$$\frac{W}{E_{k0}} = \frac{W}{\frac{mJ_0^2}{2}} = \frac{\frac{J_0^2}{2}\frac{mM}{m+M}}{\frac{mJ_0^2}{2}} = \frac{M}{m+M} \to 1$$

2) ① → ②

ЗСЭ:

$$\frac{(m+M)J^2}{2} = (m+M)gh \; ; \; h = L(1-\cos\alpha)$$

$$J = \sqrt{2gL(1-\cos\alpha)}$$

$$\frac{M}{m+M} J_0 = \sqrt{2gl(1-\cos\alpha)}$$

$$J_0 = \frac{m+M}{m}\sqrt{2gl(1-\cos\alpha)} = \sqrt{2gl(1-\cos\alpha)} +$$

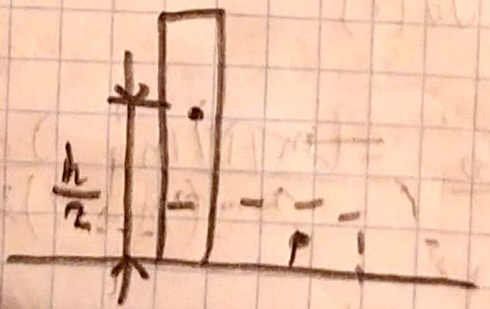
$$+ \frac{M}{m}\sqrt{2gl(1-\cos\alpha)}$$

№3 – 9

① $h = 3$ м

$M = 500$ кг

$J - ?$



$\frac{mgh}{2} = \frac{Iw^2}{2}$

$mgh = \frac{mh^2}{3} w^2$

$w = \sqrt{3\frac{g}{h}}$

$v = wh = \sqrt{3gh} =$

$= \sqrt{3 \cdot 9{,}81 \cdot 3} = \sqrt{81{,}9} \approx 9{,}39 м/с$

$L = Iw = \frac{mh^2}{3} \sqrt{\frac{3g}{h}} =$

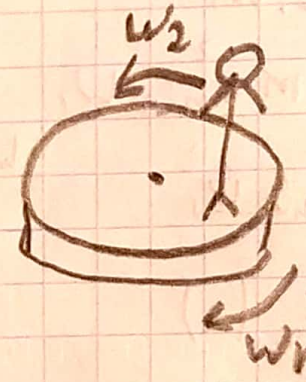
$= \frac{50 \cdot 9^3}{3} \sqrt{\frac{3 \cdot 9{,}81}{3}} \approx 470 кг \cdot м^2/с$

(2) $m_п = 240 кг$

$m_г = 60 кг$

$\varphi_2 = 2\sqrt{J1}$

$\varphi_п = ?$



$\vec{L} = const$

$0 = \vec{L_2} + \vec{L_п}$

$0 = L_2 - L_п$

$L_2 = L_п$

$I_п w_п = I_г w_г$

$\frac{1}{2} m_п R^2 w_п = m_г R^2 w_г$

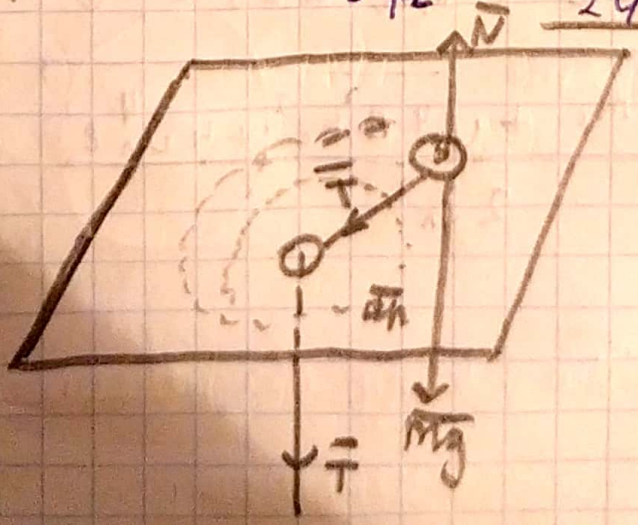
$w = \frac{\Delta\varphi}{\Delta t}$

$\frac{m_п \Delta\varphi_п}{2\Delta t} = \frac{m_г \Delta\varphi_г}{\Delta t}$

$\Delta\varphi_п = 2\frac{m_г}{m_п}\Delta\varphi_г = 2 \cdot \frac{60}{240} \cdot 2\sqrt{J1} = \sqrt{J1}$

(3) m, r_0, w_0

$T(r) = ?$



$L = const$ $\quad \bar{\Sigma} f = ma$

$I_1 w_1 = I_0 w_0$ $\quad x: T = m a_n$ $\quad a_n = w^2 r$

$m r^2 w = m r_0^2 w_0$ $\quad T = m w^2 r$

$w = w_0 \frac{r_0^2}{r^2}$ $\quad T = m w_0^2 \frac{r_0^4}{r^4} r = m w_0^2 \frac{r_0^4}{r^3}$

$T(r) = m w_0^2 r_0^4 \cdot \frac{1}{r^3}$

④ $\underline{J_n, \ell}$ / r_{min} $\quad I_0 w_0 = I_1 w_1$ $\quad I_0 = m \ell^2$

$m \ell^2 w_0 = m r_{min}^2 w_1$

$\ell^2 w_0 = r_{min}^2 w_1$ $\quad w_0 = \frac{J_n}{\ell}$ (1)

$w_1 = \frac{J_n \ell}{r_{min}^2}$ (2)

$\frac{I_0 w_0^2}{2} = -G \frac{m_c m}{r_{min}} + \frac{I_1 w_1^2}{2}$

$\frac{m \ell^2 w_0^2}{2} = -G \frac{m_c m}{r_{min}} + \frac{m r_{min} w_1^2}{2}$ (3)

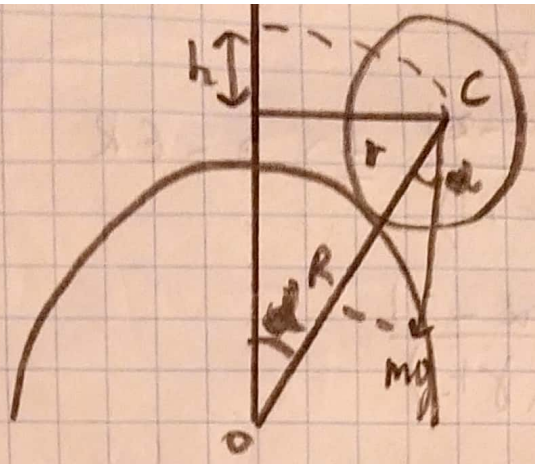
Из 1 и 2 получим 3

$J_n^2 r_{min}^2 + 2 G m_c r_{min} - J_0^2 \ell^2 = 0$

$r_{min} = \frac{-2 G m_c + \sqrt{4 G^2 m_c^2 + 4 J_n^4 \ell^2}}{2 J_n^2}$

5. m, R

ω



$$\frac{mv^2}{R+r} = mg\cos\alpha$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$I = \frac{2}{5}mr^2 \quad v = \omega r \quad h = (R+r)(1-\cos\alpha)$$

$$\omega = \sqrt{\frac{10g(R+r)}{17r^2}}$$

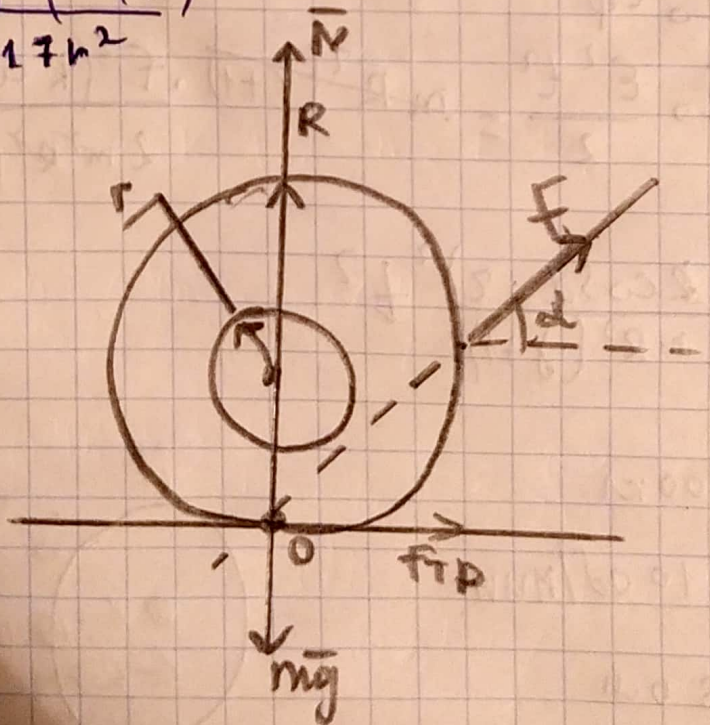
6. m

R

$I = \gamma m R^2$

α - ?

A_f - ?



O - ось вращения

$$M_f = I\varepsilon \quad I = I_c + mR^2 = \gamma m R^2 + mR^2 = mR^2(\gamma + 1)$$

$l = R\cos\alpha - r$

$\varepsilon = \frac{f(R\cos\alpha - r)}{R^2(\gamma+1)} \Rightarrow a = \varepsilon R$

$a = \frac{f(R\cos\alpha - r)}{mR(\gamma+1)}$

1) $A = f \cdot S\cos\alpha$

$A = M\varphi$

2) $A_f = \Delta E_k$

$A_f = f l$ $\qquad \varphi = \frac{\varepsilon t^2}{2}$

$A_f = I_0 \varepsilon\varphi$

$A_f = I_0 \frac{\varepsilon^2 t^2}{2} = \cancel{mR^2(\gamma+1)} \cdot \frac{f^2(R\cos\alpha - r)^2}{2m^2R^2(\gamma+1)^2} t^2 =$

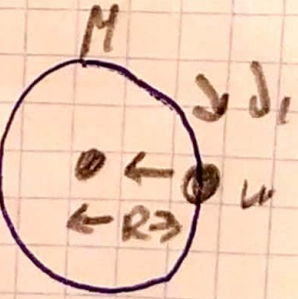
$= \frac{f^2(R\cos\alpha - r)^2}{2mR^2(\gamma+1)} t^2$

7. $M = 100$ кг

$\nu_1 = 10$ об/мин

$m = 6$ см

$\nu_2 - ?$



По закону сохранения момента импульса

$I_1 \omega_1 + I_2 \omega_1 = I_2 \omega_2$ $\quad I_1 = \frac{MR^2}{2}$ $\quad I_2 = \frac{MR^2}{2}$

$I_2 = mR^2$

$\frac{MR^2}{2}\omega_1 + mR^2\omega_1 = \frac{MR^2}{2}\omega_2$

$\omega_2 = \frac{M+2m}{M}\omega_1 = \frac{220}{100} \cdot 10\ об/мин = 22\ об/мин$

(8) $\omega_A = 0{,}5\ рад/с$

$I_k = 1{,}6\ кг \cdot м^2$

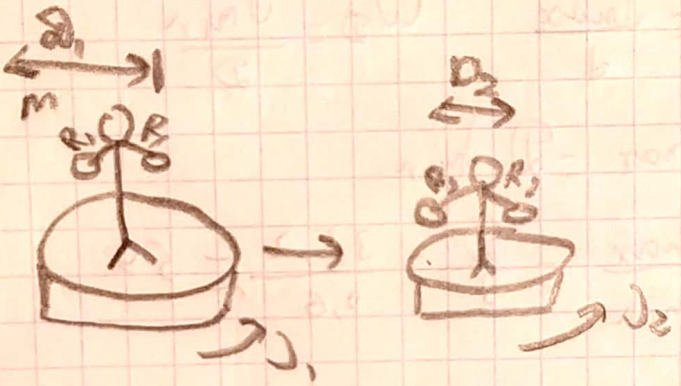
$I_c = 2\ кг \cdot м^2$

$m = 2\ кг$

$D_1 = 1{,}6\ м$

$D_2 = 0{,}4\ м$

$\omega_2 - ?$



По закону:

$I_2 \omega_1 + I_c \omega_1 + I_1 \omega_1 = I_k \omega_2 + I_c \omega_2 + I_2 \omega_2$

$I_1 = 2m\frac{D_1^2}{4}$; $I_2 = 2m\frac{D_2^2}{4}$

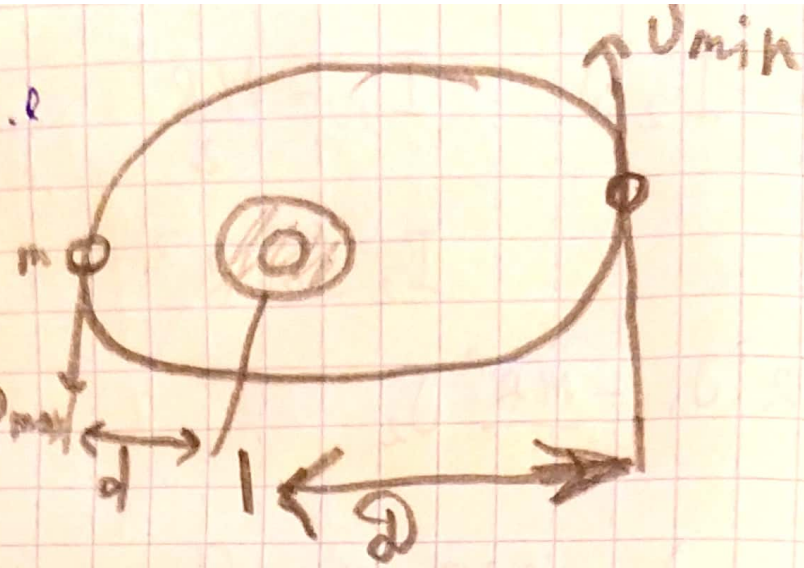
$(I_2 + I_c + I_1)\omega_1 = (I_k + I_c + I_2)\omega_2$

$\omega_2 = \frac{I_2 I_c + I_1}{I_2 + I_c + I_2}$ $\quad \omega_1 = 0{,}82\ рад/с$

9) $D = 35{,}2$ а.е

$d = 0{,}6$ а.е

$\frac{J_{max}}{J_{min}} - ?$



$I_d \omega_d = I_D \omega_D$

$d^2 \omega_d = D^2 \omega_D$

$\omega_d = \frac{J_{max}}{d}$ $\omega_D = \frac{J_{min}}{D}$

$d J_{max} = D J_{min}$

$\frac{J_{max}}{J_{min}} = \frac{D}{d} = \frac{35{,}2}{0{,}6} \approx 59$