)}$$