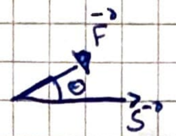
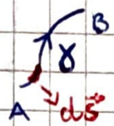
LAVORO - ENERGIA



Se $\vec{F}$ é costante, il lavoro é $\vec{F} \cdot \vec{S}$
$= F s \cos\theta$
$= F_{\parallel} s$

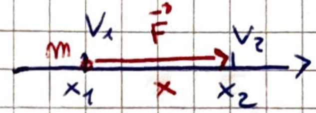
Se $\vec{F}$ e $\perp$ a $\vec{S}$ $\Rightarrow L = 0$ Es:

Se $\vec{F}$ non é costante $L = \int_{a\,\gamma}^{b} \vec{F} \cdot d\vec{s}$



Es: forza elastica → 1 DIM
$L = \int_{x_1}^{x_2} F_x \, dx$

Consideriamo la componente unidimensionale $F = F_x$



Se $\vec{F}$ = costante $\Rightarrow$ MUA
A = costante

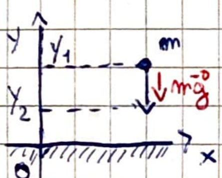
MUA
$V = V_1 + at$

$L_{x_1 \to x_2} = F_x = ma \cdot (V_1 t + \frac{1}{2} a t^2) = m a V_1 t + \frac{1}{2} m a^2 t^2 = m V_1 \underline{(V_2 - V_1)} + \frac{1}{2} m (V_2 - V_1)^2 =$

$= \cancel{m V_1 V_2} - m V_1^2 + \frac{1}{2} m V_2^2 - \cancel{m V_1 V_2} + \frac{1}{2} m V_1^2 = \underbrace{\frac{1}{2} m V_2^2 - \frac{1}{2} m V_1^2}_{\Delta E_K = E_K^f - E_K^i}$

TEOREMA ENERGIA CINETICA
Vale per qualunque forza

Potenzialità di una forza di eseguire un Lavoro → energia potenziale
↳ dipende dal Tipo di forza
non é sempre la stessa



$L_{peso} = mg(Y_1 - Y_2) = mg Y_1 - mg Y_2$

$U = mgy$ energia potenziale del corpo di massa m

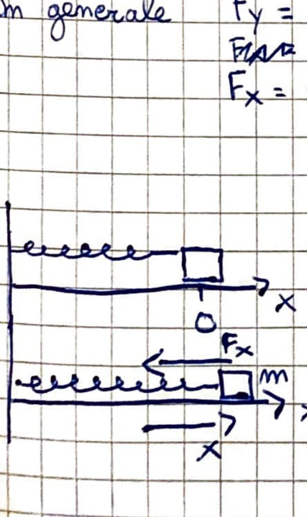
$\Rightarrow L = U_{iniziale} - U_{finale} = -\Delta U$

$L = \Delta E_K = -\Delta U \Rightarrow \Delta(E_K + U) = 0 \Rightarrow \boxed{E_K + U = \text{costante}}$ CONS. ENERGIA TOTALE MECCANICA

↑
solo per forze conservative
(il lavoro non dipende dal percorso)

In generale $F_y = -\frac{dU}{dy}$

$F_x = -\frac{dU}{dx} \quad \left(-\frac{\partial U}{\partial x}\right)$
↳ derivata parziale (la facciamo dipendere solo da una variabile)



$F_x = -Kx$

$U = \frac{1}{2} K x^2$ energia potenziale elastica

↳ $L_{x \to 0} = \int_x^0 -Kx \, dx = -\frac{1}{2} K x^2 \Big|_x^0 \Rightarrow -0 + \frac{1}{2} K x^2 = U_x - U_0$ (INIZ, FIN)

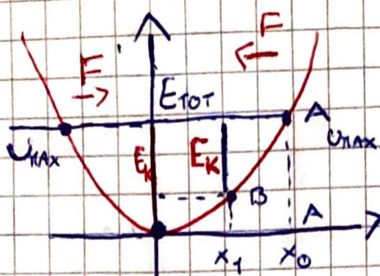
$$\delta L = \vec{F}\cdot d\vec{s} = m a \cdot \vec{v}\,dt = m\frac{dv}{dt}\cdot v\,dt = m\,d\vec{v}\cdot\vec{v} = \frac{1}{2} m\, d(\underbrace{\vec{v}\cdot\vec{v}}_{v^2})$$

$$d\vec{s} = \vec{v}\,dt \qquad a = \frac{dv}{dt}$$

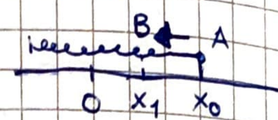
$$\frac{1}{2} d(v\cdot v) = \frac{1}{2}(dv\cdot v + v\cdot dv) = v\,dv$$

$$\delta L = \frac{1}{2} m\, dv^2 = d\left(\frac{1}{2} m v^2\right)$$

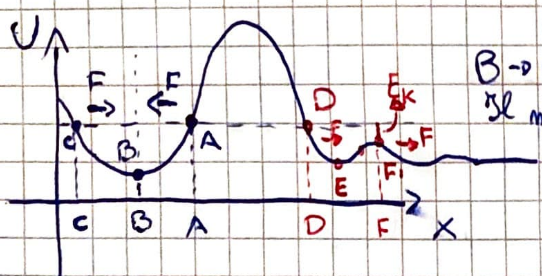
$$L_{A\to B} = \frac{1}{2} m v_B^2 - \frac{1}{2} m v_A^2$$



$$U_{el} = \frac{1}{2} k x^2$$

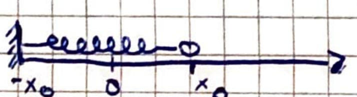


$$F_x = -\frac{dU}{dx}$$



B → F = 0

Il moto è confinato tra A e C (nel primo caso)



$$U = \frac{1}{2} k x^2 \qquad E_K = \frac{1}{2} m v^2$$

$$x = x_0 \cos \omega t \qquad v = -\omega x_0 \sin \omega t$$

$$V_{max}(\sin \omega t = 1) = v_0 = \omega x_0$$

$$v = -v_0 \sin \omega t$$

$$E_K = \frac{1}{2} m v_0^2 \sin^2(\omega t)$$

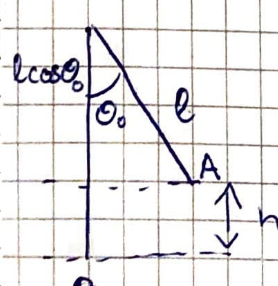
$$U = \frac{1}{2} k x_0^2 \cos^2(\omega t)$$

$$E_{TOT} = E_K + U$$

$$E_{TOT} = \frac{1}{2} m \underbrace{v_0^2}_{\omega^2 x_0^2} \sin^2 \omega t + \frac{1}{2} k x_0^2 \cos^2 \omega t$$

$$= \frac{1}{2}\left(\underbrace{m\omega^2}_{k} x_0^2 \sin^2 \omega t + k x_0^2 \cos^2 \omega t\right) \qquad \omega^2 = \frac{k}{m}$$

$$= \frac{1}{2}\left(k x_0^2 \underbrace{(\sin^2 \omega t + \cos^2 \omega t)}_{=1}\right) \Rightarrow \frac{1}{2} k x_0^2$$



$$h = l(1-\cos\theta_0)$$

$$E_{tot} = \underbrace{mgl(1-\cos\theta_0)}_{A} = \underbrace{\frac{1}{2} m v_0^2}_{B}$$