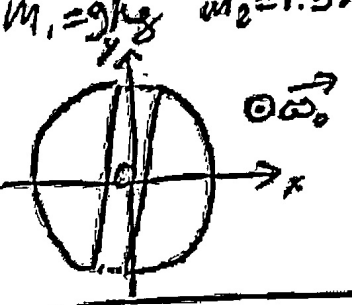
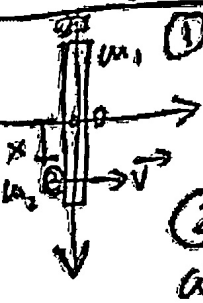
$m_1 = 2m_2$ $m_2 = 1.5\,kg$ $\omega_0 = \frac{3}{5}$



Conservazione momento angolare

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

$\frac{m_1 r^2 \omega_0}{2} = r^2\omega\left(\frac{m_1}{2} + m_2\right)$ $\omega = \frac{m_1\omega_0}{m_1 + 2m_2} = \frac{\frac{3}{5}\pi}{3} \frac{rad}{s} = 4.5 \frac{rad}{s}$



① $m_2 V = (m_1 + m_2) V_{cm}$ $V_{cm} = \frac{m_2}{m_1 + m_2} V$ $r_{cm} = \frac{x m_2}{m_1 + m_2}$

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

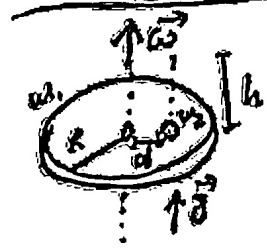
② $m_1 = m_2 = m$ $x = \frac{\ell}{2}$ $r_{cm} m V = I\omega = \left(\frac{m\ell^2}{12} + \frac{m}{4}r^2\right)\omega$

$\omega = \frac{r m V}{\frac{\ell^2}{12} + \frac{r^2}{4}}$ $J = \Delta P = m\omega r - mV$

$J_x = \Delta P_x = -m_2 V$

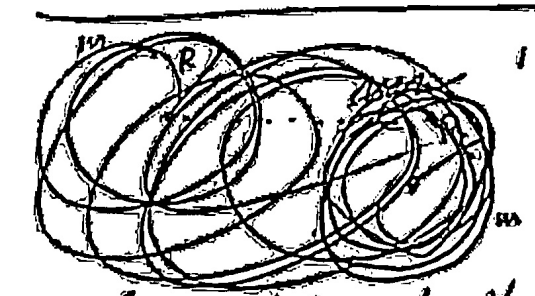
$I\omega = I'\omega'$ $\frac{m_1 \ell^2}{12}\omega = \left(\frac{m_1 \ell^2}{12} + \frac{m_2 \ell^2}{4}\right)\omega'$ $\omega' = \frac{m_1 \omega}{m_1 + 3m_2}$

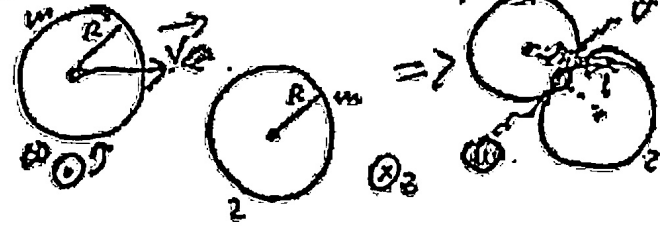
$J_y = \Delta P_y = m_2 \omega' \frac{\ell}{2}$ $J = \sqrt{J_x^2 + J_y^2}$ $\theta = \arcsin \frac{J_x}{J}$



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

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





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

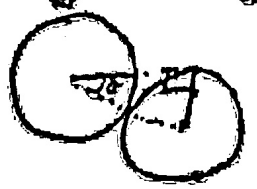
2: m, R, $V = 0$ $\omega = 0$

1+2: $CM \equiv O$, $V = V_{cm}$, $\omega =$

$m V = 2m V_{cm}$ $V_{cm} = \frac{V}{2}$ Polo: O $L_i = R m V \sin\theta - I\omega = \frac{\sin\theta}{R} R m V - \frac{1}{2} m R^2 \omega$

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

$\omega = \frac{V}{R}$



$2R \sin\theta = R$

$\sin\theta = \frac{1}{2}$

$\theta = \frac{\pi}{6}$

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

$P = m V_{cm} = 0$ $L = 3 R m V_m$

$\frac{m V^2}{R} = \frac{G M m}{R^2} + \frac{2 G m^2}{(2R\sin\frac{\pi}{3})^2} = \frac{G M m}{R^2} + \frac{2 G m^2}{3R^2}$ $V_m = \sqrt{\frac{G}{R}\left(M + \frac{2}{3}m\right)}$

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

$E_p = 0$ $\frac{1}{\mu} = \frac{1}{M} + \frac{3}{m} = \frac{m + 3M}{Mm}$ $\mu = \frac{Mm}{m + 3M}$ $E_p = -3\frac{G M m}{R} = 3\frac{G m^2}{\sqrt{3}R}$