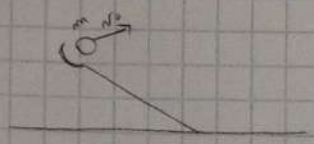
Questionario di fisica n°6 — Michele D'Urso

Esercizio n°1



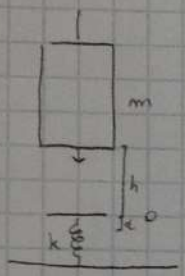
$m = 200g = 0,2kg$

$\Delta t = 0,1s$

$v_0 = 40 m/s$

$$F_m = \frac{1}{\Delta t}\int_{t_1}^{t_2} F(t)\,dt = \frac{m}{\Delta t}\int_{t_1}^{t_2}\frac{dv(t)}{dt}\,dt = \frac{m}{\Delta t}\left[v(t)\right]_{t_1}^{t_2} = \frac{m}{\Delta t}v(t_2) - \frac{m}{\Delta t}v(t_1) = \frac{m}{\Delta t}v_0 = \frac{0,2}{0,1}\cdot 40 = 80N$$

Esercizio n°2



$m = 500kg$

$k = 5\cdot 10^6 \frac{N}{m}$

$d = 8cm = 0,08m$

$h = ?$

$E_A = mgh$

$E_B = \frac{1}{2}kd^2 - mgd$

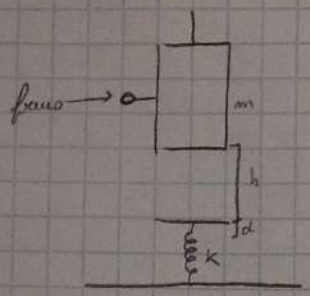
Assenza di attrito $E_A = E_B$

$$\frac{1}{2}kd^2 - mgd - mgh = 0 \rightarrow mg(h+d) = \frac{1}{2}kd^2$$

$$h + d = \frac{1kd^2}{2mg} \rightarrow h = \frac{1kd^2}{2mg} - d = 3,18m$$

Per la conservazione dell'energia l'oscillazione risale alla stessa altezza di caduta

Esercizio 3



$m = 500\,kg$
$k = 5 \cdot 10^6\,N/m$

$F_{el} = 8000\,N$
$h = 3{,}18\,m$

$\Delta E = W_{NC}$

$E_A = mgh$
$E_B = \frac{1}{2}kd^2 - mgd$
$W_{NC} = -F_{el}(h+d)$

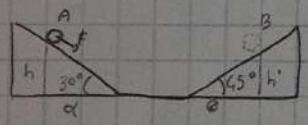
$\Delta E = W_{NC}$
$\Delta E = E_B - E_A$

$\frac{1}{2}kd^2 - mgd - mgh = -F_{el}(h+d) \rightarrow \frac{1}{2}kd^2 - mg(h+d)$

$\rightarrow \frac{1}{2}kd^2 = mg(h+d) - F_{el}(h+d)$ → Troviamo d siccome piccolo rispetto ad h

$\frac{1}{2}kd^2 = mgh - F_{el}h \rightarrow d = \sqrt{\frac{2(mgh - F_{el}h)}{k}} = 0{,}05 = 5\,cm$

Esercizio n°4



$m = 100g = 0{,}1kg$
$d = 3m$
$\alpha = 30°$
$\theta = 45°$
$\mu_d = 0{,}2$

$F = mg\cos\alpha$

$E_A = mgh$
$E_B = mgh'$

$h = d \sin 30° = 1{,}5\,cos$
$h' = d' \sin 45° \longrightarrow d' = \frac{h'}{\sin 45°}$

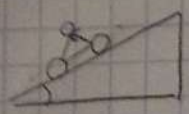
$W_{NC} = -F_a d' = -\mu_d mg\cos 45° \frac{h'}{\sin 45°} = -\mu_d mg \frac{h'}{tg45°}$

$E_B - E_A = W_{NC} \rightarrow mgh' - mgh = -\mu_d mg\frac{h'}{tg45°} \rightarrow h' - h = -\mu_d \frac{h'}{tg45°} \rightarrow$

$\rightarrow h = h' + \mu_d \frac{h'}{tg45°} \rightarrow h = h'\left(1 + \frac{\mu_d}{tg45°}\right) \rightarrow h' = \frac{h}{\left(1 + \frac{\mu_d}{tg45°}\right)} = \frac{1{,}5}{1{,}2} = 1{,}25\,m$

$E_{dis} = E_A - E_B = mgh - mgh' = 1{,}5 - 1{,}25 = 0{,}25\,J$

Esercizio 5



$m = 80kg$

$v_0 = 25 km/h = 6,94 \frac{m}{s}$

$\alpha = 4\% \rightarrow \sin\alpha \simeq 0,04$

Forza esgita $= mg \sin\alpha$

$P = F \cdot v_0 = mg \sin\alpha \cdot v_0 = 80 \cdot 9,82 \cdot 0,04 \cdot 6,94 = 218W$

Discesa

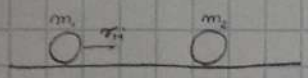
$v = 50 \frac{km}{h} = 13,9 \frac{m}{s}$

$-p = mg \sin\alpha$

$W_{NC} = \mu_d N r$

$mg \sin\alpha = \mu_d N r \rightarrow \mu_d = \frac{mg \sin\alpha}{Nr} = 2,26 \frac{N^2}{m}$

Esercizio 6



$m_1 = 10g = 0,01kg$

$m_2 = 20g = 0,02kg$

$v_{1i} = 10 \frac{m}{s}$

Urto è impulsivo

$I_{12} = \int_{t_1}^{t_2} \vec{F}_{12} dt = \Delta \vec{P}_1 = I_{21} = \int_{t_1}^{t_2} \vec{F}_{21} dt = \Delta \vec{P}_2$

$\Delta \vec{P}_1 = \Delta \vec{P}_2$

$P_A = m_1 \cdot v_{1i} \rightarrow m_1 v_{1i} = m_1 v_{1f} + m_2 v_{2f}$

$P_B = m_1 \cdot v_{1f} + m_2 v_{2f}$

Urto anelastico $v_{1f} = v_{2f} = v_f$

$m_1 v_{1i} = v_f (m_1 + m_2) \rightarrow v_f = \frac{m_1 \cdot v_{1i}}{m_1 + m_2} = 3,33 \frac{m}{s}$

$\Delta E = W_{NC}$

$E_B - E_A = -E_{dis}$

$E_A = \frac{1}{2} m_1 v_{1i}^2$

$E_B = \frac{1}{2} (m_1 + m_2) v_f^2$

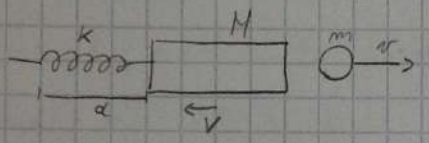
$$E_{dis} = \frac{1}{2} m v_{1i}^2 - \frac{1}{2}(m_1+m_2) v_f^2 =$$

$$\frac{1}{2} m v_{1i}^2 - \frac{1}{2}(m_1+m_2)\frac{m_1^2 v_{1i}^2}{(m_1+m_2)^2} =$$

$$= \frac{1}{2} m v_{1i}^2 \left(1 - \frac{m_1}{m_1+m_2}\right) = \frac{1}{2} m_1 v_{1i}^2 \left(\frac{m_1+m_2-m_1}{m_1+m_2}\right) = \frac{1}{2} m_1 v_{1i}^2 \left(\frac{m_2}{m_1+m_2}\right)$$

$$E_{dis} = \frac{1}{2} 0{,}01 \cdot 10^2 \left(\frac{0{,}02}{0{,}03}\right) = 0{,}33\ J$$

Exercício 7



$M = 500\,kg$

$k = 10^7\ \frac{N}{m}$

$m = 500g = 0{,}5\,kg$

$v = 300\ \frac{m}{s}$

$\Delta P = \Delta P$

$MV = mv \rightarrow V = \frac{mv}{M} = 0{,}3\ \frac{m}{s}$

$E_c = E_k$

$E_c = \frac{1}{2} m V^2 \qquad E_k = \frac{1}{2} k d^2$

$\frac{1}{2} m V^2 = \frac{1}{2} k d^2 \rightarrow d = \sqrt{\frac{m V^2}{k}} = 0{,}002\ m$