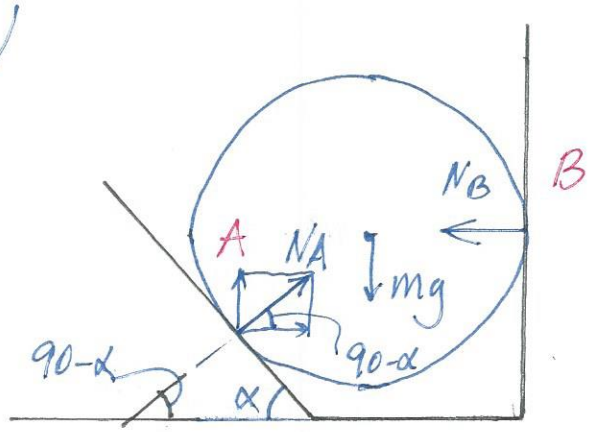
Fysik del A LMA 538 & SEE095 201030

OBS: Indatas siffervärden varierar

1)



Givet $m = 90$ kg

$\alpha = 25°$

Sökt kontaktkrafter vid A och B

Kraftjämvikt för klotet (inga friktionskrafter)

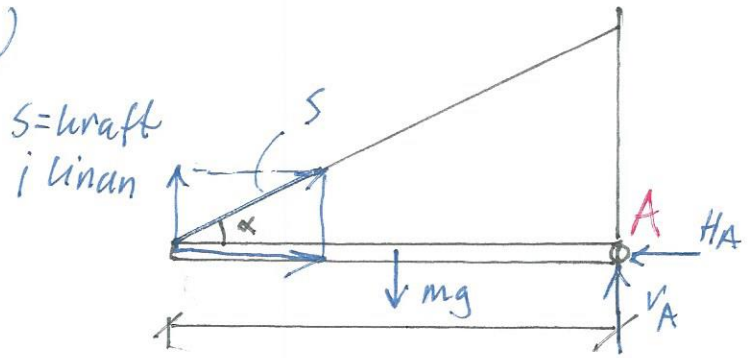
$\rightarrow \quad N_A \cos(90-\alpha) - N_B = 0$ 1)

$\uparrow \quad N_A \sin(90-\alpha) - mg = 0$ 2)

2) $\Rightarrow N_A = \dfrac{mg}{\sin(90-\alpha)} = 9.8 \cdot 10^{9}$ N

1) $\Rightarrow N_B = N_A \cos(90-\alpha) = 4.1 \cdot 10^{2}$ N

2)



Givet $m = 2.0$ kg

$L = 2.9$ m

$\alpha = 54°$

Krafter på boommen

$\circlearrowleft A \quad mg\frac{L}{2} - S \sin\alpha \cdot L = 0 \Rightarrow S = \dfrac{mg}{2\sin\alpha}$

$S = \dfrac{2.0 \cdot 9.82}{2 \cdot \sin 54°} = 12$ N

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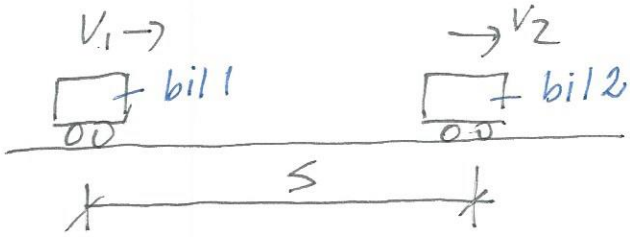
3)



Givet: $v_1 = 109$ km/h

$v_2 = 64$ km/h

$t = 0.52$ min

Sökt: sträckan s innan omkörningen börjar

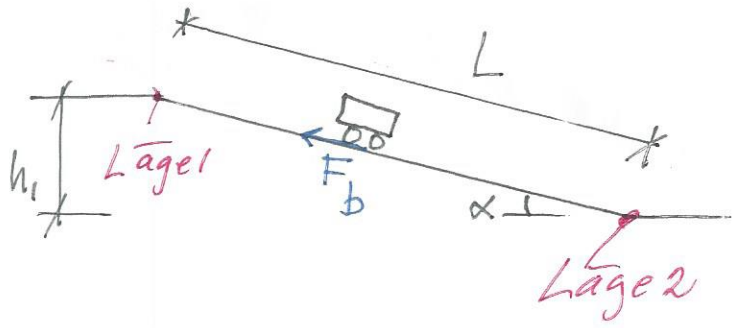
Bilarna har konstant hastighet $\Rightarrow$

$s_1 = v_1 t$, $s_2 = v_2 t \Rightarrow$

$s = s_1 - s_2 = v_1 t - v_2 t = (v_1 - v_2)t =$

$= (109 - 64)\frac{0.5^2}{60}$ km $= 0.39$ km

4)



Givet:

$m = 158$ kg

$v_1 = 8.9$ m/s

$v_2 = 1.9$ m/s

$L = 98.9$ m

$\alpha = 15°$

Använd Energiprincipen

$E_{p1} + E_{k1} = E_{p2} + E_{k2} + W_b$

$mgh_1 + \frac{1}{2}mv_1^2 = 0 + \frac{1}{2}mv_2^2 + F_b L$

$F_b = \frac{1}{L}\left(mgh_1 + \frac{1}{2}mv_1^2 - \frac{1}{2}mv_2^2\right)$, $h_1 = L\sin\alpha$

$= \frac{158}{98.9}\left(9.82 \cdot 98.9 \cdot \sin 15° + \frac{1}{2}8.9^2 - \frac{1}{2}1.9^2\right) =$

$= 4.6 \cdot 10^2$ N

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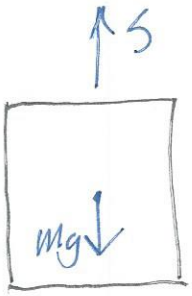
5)



Givet $m = 2{,}8 \cdot 10^3$ kg

$a = 1{,}1\ m/s^2$

Sökt: kraft i kabeln

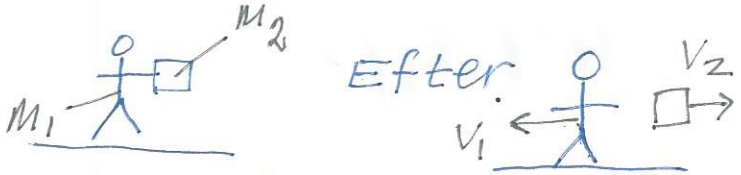
Rörelseekvationen för hissen

$\uparrow \quad S - mg = ma$

$S = mg + ma = 2.8 \cdot 10^3 (9.82 + 1.1) =$

$= 3.1 \cdot 10^4\ N$

6)



Givet:

$m_1 = 54$ kg

$m_2 = 1.6$ kg

$v_2 = 2$ m/s

Välj positiv riktning ←

Rörelsemängden bevaras

$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$

$0 = m_1 v_1 + m_2 v_2$

$v_1 = -\frac{m_2 v_2}{m_1} = \frac{1.6 \cdot 2}{54} = 0.059\ m/s$

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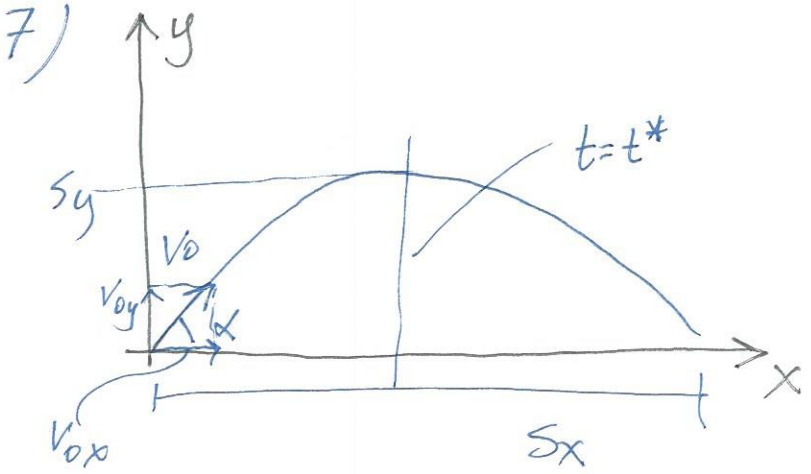
7)



Givet $v_0 = 26\ m/s$

$\alpha = 34^\circ$

Sökt: s_x, s_y

Kaströrelse

Rörelse i x-led $v_{0x} = v_0 \cos\alpha = \text{konstant} \Rightarrow s_x = v_{0x} t$ 1)

Rörelse i y-led $a_y = -g = \text{konstant}$

$v_y = v_{0y} - gt = v_0 \sin\alpha - gt$ 2)

$s_y = v_{0y} t - \frac{1}{2} g t^2$ 3)

Först: tiden att nå högsta punkten, $v_y = 0$

2) $\Rightarrow v_y = 0 = v_0 \sin\alpha - g t^* \Rightarrow t^* = \frac{v_0 \sin\alpha}{g}$

3) $\Rightarrow s_y = v_0 \sin\alpha \cdot \frac{v_0 \sin\alpha}{g} - \frac{1}{2} g \left(\frac{v_0 \sin\alpha}{g}\right)^2$

$s_y = \frac{(v_0 \sin\alpha)^2}{2g} = \frac{(26 \sin 34^\circ)^2}{2 \cdot 9.82} = 11\ m$

Total tid $= 2t^*$, 1) $\Rightarrow s_x = 2 v_{0x} t^*$

$s_x = 2 v_0 \cos\alpha \cdot \frac{v_0 \sin\alpha}{g} = 2 \cdot 26 \cdot \cos 34^\circ \cdot \sin 34^\circ \frac{1}{9.82}$

$= 64\ m$

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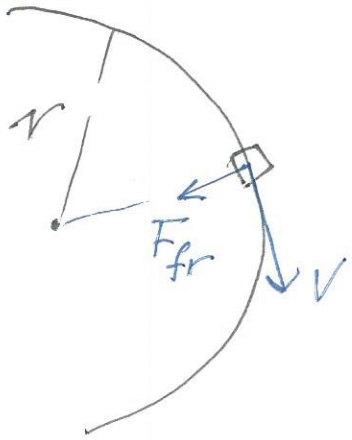
8) uppifrån



Givet $m = 1{,}2 \cdot 10^3$ kg
$r = 5{,}7 \cdot 10^2$ m
$v = 1{,}2 \cdot 10^2$ km/h

Sökt F_{fr}

Bilen rör sig inte i radiell led utan följer radien

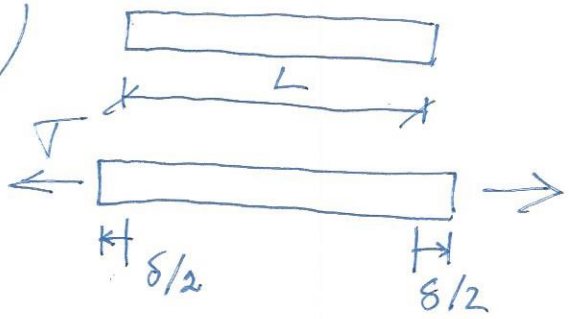
Rörelselagen i radiell led

$$\leftarrow \quad F_{fr} = ma_c = m\frac{v^2}{r}$$

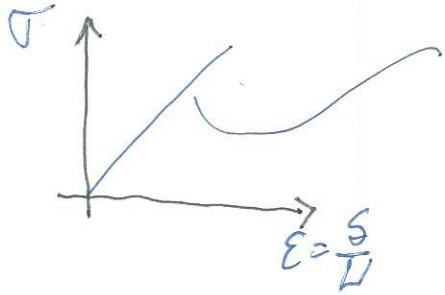
$$F_{fr} = \frac{1.2 \cdot 10^3}{5.7 \cdot 10^2} \cdot \left(\frac{1.2 \cdot 10^2}{3.6}\right)^2 = 2.3 \cdot 10^3 \text{ N}$$

$$\left(\mu = \frac{F_{fr}}{N} = \frac{F_{fr}}{mg} = \frac{2.3 \cdot 10^3}{1.2 \cdot 10^2 \cdot 9.82} = 0{,}20\right)$$

9)



Givet $L = 0.93$ m
$\sigma = 1{,}5 \cdot 10^2$ N/mm^2
$E = 2.1 \cdot 10^5$ N/mm^2



$\sigma = E \cdot \varepsilon$ där $\varepsilon = \frac{\delta}{L}$

$$\Rightarrow \delta = \varepsilon \cdot L = \frac{\sigma}{E} \cdot L = \frac{1.5 \cdot 10^2}{2.1 \cdot 10^5} \cdot 0.93 \cdot 10^3$$

$$\delta = 0.66 \text{ mm}$$

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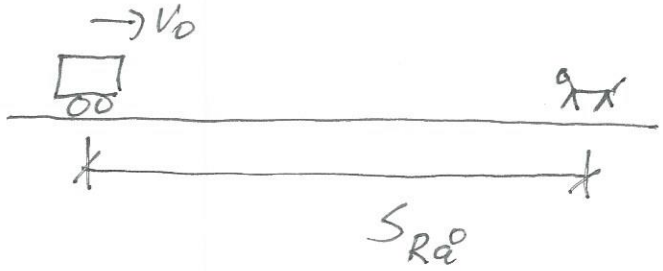
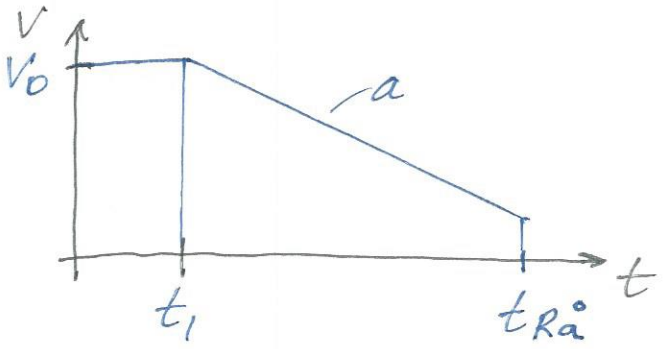
10)



Givet $s_{Rå} = 100$ m
$t_1 = 1{,}0$ s
$v_0 = 89$ km/h
$a = 4{,}3$ m/s^2
$t_{Rå} = 4{,}0$ s

Sökt: Total sträcka för bilen under tiden $t_{Rå}$



Är totala sträckan $s \leq s_{Rå}$?

Under tiden t_1 (reaktionstid) v_0 = konstant $\Rightarrow$
$s_1 = v_0 t_1$

Under tiden $t_{Rå} - t_1$ bromsning med accelerationen a (negativ)

$$s_2 = v_0 (t_{Rå} - t_1) - \frac{1}{2} a (t_{Rå} - t_1)^2 \Rightarrow$$

$$s = v_0 t_1 + v_0 (t_{Rå} - t_1) - \frac{1}{2} a (t_{Rå} - t_1)^2 =$$

$$= v_0 t_{Rå} - \frac{1}{2} a (t_{Rå} - t_1)^2 =$$

$$= \frac{89}{3.6} \cdot 4 - \frac{1}{2} 4{,}3 (4{,}0 - 1{,}0)^2 = 80 \text{ m} \quad \underline{\text{OK}}$$

v_0 bilens hastighet när rådjuret hoppar ut som frågas

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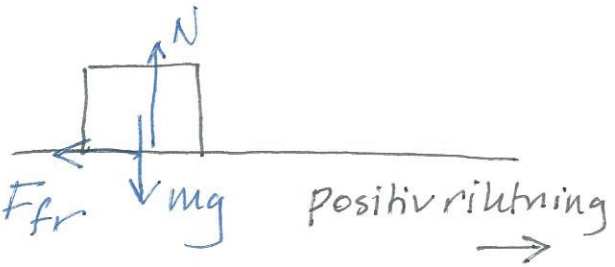
11)



Givet $m = 0.284\,kg$
$t = 5,73\,s$
$V_0 = 8.24\,m/s$
$V = 4.41\,m/s$

Sökt: μ

Krafter på klossen:
Rörelse ekv + jämvikt

$$\rightarrow \quad -F_f = m \cdot a \qquad 1)$$

$$\uparrow \quad N - mg = 0 \qquad 2)$$

$$F_f = \mu N \qquad 3)$$

$$a = \frac{V - V_0}{t} \qquad 4)$$

Fullt utbildad friktion, klossen glider

2) i 3) $\Rightarrow$ $F_f = \mu mg$ + 4) i 1) $\Rightarrow$

$$-\mu mg = m\,\frac{V - V_0}{t} \Rightarrow$$

$$\mu = -\frac{V - V_0}{g \cdot t} = \frac{8.24 - 4.41}{9.82 \cdot 5.73}$$

$$= 0.0684$$