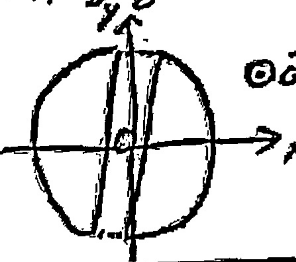
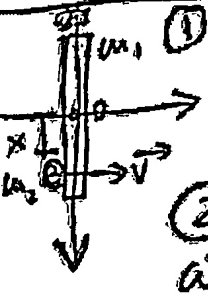
$m_1 = 9\,kg \quad m_2 = 1.5\,kg \quad \omega_0 = \ldots \frac{rad}{s}$

conservazione momento angolare



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

$\frac{m_1 \cancel{r^2} \omega_0}{2} = \cancel{r^2}\omega\left(\frac{m_1}{2} + m_2\right) \quad \omega = \frac{m_1 \omega_0}{m_1 + 2m_2} = \frac{\frac{9}{5}\pi}{12} \frac{rad}{s} = 4.5 \frac{rad}{s}$



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

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

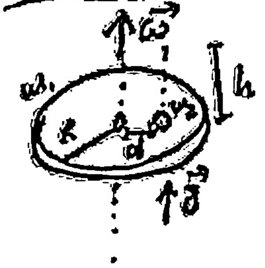
② $m_1 = m_2 = m \quad x = r \quad r \cancel{m} V = I\omega = \left(\frac{\cancel{m}\ell^2}{12} + \cancel{m} r^2\right)\omega$

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

$J_x = \Delta p_x = -m_2 V$

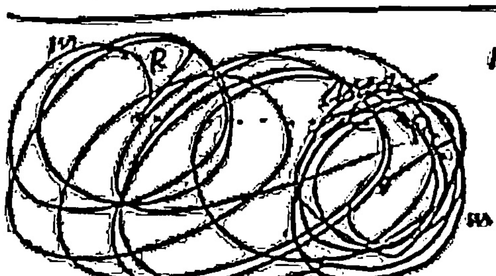
$I\omega = I'\omega' \quad \frac{m_1 \ell^2}{12}\omega = \left(\frac{m_1 \ell^2}{12} + \frac{m_2 \ell^2}{4}\right)\omega' \quad \omega' = \frac{m_1 \omega}{m_1 + 3m_2}$

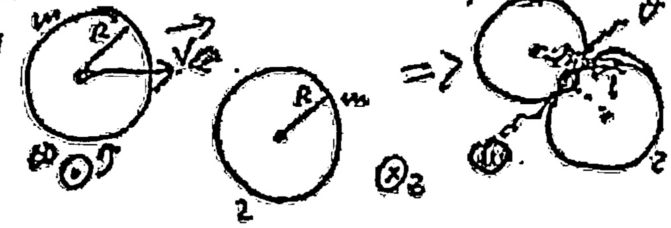
$J_y = \Delta p_y = m_2 \omega' \frac{\ell}{2} \qquad J = \sqrt{J_x^2 + J_y^2} \quad \theta = \arcsin \frac{J_x}{J}$



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

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





1: $m, R, V = V, \omega = 0$
2: $m, R, V = 0, \omega = 0$
1,2: $cm \equiv O, V = V_{cm}, \omega$

$\cancel{m} V = 2\cancel{m} V_{cm} \quad V_{cm} = \frac{V}{2}$

Polo: $O \quad L_i = RmV\sin\theta - I\omega = \sin\theta\, RmV - \frac{1}{2} m R^2 \omega$

$L_f = 0 \quad \Rightarrow \sin\theta\, RmV = \frac{mR^2\omega}{2} \quad \omega = \frac{2V\sin\theta}{R}$

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

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

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

$P = m V_{cm} = 0 \qquad L = 3RmV_m$

$\frac{\cancel{m}V^2}{R} = \frac{GMm}{R^2} + \frac{2Gm^2}{(2R\sin\frac{\pi}{3})^2} = \frac{GM\cancel{m}}{R^2} + \frac{2Gm^2}{3R^2} \quad V_m = \sqrt{\frac{G}{R}\left(M + \frac{1}{3}m\right)}$

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

$E_{p0} \quad \frac{1}{\mu} = \frac{1}{M} + \frac{3}{m} = \frac{m + 3M}{Mm} \quad \mu = \frac{Mm}{m + 3M} \qquad E_{p0} = 3\frac{GMm}{R} + 3\frac{Gm^2}{\sqrt{3}R}$