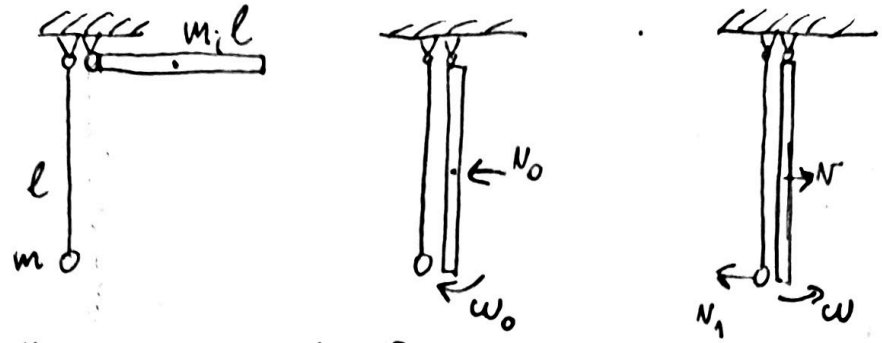
(F1.)



mid ütközés előtt: $mg\frac{l}{2} = \frac{1}{2}\cdot\frac{1}{3}ml^2\omega_0^2 \rightarrow \omega_0 = \sqrt{\frac{3g}{l}}$; $v_0 = \frac{l}{2}\omega_0 = \sqrt{\frac{3gl}{4}}$

perületmegmaradás a felfüggesztésre:

$$\frac{1}{3}ml^2\omega_0 = mv_1 l - \frac{1}{3}ml^2\omega^2 \rightarrow l\omega_0 = 3v_1 - l\omega \quad (1)$$

energiamegmaradás:

$$\frac{1}{2}\cdot\frac{1}{3}ml^2\omega_0^2 = \frac{1}{2}mv_1^2 + \frac{1}{2}\cdot\frac{1}{3}ml^2\omega^2 \rightarrow l^2\omega_0^2 = 3v_1^2 + l^2\omega^2 \quad (2)$$

(1): $l\omega = 3v_1 - l\omega_0$; (2)-be ezt beírva:

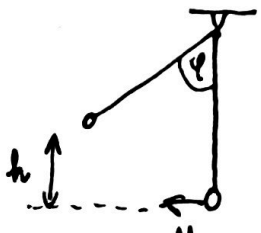
$$l^2\omega_0^2 = 3v_1^2 + (3v_1 - l\omega_0)^2$$

$$l^2\omega_0^2 = 3v_1^2 + 9v_1^2 + l^2\omega_0^2 - 6v_1 l\omega_0$$

$$12v_1^2 = 6v_1 l\omega_0 \rightarrow v_1 = \frac{l\omega_0}{2}$$

Valamint: $\omega = \frac{3v_1}{l} - \omega_0 = \frac{1}{2}\omega_0$

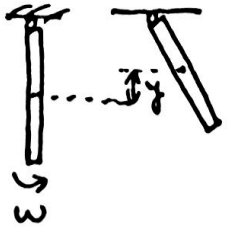
<u>fonálinga kilendülése:</u>



$\frac{1}{2}mv_1^2 = mgh$

$h = \frac{v_1^2}{2g} = \frac{l^2\omega_0^2}{8g} = \frac{l^2}{8g}\cdot\frac{3g}{l} = \frac{3}{8}l$

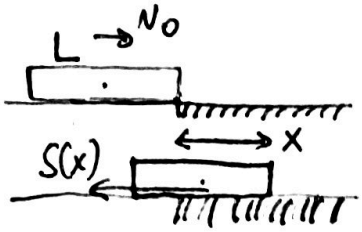
<u>rúd kilendülése:</u>



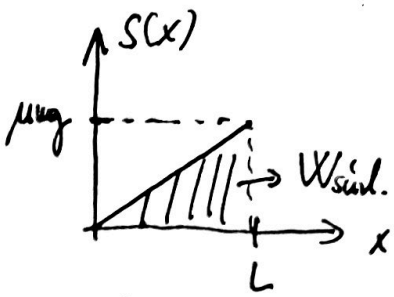
$\frac{1}{2}\cdot\frac{1}{3}ml^2\omega^2 = mgy$

$y = \frac{l^2\omega^2}{6g} = \frac{l^2}{6g}\cdot\frac{\omega_0^2}{4} = \frac{l^2}{24g}\cdot\frac{3g}{l} = \frac{l}{8}$

(F2)



súrlódási erő: $S(x) = \mu mg \cdot \frac{x}{L}$

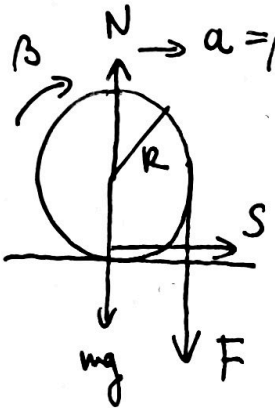


$$|W_{súrl}| = \frac{\mu mg}{2} \cdot L$$

munkatétel: $W_{súrl} = \Delta E_{kin}$

$$-\frac{\mu mgL}{2} = -\frac{1}{2} m v_0^2 \rightarrow \underline{\underline{v_0 = \sqrt{\mu g L}}}$$

(F3)



$a = \beta R$ (tisztán gördül)

$$\left.\begin{array}{l} S = ma \\ (F-S)R = \frac{1}{2} m R^2 \beta \end{array}\right\} F = \frac{3}{2} ma \rightarrow ma = \frac{2}{3} F$$

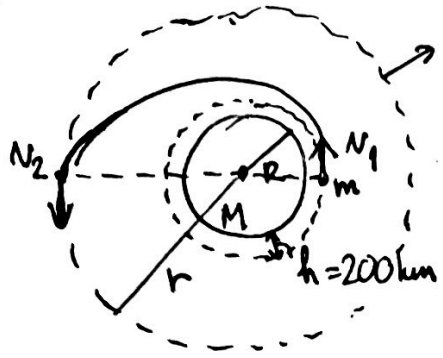
$$S \leq \mu_0 N = \mu_0 (mg + F)$$

$$\frac{2}{3} F \leq \mu_0 mg + \mu_0 F$$

$$\underline{\underline{F \leq \frac{\mu_0 mg}{\frac{2}{3} - \mu_0}}}$$

$$\underline{\underline{a = \frac{2}{3} \frac{F}{m} = \frac{2}{3} \cdot \frac{\mu_0 g}{\frac{2}{3} - \mu_0} = \frac{\mu_0}{1 - \frac{3}{2}\mu_0} g}}$$

F4.



→ geostacionárius pálya: $T = 24h$

$$\frac{\gamma mM}{r^2} = m\omega^2 r = m\frac{4\pi^2}{T^2} r$$

$$r = \sqrt[3]{\frac{\gamma M}{4\pi^2} T^2} \approx 42300\,km$$

$$\frac{T^2_{ellipszis}}{a^3} = \frac{T^2}{r^3}$$

Az ellipszis fél nagytengelye:

$$r + R + h = 2a \rightarrow a \approx 24500\,km$$

$$t = \frac{T_{ellipszis}}{2} = \frac{1}{2} \cdot T \cdot \left(\frac{a}{r}\right)^{3/2} \approx 0{,}22\,T = \underline{\underline{5{,}3\,óra}}$$

$=\downarrow$ Kepler II.