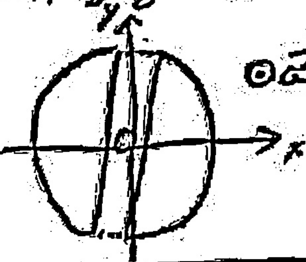
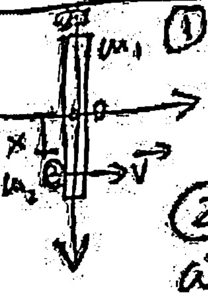
$m_1 = 9\,kg$ $m_2 = 1.5\,kg$ $\omega_0 = \dots \frac{}{s}$

conservazione momento angolare



$\odot\, \vec{\omega}_0$ $L_0 = I\omega_0 = \frac{m_1 r^2}{2}\omega_0 = L_1 = \frac{m_1 r^2}{2}\omega + m_2 r^2 \omega$

$\frac{m_1 r^2 \omega_0}{2} = r^2 \omega \left(\frac{m_1}{2} + m_2\right)$ $\omega = \frac{m_1 \omega_0}{m_1 + 2m_2} = \frac{54}{12}\frac{rad}{s} = 4.5\frac{rad}{s}$

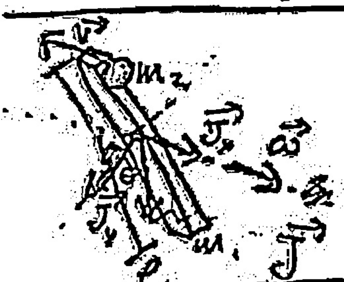


① $m_2 v = (m_1 + m_2) v_{cm}$ $v_{cm} = \frac{m_2}{m_1+m_2} v$ $r_{cm} = \frac{x m_2}{m_1 + m_2}$

$(x - r_{cm}) m_2 v = I\omega = \left(\frac{m_1 \ell^2}{12} + r_{cm}^2 m_1 + m_2 (x - r_{cm})^2\right)\omega$ $\omega = \frac{(x - r_{cm}) m_2 v}{I}$

② $m_1 = m_2 = m$ $x = r$ $r m v = I\omega = \left(\frac{m\ell^2}{12} + m r^2\right)\omega$

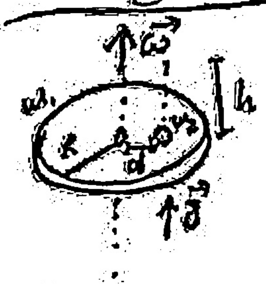
$\omega = \frac{r v}{\frac{\ell^2}{12} + r^2}$ $J = \Delta p = m\omega r - mv$



$J_x = \Delta p_x = -m_2 v$

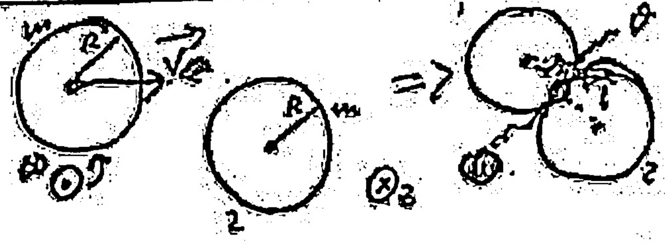
$I\omega = I'\omega'$ $\frac{m_1 \ell^2}{12}\omega = \left(\frac{m_1 \ell^2}{12} + \frac{m_2 \ell^2}{4}\right)\omega'$ $\omega' = \frac{m_1 \omega}{m_1 + 3m_2}$

$J_y = \Delta p_y = m_2 \omega' \frac{\ell}{2}$ $J = \sqrt{J_x^2 + J_y^2}$ $\theta = \arcsin\frac{J_x}{J}$



$I\omega = I_1 \omega'$ $\frac{1}{2} m_1 R^2 \omega = \left(\frac{1}{2} m_1 R^2 + m_2 d^2\right)\omega'$ $\omega' = \frac{m_1 R^2 \omega}{m_1 R^2 + 2 m_2 d^2}$

$J_y = m_2 \sqrt{2gh}$ Impulso angolare $= J_y d$



1: m, R, $v = v$, $\omega = 0$

2: m, R, $v = 0$ $\omega = 0$

1,2: $cm \equiv O$, $v = v_{cm}$, ω

$mv = 2m v_{cm}$ $v_{cm} = \frac{v}{2}$ Polo: O $L_i = Rmv\sin\theta - I\omega = \sin\theta\, Rmv - \frac{1}{2} m R^2 \omega$

$L_f = 0$ $\Rightarrow \sin\theta\, R m v = \frac{m R^2 \omega}{2}$ $\omega = \frac{2v\sin\theta}{R}$ $\omega = \frac{v}{R}$

$2R\sin\theta = R$ $\sin\theta = \frac{1}{2}$ $\theta = \frac{\pi}{6}$

$\frac{GM}{R^2} = \frac{v^2}{R}$ $T = \frac{2\pi R}{v}$ $T^2 = \frac{4\pi^2 R^2}{v^2} = \frac{4\pi^2}{GM} R^3$

$P = m v_{cm} = 0$ $L = 3Rmv_m$

$\frac{mv^2}{R} = \frac{GMm}{R^2} + \frac{2Gm^2}{(2R\sin\frac{\pi}{3})^2} = \frac{GMm}{R^2} + \frac{2Gm^2}{3R^2}$ $v_m = \sqrt{\frac{G}{R}\left(M + \frac{2}{3}m\right)}$

$T = \frac{2\pi r}{v}$

E_p $\frac{1}{\mu} = \frac{1}{M} + \frac{3}{m} = \frac{m + 3M}{Mm}$ $\mu = \frac{Mm}{m + 3M}$ $E_p = -3\frac{GMm}{R} - 3\frac{Gm^2}{\sqrt{3}R}$