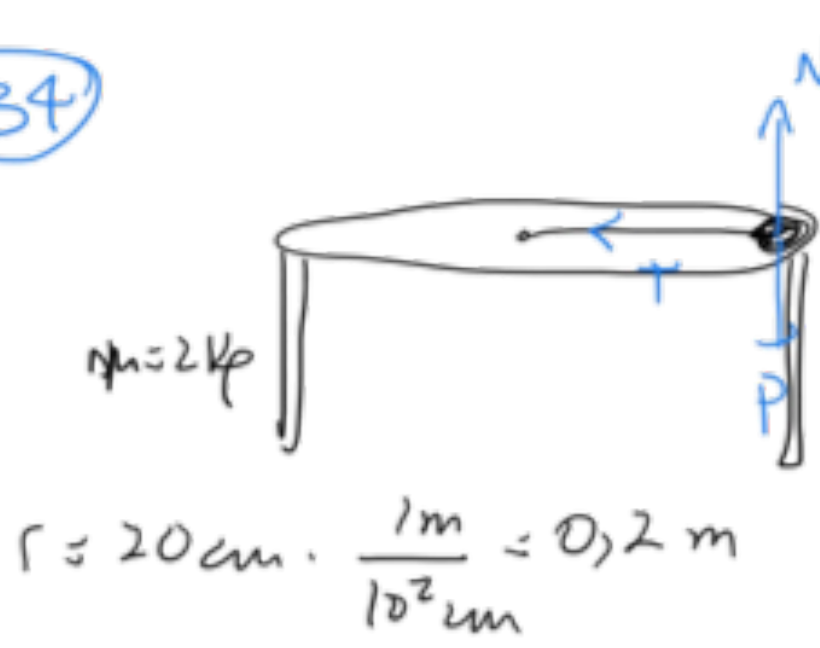


34



$$r = 20 \text{ cm} = \frac{1 \text{ m}}{10^2 \text{ cm}} = 0,2 \text{ m}$$

$$\omega = 5 \text{ rpm}$$

$$\frac{5 \text{ rev}}{\text{min}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} \cdot \frac{1 \text{ min}}{60 \text{ s}} = \frac{\pi}{6} \text{ rad/s} \quad \text{moment } T = |T|$$

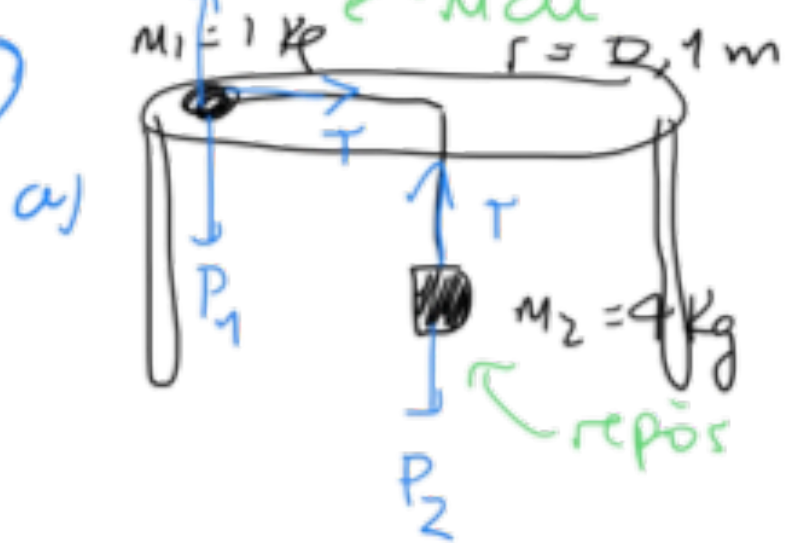
eix X $T = m \cdot a_n$

$$T = m \cdot \omega^2 \cdot r$$

$$T = 2 \cdot \left(\frac{\pi}{6}\right)^2 \cdot 0,2$$

$$[T = 0,11 \text{ N}]$$

35



eix X: $T = m_1 \cdot a_n$

eix Y $P_2 - T = m_2 \cdot a$

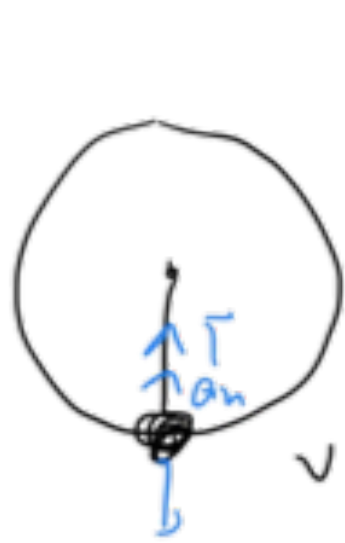
$$T = P_2 - m_2 \cdot a \quad a = 0$$

$$T = m_2 g = 4 \cdot 9,8 = 39,2 \text{ N}$$

c) $a_n = \frac{T}{m_1} = [39,2 \text{ m/s}^2]$ $v = \sqrt{\frac{T \cdot r}{m_1}} = \sqrt{\frac{39,2 \cdot 0,1}{1}} = [1,98 \text{ m/s}]$

$a_t = 0 \rightarrow$ no és MCA!

36



$m = 3 \text{ kg}$

$r = 2 \text{ m}$

eix Y

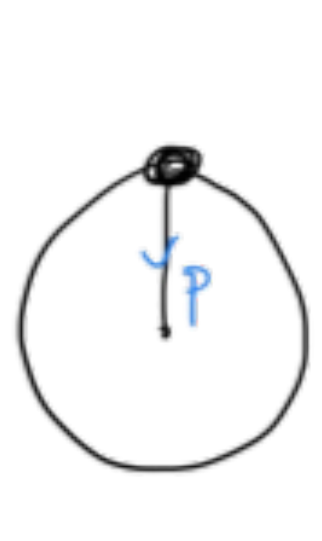
a) $T - P = m \cdot a_n$

$$T - P = m \cdot \frac{v^2}{r}$$

$$T = P + m \frac{v^2}{r}$$

$$T = 3 \cdot 9,8 + 3 \cdot \frac{20^2}{2} = [629,4 \text{ N}]$$

b)



Velocitat
punt més alt

$T = 0 \text{ N}$

$P = m \cdot a_n$

$mg = m \cdot a_n$

$$g = \frac{v^2}{r}$$

$$v = \sqrt{rg} = \sqrt{2 \cdot 9,8} = [4,43 \text{ m/s}]$$

37

$$25 \text{ g} \cdot \frac{1 \text{ kg}}{10^3 \text{ g}} = 0,025 \text{ kg}$$

$$20 \text{ cm} \cdot \frac{1 \text{ m}}{10^2 \text{ cm}} = 0,2 \text{ m}$$

$$v = 4 \text{ m/s}$$



a)

$$P + T = m \cdot a_n = m \frac{v^2}{r}$$

$$mg + T = m \frac{v^2}{r}; T = m \frac{v^2}{r} - mg = m \left(\frac{v^2}{r} - g \right)$$

$$T = 0,025 \cdot \left(\frac{4^2}{0,2} - 9,8 \right) = [1,755 \text{ N}]$$

b)

Velocitat al punt
més alt $T = 0 \text{ N}$

$P = m \cdot a_n = m \cdot \frac{v^2}{r}$

$mg = m \cdot \frac{v^2}{r}$

$$v = \sqrt{r \cdot g} = \sqrt{0,2 \cdot 9,8} = [1,4 \text{ m/s}]$$

38

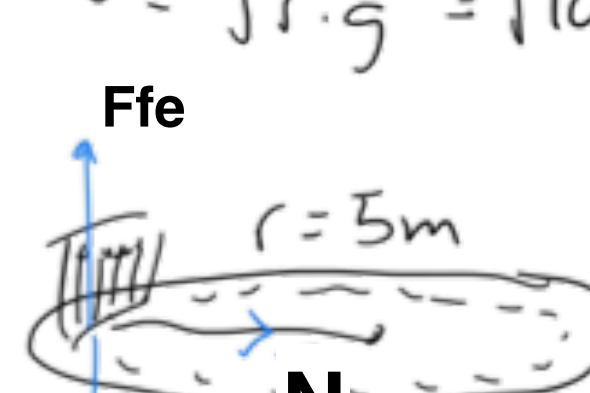
El water cas!

$P = m \cdot a_n = m \cdot \frac{v^2}{r}$

$mg = m \cdot \frac{v^2}{r}$

$$v = \sqrt{r \cdot g} = \sqrt{10 \cdot 9,8} = [9,9 \text{ m/s}]$$

39



$\mu = 1$

eix X: $N = m \cdot a_n$

eix Y $P - F_{fe} = 0$

$$N = F_{fe} / \mu \quad N = mg / \mu$$

$N = m \cdot a_n$

$mg = m \cdot a_n$

$$g = \omega^2 \cdot r; \omega = \sqrt{\frac{g}{r}} = \sqrt{\frac{9,8}{5}} = [1,4 \text{ rad/s}]$$

b)

$m = 55 \text{ kg}$

$F_{fe} = m \cdot a_n = m \cdot \omega^2 \cdot r = 55 \cdot 1,4^2 \cdot 5 = 539 \text{ N}$

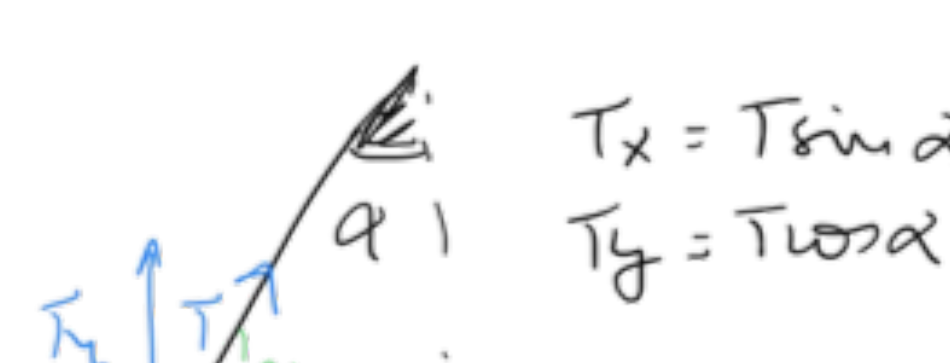
$$F_{fe} = 5 \cdot 539 = [2695 \text{ N}]$$

40

$$25 \text{ g} \cdot \frac{1 \text{ kg}}{10^3 \text{ g}} = 0,025 \text{ kg}$$

$$r = 56 \text{ cm} \cdot \frac{1 \text{ m}}{10^2 \text{ cm}} = 0,56 \text{ m}$$

$$\omega = \frac{5 \text{ rev}}{7 \text{ s}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} = \frac{10\pi}{7} \text{ rad/s}$$



$T_x = T \sin \alpha$

$T_y = T \cos \alpha$

eix Y $P - T \cos \alpha = 0 \rightarrow T \cos \alpha = mg$

eix X

$\frac{T \sin \alpha}{T \cos \alpha} = \frac{m \cdot a_n}{m \cdot g}$

$\frac{\sin \alpha}{\cos \alpha} = \frac{a_n}{g}$

$\tan \alpha = \frac{a_n}{g} = \frac{\omega^2 \cdot r}{g} = \frac{\left(\frac{10\pi}{7}\right)^2 \cdot 0,56}{9,8}$

$\tan \alpha = 1,15$

$\alpha = \arctan 1,15 = [49,01^\circ]$

$F_c = T_x = m \cdot a_n$

$F_c = 0,025 \cdot \omega^2 \cdot r$

$F_c = 0,025 \cdot \left(\frac{10\pi}{7}\right)^2 \cdot 0,56$

$[F_c = 0,28 \text{ N}]$

$T \sin \alpha = 0,28$

$T \sin 49^\circ = 0,28$

$T = \frac{0,28}{\sin 49^\circ} = [0,37 \text{ N}]$

41



a) $\omega? \quad \alpha = 37^\circ$

eix X $T_x = m \cdot a_n$

eix Y $P - T_y = 0 \rightarrow P = T_y$

$\frac{T \sin \alpha}{T \cos \alpha} = \frac{m \cdot a_n}{m \cdot g}$

$\tan \alpha = \frac{a_n}{g} = \omega^2 \cdot r$

$\omega = \sqrt{\frac{\tan \alpha \cdot g}{r}} = \sqrt{\frac{\tan 37^\circ \cdot 9,8}{3}}$

$[\omega = 1,77 \text{ rad/s}]$

$r'' = r \sin \alpha$

$r'' = 3 \sin 37^\circ$

$r = r' + r'' = 3 + 4 \sin 37^\circ = 5,4 \text{ m}$

b)

$T = \frac{m \cdot g}{\cos \alpha} = \frac{2 \cdot 9,8}{\cos 37^\circ} = [24,54 \text{ N}]$

c)

$T' = 796 \text{ N} \quad \text{eix Y} \quad P = T'_y = 796 \cos 37^\circ$

$P = 635,71 \text{ N}$

$Mg + mg = 635,71$

$Mg = 635,71 - 2 \cdot 9,8 = [616,11 \text{ N}]$

$M = \frac{616,11}{9,81} = [62,8 \text{ kg}]$

42

$m = 1400 \text{ kg}$

$r = 170 \text{ m} \quad (\text{corba})$

$v = \frac{60 \text{ km}}{\text{h}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} \cdot \frac{10^3 \text{ m}}{1 \text{ km}} = 16,6 \text{ m/s}$

$\mu = 0,5$

eix X $F_{fe} = m \cdot a_n$

eix Y $N - P = 0$

$F_{fe} = m \cdot \frac{v^2}{r} = 1400 \cdot \frac{(16,6)^2}{170}$

$[F_{fe} = 2288 \text{ N}]$

b)

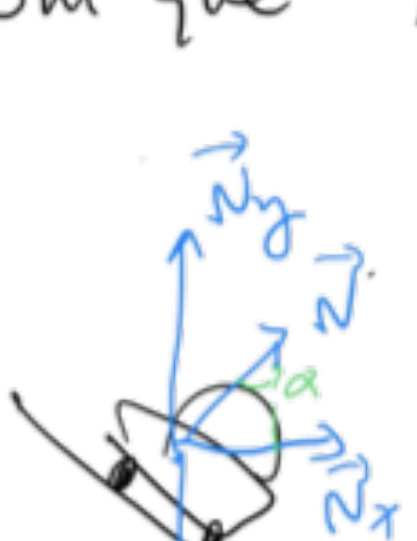
$F_{fe} = \mu mg$

$F_c = F_{fe}$

$F_{fe} = 0,5 \cdot 1400 \cdot 9,8 = 6860 \text{ N}$

Com que $F_{fe} \max > F_c$ no s'arrapara!

43



$r = 120 \text{ m}$

$v = \frac{90 \text{ km}}{\text{h}} \cdot \frac{10^3 \text{ m}}{1 \text{ km}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} = 25 \text{ m/s}$

$\mu = 0$ mínim peralt!

eix X $N_x = m \cdot a_n$

eix Y $P - N_y = 0 \rightarrow N_y = P$

$N \sin \alpha = m \cdot a_n$

$N \cos \alpha = m \cdot g$

$\tan \alpha = \frac{a_n}{g} = \frac{v^2}{r \cdot g}$

$\tan \alpha = \frac{25^2}{120 \cdot 9,8} = 0,53$

$\alpha = \arctan 0,53 = [27,99^\circ]$