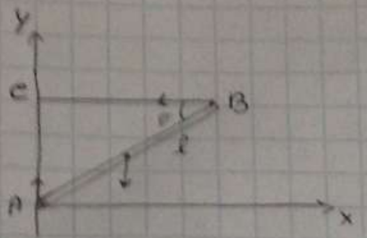
Questionario di fisica n°8 — Michele Di Luca

Esercizio 1



$m = 1kg$

$(AB): l = 1m$

$(BC): 50cm = 0,5m$

Forze

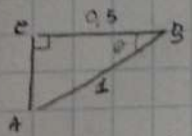
$\vec{R} + \vec{P} + \vec{T} = 0$

$x)\ -T + R_x = 0 \rightarrow R_x = T$

$y)\ R_y - Mg = 0 \rightarrow R_y = Mg$

Momenti

$z)\ -\frac{L}{2} Mg \cos\theta + LT \sin\theta = 0 \rightarrow T = \frac{Mg}{2tg\theta}$



$AC = \sqrt{AB^2 - BC^2} = \sqrt{1 - 0,25} = 0,87\ m$

$tg\theta = \frac{AC}{BC} = \frac{0,87}{0,5} = 1,74$

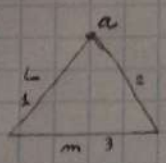
$T = \frac{Mg}{2tg\theta} = \frac{1 \cdot 9,82}{2 \cdot 1,74} = 2,8N$

$R = \sqrt{R_x^2 + R_y^2} = \sqrt{2,8^2 + 9,82^2} \simeq 10N$

$R_y = Mg = 1 \cdot 9,82 = 9,82N$

$R_x = T = 2,8N$

Esercizio 2



Momento d'inerzia

$I_a = I_1 + I_2 + I_3$

$I_1 = I_c + Md^2$

$= \frac{1}{12} mL^2 + m\left(\frac{L}{2}\right)^2 = \frac{1}{3} mL^2$

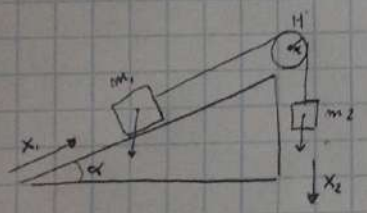
$I_2 = \frac{1}{12} mL^2 + m\left(\frac{L}{2}\right)^2 = \frac{1}{3} mL^2$

$I_3 = \frac{1}{12} mL^2 + m\left(\frac{L\sqrt{3}}{2}\right)^2 = \left(\frac{1}{12} + \frac{3}{4}\right) mL^2 = \frac{5}{6} mL^2$

$I_a = \frac{1}{3} mL^2 + \frac{1}{3} mL^2 + \frac{5}{6} mL^2 = \left(\frac{1}{3} + \frac{1}{3} + \frac{5}{6}\right) mL^2$

$= \frac{3}{2} mL^2$

Esercizio n° 3



$M = 10\,kg$
$r = 10\,cm = 0{,}1\,m$
$m_1 = m_2 = 2\,kg$
$\alpha = 30°$

Eq. Forze massa 1

$P + T = ma$

$x_1) \; -mg \sin\alpha + T = ma$

Eq Forze massa 2

$P + T = ma$

$x_2) \; mg - T = ma$

Momento

$=) \; T_2 r - T_1 r = I_a \alpha \rightarrow (T_2 - T_1) r = \frac{1}{2} M r^2 \cdot \alpha$

$v = \omega r$ $\qquad$ $\alpha = \frac{a}{r}$

$a = \alpha r$

$$(T_2 - T_1) r = \frac{1}{2} M r^2 \frac{a}{r} \rightarrow (T_2 - T_1) = \frac{1}{2} M a$$

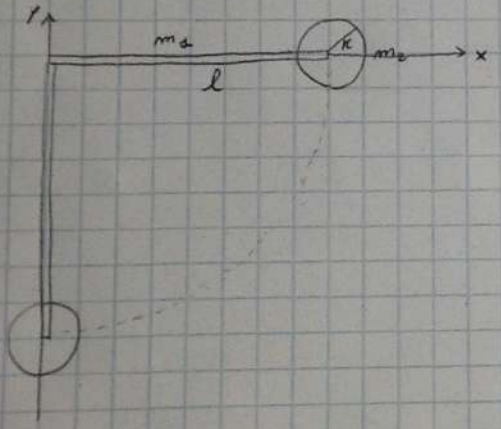
$$\begin{cases} (T_2 - T_1) = \frac{1}{2} M a \\ -mg \sin\alpha + T = ma \\ mg - T = ma \end{cases}$$

$$-mg \sin\alpha + mg = \left(2m + \frac{1}{2} M\right) a$$

$$mg (1 - \sin\alpha) = \left(2m + \frac{1}{2} M\right) a$$

$$a = \frac{mg(1-\sin\alpha)}{\left(2m + \frac{1}{2} M\right)} = \frac{2 \cdot 9{,}82 (1 - 0{,}5)}{\left(2 \cdot 2 + \frac{1}{2} 10\right)} = 1{,}09 \frac{m}{s^2}$$

Quesito n° 4



$m_1 = 1\,kg$
$l = 1\,m$
$m_2 = 1\,kg$
$r = 10\,cm = 0{,}1\,m$

$I_a = I_{sbarretta} + I_{disco}$

$$I_{sbarretta} = \frac{1}{12} m_1 l^2 + m_1 \left(\frac{l}{2}\right)^2 = \frac{1}{3} m_1 l^2$$

$$I_{disco} = \frac{1}{2} m_2 r^2 + m_2 l^2 = m_2 \left(\frac{r^2}{2} + l^2\right)$$

$$I_a = \frac{1}{3} m_1 l^2 + m_2 \left(\frac{r^2}{2} + l^2\right) = \frac{1}{3} + 1 = \frac{4}{3}$$

$$x_c = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} = \frac{1 \cdot \frac{l}{2} + 1 \cdot l}{2} = \frac{3}{4} l$$

Stato A = $Mg\,L$

Stato B = $\frac{1}{2} I_a \omega^2 + Mg \frac{3}{4} l$

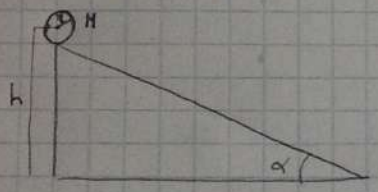
$\Downarrow$

$\frac{1}{2} I_a \omega^2 = Mg \frac{3}{4} l \rightarrow \omega = \sqrt{\frac{3\,Mg\,l}{2\,I_a}} = 4,7 \frac{rad}{s}$

$v = \omega r = 4,7 \cdot (l + r) \simeq 4,7 \frac{m}{s}$

$T = 2\pi \sqrt{\frac{I_a}{Mgl}} = 1,63\,s$

Esercizio n°5



$r = 2cm = 0,02\,m$
$M = 1kg$
$h = 30\,cm = 0,3\,m$
$\alpha = 45°$

Stato A = Mgh

Stato B = $E_K = \frac{7}{10} M v_e^2$

$E_K = \frac{1}{2} I_e \omega^2 + \frac{1}{2} M v_e^2 = \frac{1}{2} \frac{2}{5} M R^2 \frac{v_e^2}{R^2} + \frac{1}{2} M v_e^2 = \left(\frac{1}{5} + \frac{1}{2}\right) M v_e^2 =$

$= \frac{7}{10} M v_e^2$

$Mgh = \frac{7}{10} M v_e^2 \rightarrow v_e^2 = \frac{10}{7} \frac{Mgh}{M} \rightarrow v_e = \sqrt{\frac{10}{7} gh} = 2,05 \frac{m}{s}$