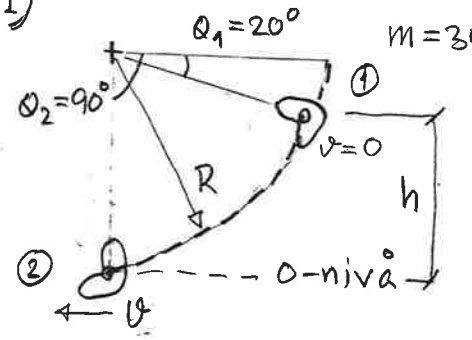
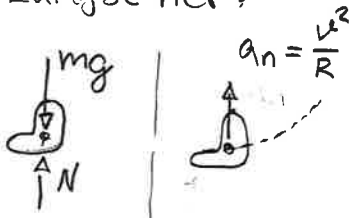
Seminariepass 15

1)



Längst ner:



Energisatsen: $\Delta E = 0$, $E = T + V_g$

$E_1 = mgh = mg(R - R\sin 20°)$
$E_2 = \frac{1}{2}mv^2$
$\Rightarrow$

$\frac{1}{2}\cancel{m}v^2 = \cancel{mg}R(\underbrace{1-\sin 20°}_{0,658})$;

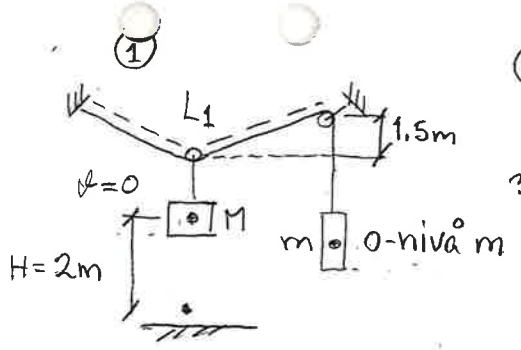
$v^2 = 2gR \cdot 0{,}658$; $v = \sqrt{2 \cdot 9.81 \cdot 2{,}5 \cdot 0{,}658} = \underline{5.7\,m/s}$

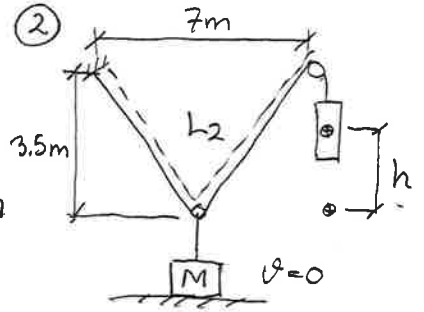
NII: (↑) $N - mg = m\frac{v^2}{R}$;

$N = m\left(g + \frac{v^2}{R}\right) = 35 \cdot \left(9.81 + \underbrace{\frac{5.7^2}{2.5}}_{13.0}\right) =$

$= 798\,N$ ($> 2mg$)

2)





Geometri: $h = L_2 - L_1 = 2 \cdot \sqrt{\left(\frac{7}{2}\right)^2 + 3.5^2} - 2 \cdot \sqrt{\left(\frac{7}{2}\right)^2 + 1.5^2} =$

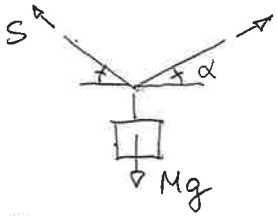
$= 9.90 - 7{,}62 = 2.28\,m$

Energisatsen: $\Delta E = 0$

$E_1 = MgH$, $E_2 = mgh$, $E_1 = E_2$ $\Rightarrow$

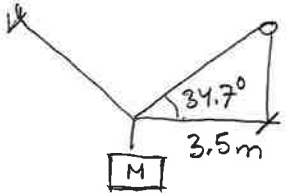
$M\cancel{g}H = m\cancel{g}h$; $m = \frac{H}{h}M = \frac{2}{2.28} \cdot 45 = \underline{39.5\,kg}$

Vad händer? Statisk jämvikt?



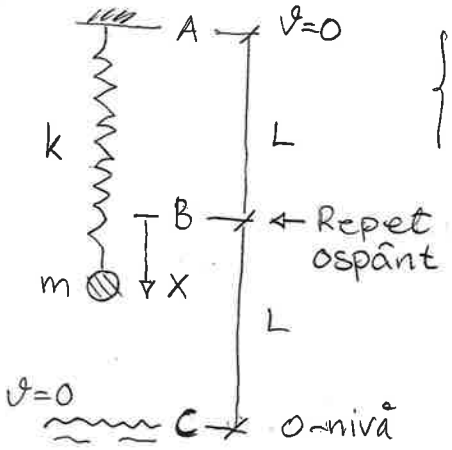
(↑) $2mg\sin\alpha = Mg$; $\sin\alpha = \frac{M}{2m}$;

$\sin\alpha = \frac{45}{39.5 \cdot 2} = 0.57$; $\alpha = 34.7°$



$\tan 34.7° \cdot 3.5 = \underline{2.43\,m} < 3.5\,m$

3)



$$\begin{cases} E_A = mg\,2L \\ E_C = \frac{1}{2}kL^2 \end{cases} \qquad W^{(fik)} = 0$$

$E_A = E_C \Rightarrow$

$\frac{1}{2}kL^2 = mg\,2L$;

$k = \frac{4mg}{L} = \frac{4\cdot 750}{18} = \underline{167\,N/m}$

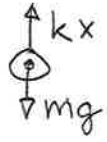
Maxhastighet? Kolla max för T

Energisatsen $A \rightarrow x$: $E_A = E_x$

$$\underbrace{mg\,2L}_{E_A} = \underbrace{T_x + mg(L-x) + \frac{1}{2}kx^2}_{E_x}$$

$T_x = mg(L+x) - \frac{1}{2}kx^2$; $\frac{dT_x}{dx} = 0 \Rightarrow$

$mg - kx = 0$; $x = \frac{mg}{k} = \frac{750}{167} = \underline{4.5\,m}$

Jmf. 

(↓) dvs max T i statiska jmv. läget

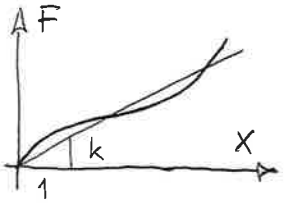
Alltså $T_x = \frac{1}{2}m v_x^2 = \underbrace{750\cdot(18+4.5)}_{16880} - \underbrace{\frac{1}{2}\cdot 167\cdot(4.5)^2}_{1691}$;

$v_x^2 = \frac{2}{mg}\cdot g \cdot 15184 = \frac{2}{750}\cdot 9.81\cdot 15184 = 397$

$v_x = \sqrt{397} = 20\,m/s = \underline{72\,km/h}$ max hast.

3 forts. Överkurs:

Hur tjockt skall repet vara om det är av vanligt gummimaterial?



Gummi : $E \approx 3\,MPa$

Hooke's lag : $\sigma = E\cdot\varepsilon$; $\frac{F}{A} = E\cdot\frac{x}{L}$;

A: tvärsnittsarea

Alltså $F = \underbrace{\frac{EA}{L}}_{k}\cdot x$

Dvs $k = \frac{EA}{L}$; $A = \frac{kL}{E} = \frac{167\cdot 18}{3\cdot 10^6} \approx 1\cdot 10^{-3}\,m^2$

$A = \pi\cdot r^2$; $r = \sqrt{\frac{A}{\pi}} = \sqrt{\frac{10^{-3}}{\pi}} = 0.018\,m$

Diameter $\approx \underline{3.5\,cm}$

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