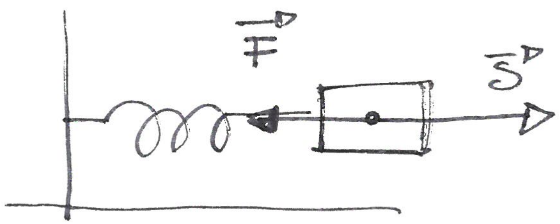
OSCILLATORE ARMONICO



$$\vec{F} = -k\vec{s}$$

Come variano E_k e U nel tempo?

$$\left.\begin{array}{l} \vec{F} = -k\vec{s} \\ \vec{F} = m\vec{a} \end{array}\right\} \quad \frac{\cancel{m}\vec{a}}{\cancel{m}} = \frac{-k\vec{s}}{m} \longrightarrow \vec{a} = -\frac{k}{m}\vec{s}$$

MOTO ARMONICO

$$\omega^2 = \frac{k}{m}$$

$$\Downarrow$$

$$k = \omega^2 m$$

$$s(t) = A \sin(\omega t)$$

$$v(t) = A\omega \cos(\omega t)$$

$$a(t) = -A\omega^2 \sin(\omega t)$$

$s(t)$

$E_M = E_k + U$ en. MECCANICA = somma di E_k e U

$$= \frac{1}{2} m v^2 + \frac{1}{2} k s^2 = \frac{1}{2} m \left[A \omega \cos(\omega t)\right]^2 + \left[\frac{1}{2} k \left[A \sin(\omega t)\right]^2\right] =$$

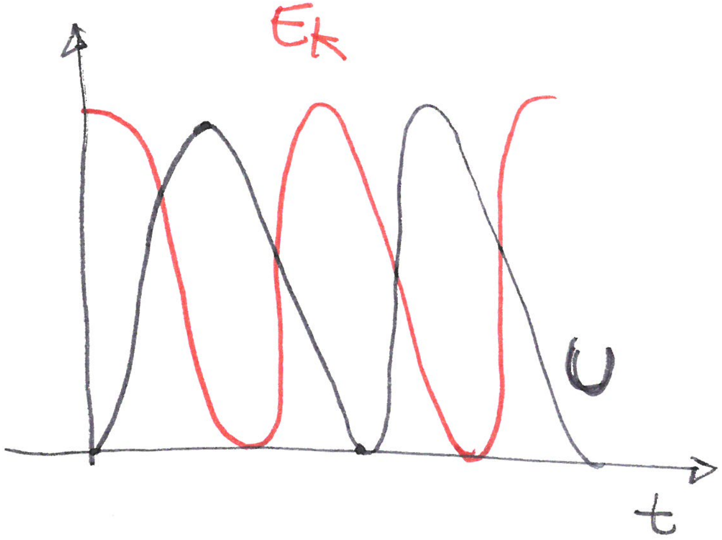
$$E_k = \left[\frac{1}{2} m A^2 \omega^2 \cos^2(\omega t)\right] + \left[\frac{1}{2} k A^2 \sin^2(\omega t)\right] U$$

$$= \frac{1}{2} \cancel{m} A^2 \frac{k}{\cancel{m}} \cos^2(\omega t) + \frac{1}{2} k A^2 \sin^2(\omega t)$$

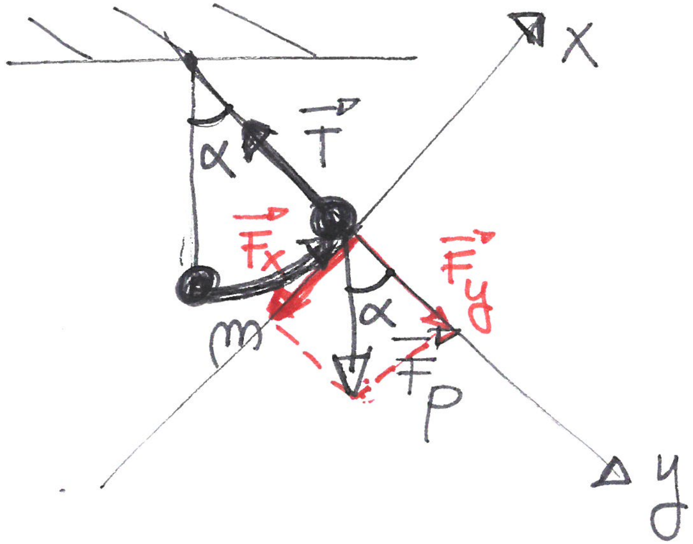
$$= \frac{1}{2} k A^2 \left[\underbrace{\cos^2(\omega t) + \sin^2(\omega t)}_{=1}\right]$$

$$= \frac{1}{2} k A^2 \quad U_{max}$$

$$= \frac{1}{2} \omega^2 m A^2 \quad E_{k\,MAX}$$



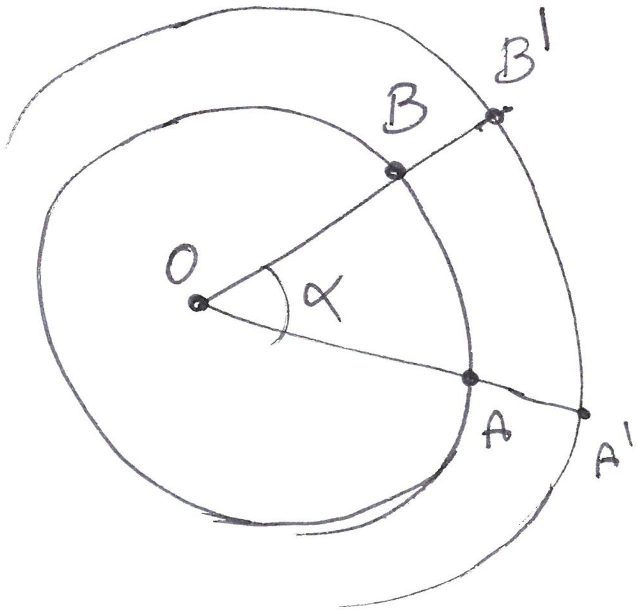
PENDOLO SEMPLICE



$$F_x = -F_P \sin\alpha = -mg \sin\alpha$$

PICCOLE OSCILLAZIONI

$$= -mg\,\alpha = -mg\,\frac{\;}{\ell}$$



$$\alpha_{RAD} = \frac{\overset{\frown}{AB}}{OA} = \frac{\text{ARCO}}{\text{RAGGIO}}$$

$$F_x = -\frac{mg}{l} s \longrightarrow F = -ks \quad \text{F. ELASTICA}$$

$$\frac{mg}{l} = k$$

$$\omega^2 = \frac{k}{m} \longrightarrow \omega^2 = \frac{\frac{\cancel{m}g}{l}}{\cancel{m}} \longrightarrow \omega^2 = \frac{g}{l}$$

$$\omega = \frac{2\pi}{\tau}$$

τ periodo

$$\left(\frac{2\pi}{\tau}\right)^2 = \frac{g}{l}$$

$$\frac{4\pi^2}{\tau^2} = \frac{g}{l}$$

$$\sqrt{\cancel{4\pi^2}\,\frac{\tau^2}{\cancel{4\pi^2}}} = \sqrt{\frac{l}{g} \cdot 4\pi^2}$$

PERIODO PENDOLO $\longrightarrow \tau = 2\pi \cdot \sqrt{\frac{l}{g}}$

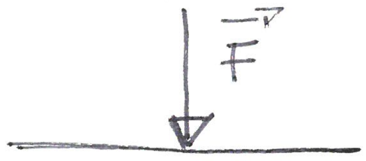
SOLIDO ⇒ forma e volume definito

FLUIDI
- LIQUIDI volume proprio ma non la forma
  - δ COSTANTE = INCOMPRIMIBILE
- GAS né volume né forma propria
  - δ VARIABILE = COMPRIMIBILE

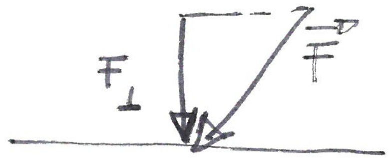
$$\text{DENSITÀ} = \delta \ (\rho) = \frac{\text{MASSA}}{\text{VOLUME}} = \frac{kg}{m^3}$$

FLUIDI
- IDEALI (perfetti) no attrito
- REALI (VISCOSI) $\vec{F}_v = -\eta A \frac{dv}{dz} \cdot \hat{v}$
  - ⇒ MOTO LAMINARE

PRESSIONE $\quad P = \dfrac{F_\perp}{S}$



UNITA' MISURA

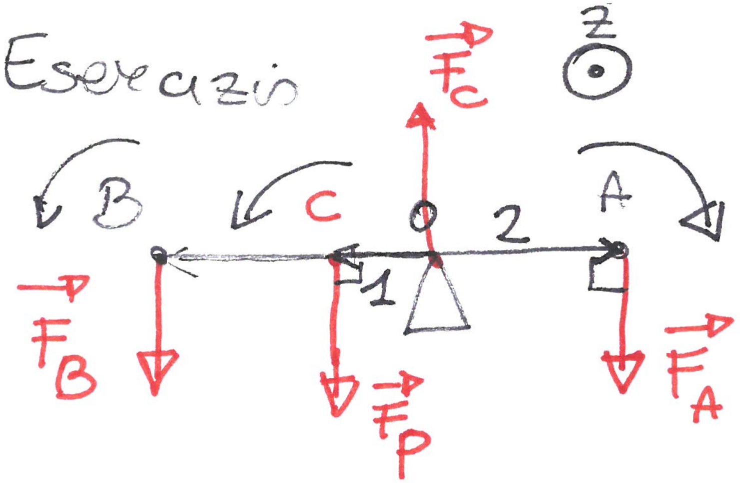


$P = \left[\dfrac{N}{m^2}\right] = Pa$

PASCAL

$P_0 = 1\ atm = 1{,}013 \cdot 10^5\ Pa$

Esercizio



$m_A = 60\,kg$

$\overline{OA} = 2\,m$

$\overline{OB} = 4\,m$

$\overline{OC} = 1\,m$

$m_{ALTAL.} = 12\,kg$

$m_B = ?$

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$$\sum \vec{M} = 0 \qquad \vec{M}_{F_A} + \vec{M}_{F_P} + \vec{M}_{F_B} + \vec{M}_{F_C} = 0$$

$$\vec{OA} \times \vec{F}_A + \vec{OC} \times \vec{F}_P + \vec{OB} \times \vec{F}_B + \cancel{\vec{OO} \times \vec{F}_C} = 0$$

$$-OA \cdot F_A \cancel{\sin \frac{\pi}{2}} + OC\, F_P \cancel{\sin \frac{\pi}{2}} + OB\, F_B \underbrace{\cancel{\sin \frac{\pi}{2}}}_{=1} = 0$$

$$-OA \cdot m_A \cancel{g} + OC \cdot m_{ALTAL} \cdot \cancel{g} + OB \cdot m_B \cancel{g} = 0$$

$$m_B = \frac{OA \cdot m_A - OC \cdot m_{ALTAL}}{OB} = \frac{2\,m \cdot 60\,kg - 1\,m \cdot 12\,kg}{4\,m} = 27\,kg$$