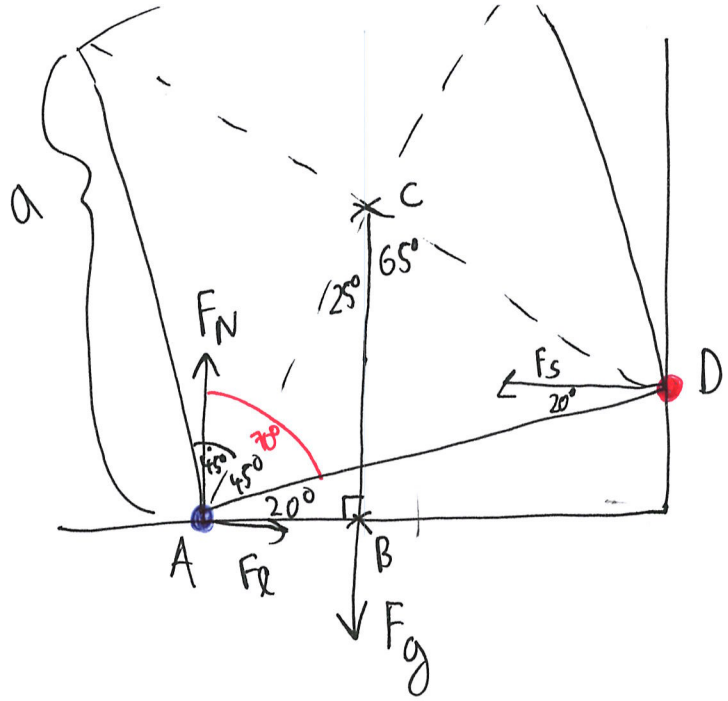
① 

$\frac{3}{4}$ če napačen kot pri F_g. ⊖ za navor in ⊖ za številski rezultat.

⊕ = $\frac{1}{8}$

$\sum F = 0$

$F_g = F_N = mg$ ⊕$_1$

$F_\ell = F_S = k_\ell F_N = mg k_\ell$ ⊕$_2$

$\sum M = 0$ glede na neko os.

a) os označena z ●

Kot ACB dobimo iz trikotnika ACB.

$\sphericalangle ACB = 180° - 90° - (45° + 20°) = 25°$

Dolžina AC je $\frac{\sqrt{2}a}{2}$, polovica diagonale.

$M_g = M_S$ ⊕$_3$ en ⊕ za $\frac{\sqrt{2}}{2}a$, drugi za $\sin 25°$

$mg \frac{\sqrt{2}}{2} a \sin 25° = mg k_\ell \cdot a \cdot \sin 20°$ ⊕$_4$ ⊕$_5$ ⊕$_6$

$k_\ell = \frac{\sqrt{2}}{2} \frac{\sin 25°}{\sin 20°} = 0{,}8737$ ⊕$_7$ ⊕$_8$

←ALI→

b) os označena z ●

Kot BCD je $90° - 25° = 65°$ ↑ $\sphericalangle ACB$ iz leve strani.

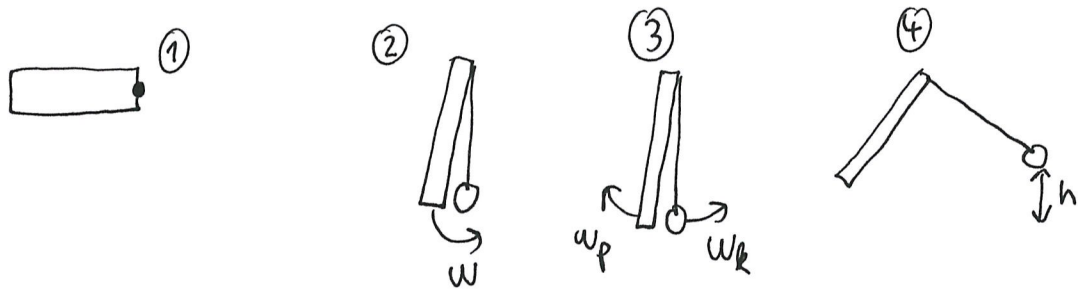
$M_g + M_\ell = M_N$ ⊕$_3$ Predznaki morajo biti pravilni.

$mg \frac{\sqrt{2}}{2} \cdot a \cdot \sin 65° + mg k_\ell a \cdot \sin 20° = a \cdot m \cdot g \sin 70°$ ⊕$_4$ ⊕$_5$ ⊕$_6$

$k_\ell = \frac{\sin 70° - \frac{\sqrt{2}}{2} \sin 65°}{\sin 20°}$ ⊕$_7$

$k_\ell = 0{,}8737$ ⊕$_8$

② $J_p = \frac{1}{3} m_p l^2$



① → ② W se ohranja

$W_1 = m_p g l$

$W_2 = m_p g \frac{l}{2} + \frac{J_p w^2}{2}$ } ⊕1

oh je $\frac{l}{2}$ ker se težišče premakne za $\frac{l}{2}$

$W_1 = W_2$

$m_p g l = m_p g \frac{l}{2} + \frac{1}{2}\frac{1}{3} m_p l^2 w^2$

$w^2 = \frac{3g}{l}$

$w = \sqrt{\frac{3g}{l}} = 5,42\ 1/s$ ⊕2

② → ③ W se ohranja
L se ohranja } ⊕3

$J_p w = w_p J_p + m_k l^2 w_k$

$\frac{J_p w^2}{2} = \frac{w_p^2 J_p}{2} + \frac{m_k l^2 w_k^2}{2}$ } ⊕4

Lahko rešimo sistem enačb. Lahko pa uporabimo formulo iz vaj.

$u_{1,2}$ začetni hitrosti.

Ker vrtenje moramo narediti substitucije $u, v \to w$
$m \to J$

$v_2 = u_1 \frac{2m_1}{m_1+m_2} + u_2 \frac{m_2-m_1}{m_1+m_2}$

$v_1 = u_2 \frac{2m_2}{m_1+m_2} + u_1 \frac{m_1-m_2}{m_1+m_2}$

⊕5 Torej $u_1 \to w_k = 0$ (začetna)

$u_2 \Rightarrow w \quad m_1 \to J_k$

$v_1 \Rightarrow w_k \quad m_2 \to J_p$

$v_2 \Rightarrow w_p$

$$\omega_k = 0 + \frac{2J_p}{J_k + J_p}\omega$$

$$\omega_p = 0 + \frac{J_p - J_k}{J_k + J_p}\omega$$

$$\omega_k = \frac{2\,\frac{1}{3}\ell^2 m_p}{m_k \ell^2 + \frac{1}{3}\ell^2 m_p} \cdot \omega = \frac{5}{3}\omega = 7{,}87\,1/s \quad (f)_6$$

$$\omega_p = \frac{\frac{1}{3}m_p - m_k}{\frac{1}{3}m_p + m_k}\omega = \left(-\frac{2}{3}\right)\omega = -3{,}62\,1/s \quad (f)_7$$

③ → ④ W se ohranja (ločeno za p in k)

$$m_k g h_k = \frac{J_k \omega_k^2}{2}$$

$$h_k = \frac{m_k \ell^2 \omega_k^2}{m_k g 2} = \frac{\ell^2 \omega_k^2}{2g} = 0{,}167\,m \quad (f)_8$$

③

a) $F = F_g - F_e = mg - \frac{e^2}{4\pi\varepsilon_0 h^2}$ ⊕1

$a = \frac{F}{m} = g - \frac{e^2}{4\pi\varepsilon_0 h^2 m}$ ⊕2

$a = 7{,}75\ \frac{m}{s^2}$ ⊕3

$\varepsilon_0 = 8{,}85 \cdot 10^{-12}\ \frac{As}{Vm}$ osnovni naboj

Pogosta napaka: zamenjava ε_0 za e_0

$e_0 = 1{,}6 \cdot 10^{-19}\ As$

b) W se ohranja.
W na začetku je enaka W v najnižji točki. ⊕4
V najnižji točki je hitrost $v = 0$.

$W_1 = mgh_1 + \frac{e^2}{4\pi\varepsilon_0 h_1}$ $\quad h_1 = 1m$

$W_2 = mgh_2 + \frac{e^2}{4\pi\varepsilon_0 h_2}$ $\quad h_2 = ?$ ⊕5

$mgh_2 + \frac{e^2}{4\pi\varepsilon_0 h_2} = W_1 \quad | \cdot h_2 : mg$

$h_2^2 - \frac{W_1}{mg} h_2 + \frac{e^2}{4\pi\varepsilon_0 mg} = 0$

$h_2 = \frac{\frac{W_1}{mg} \pm \sqrt{\left(\frac{W_1}{mg}\right)^2 - 4\frac{e^2}{mg\,4\pi\varepsilon_0}}}{2}$

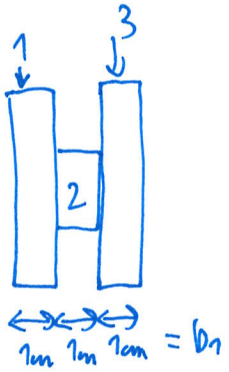
$h_{2,1} = 1m$ ← začetna lega
$h_{2,2} = 0{,}22\ m$ ← min višina ⊕6

c) V ravnovesju $F_g = F_e$ ⊕7

$mg = \frac{e^2}{4\pi\varepsilon_0 h^2}$

$h = \sqrt{\frac{e^2}{4\pi\varepsilon_0 mg}} = 0{,}47\ m$ ⊕8

(4)



$m_1 = m_3 = V_1 \cdot \rho$

$V_1 = \pi \left(\frac{d}{2}\right)^2 b_1$

$m_2 = \pi r^2 b_1 \rho$

$M = 2m_1 + m_2 = \rho \pi b_1 \left(\frac{d^2}{4} \cdot 2 + r^2\right)$ ⊕1

$J = 2J_1 + J_2$ ⊕2

$= \frac{2 m_1 \left(\frac{d}{2}\right)^2}{2} + \frac{m_2 r^2}{2} = \rho \pi b_1 \left[\left(\frac{d}{2}\right)^4 + \frac{r^4}{2}\right]$ ⊕3

$F = m \cdot a = F_g - F_V$ ⊕4

$M = J\alpha = F_V \cdot r$ ⊕5

$\alpha = \frac{a}{r}$ ⊕6

$\Rightarrow F_V = \frac{J\alpha}{r} = \frac{Ja}{r^2}$

$ma = mg - \frac{Ja}{r^2}$

$a\left(m + \frac{J}{r^2}\right) = mg$

$a = g \frac{m}{m + \frac{J}{r^2}}$ ⊕7

$\rho \pi b_1$ se krajšajo.

$a = g \frac{\frac{d^2}{4} \cdot 2 + r^2}{\frac{d^2}{4} \cdot 2 + r^2 + \frac{\left[\left(\frac{d}{2}\right)^4 + \frac{r^4}{2}\right]}{r^2}}$

$a = g \cdot 0{,}189 = 1{,}85 \frac{m}{s^2}$ ⊕8