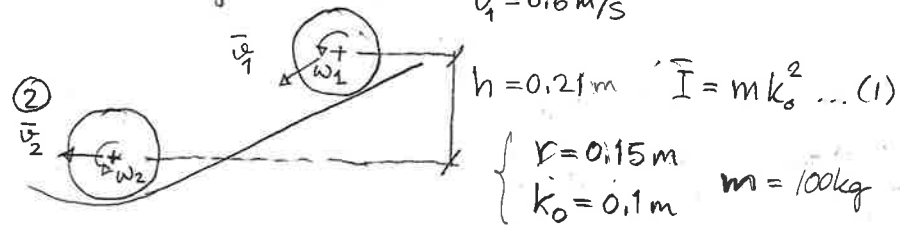


3) Energiberäkning ger hjulets hastighet i botten läget. ①  $\bar{v}_1 = 0.6 \text{ m/s}$



Energisatsen:  $\Delta E = 0$ ,  $W_{\text{ik}} = 0 \Rightarrow$

$$\Delta T + \Delta V_g = 0 \quad ; \quad \Delta V_g = mgh$$

Rullning utan glidning  $\Rightarrow \bar{v} = \omega r \dots (2)$

$$T = \frac{1}{2} m \bar{v}^2 + \frac{1}{2} I \omega^2 \quad (1) \text{ och } (2) \Rightarrow$$

$$T = \frac{1}{2} m \omega^2 r^2 + \frac{1}{2} m k_0^2 \omega^2 = \frac{1}{2} m (r^2 + k_0^2) \omega^2 = \\ = \frac{1}{2} \cdot 100 (0.15^2 + 0.1^2) \omega^2 = 1.625 \omega^2$$

Läge ①:  $(2) \Rightarrow \omega_1 = \frac{0.6}{0.15} = 4 \text{ rad/s}$

$$T_1 = 1.625 \cdot 4^2 = 26 \text{ J}$$

$$V_{g1} = mgh = 100 \cdot 9.81 \cdot 0.21 = 206 \text{ J}$$

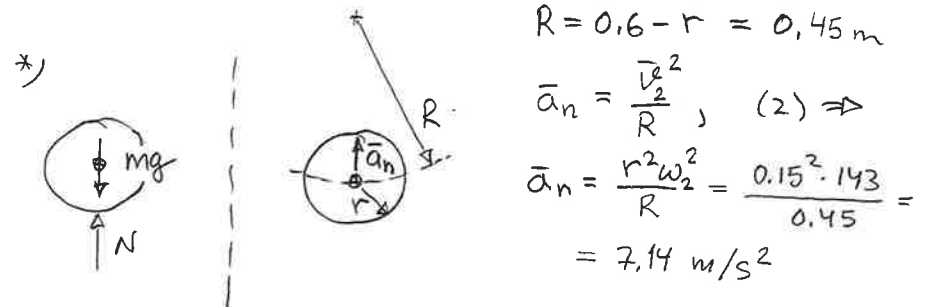
Läge ②:

$$T_2 = 1.625 \omega_2^2 \quad , \quad V_{g2} = 0$$

$$\Delta E = 0 \quad ; \quad 1.625 \omega_2^2 = (206 + 26) \text{ J} \quad ;$$

$$\omega_2^2 = 143 \text{ rad}^2/\text{s}^2 \quad ; \quad (\omega_2 = 11.95 \text{ rad/s})$$

Normalkraften i läge ②:



$$R = 0.6 - r = 0.45 \text{ m}$$

$$\bar{a}_n = \frac{\bar{v}^2}{R} \quad , \quad (2) \Rightarrow$$

$$\bar{a}_n = \frac{r^2 \omega_2^2}{R} = \frac{0.15^2 \cdot 143}{0.45} = \\ = 7.14 \text{ m/s}^2$$

$$(\uparrow) \quad N \uparrow : \quad N - mg = m \bar{a}_n \quad ; \quad N = m(g + \bar{a}_n) \quad ; \\ N = 100 (9.81 + 7.14) = \underline{\underline{1.69 \text{ kN}}}$$

(Hastighet i läge ②):  $(2) \Rightarrow$

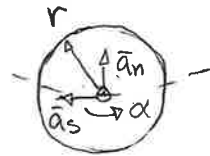
$$\bar{v}_2 = \omega_2 \cdot r = 11.95 \cdot 0.15 = 1.8 \text{ m/s}$$

Anm. \*) Friktionskraft och  $\bar{a}_s$  ej utritade, men dessa = 0. Visas enl. nästa sida

Sem. 21 forts. 4

Extra:

Friktionskraften i läge ②:



Rullning utan  
glidning:

$$\bar{a}_s = r\alpha$$

$$(\rightarrow) \quad -F = m\bar{a}_s ; \quad -F = mr\alpha$$

$$\curvearrowright \quad F \cdot r = \bar{I} \cdot \alpha ; \quad F = \frac{\bar{I}}{r} \alpha$$

$$-\frac{\bar{I}}{r} \alpha = mr\alpha ; \quad -\left(\frac{\bar{I}}{r} + mr\right) \alpha = 0$$

Uppfylles endast om  $\alpha = 0$ !

$$\Rightarrow F = 0$$