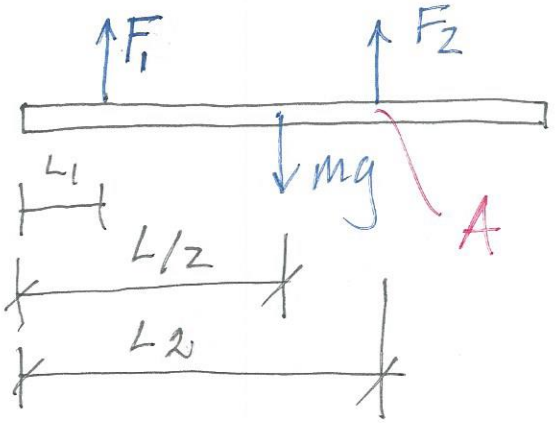
1/ Rita krafter på stången

Givet $L_1 = 2{,}7\,cm$

$L_2 = 6{,}2\,cm$

$L = 10.0\,cm$

$F_1 = 1{,}8\,N$

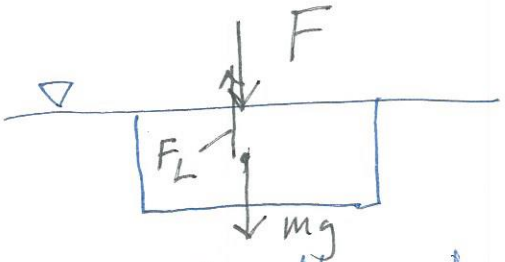


Momentjämvikt kring en axel genom A ⇒

$$\curvearrowleft_A \quad mg\cdot\left(L_2-\frac{L}{2}\right) - F_1(L_2-L_1) = 0$$

$$\Rightarrow m = \frac{F_1}{g}\,\frac{L_2-L_1}{L_2-\frac{L}{2}} = 0{,}53\,kg$$

2/



Rita krafter på klossen.

Sökt F. Jämvikt

Givet: $M = 5.0\,kg$

$V = 11\,dm^3$

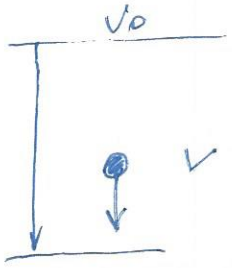
$\rho_V = 0.997\cdot 10^3\,kg/m^3$

$$\downarrow \quad F + mg - F_L = 0 \quad \text{där } F_L = \underbrace{\rho_V V}_{m_V}\cdot g \Rightarrow$$

$$F = F_L - mg = \rho_V V g - mg =$$

$$= 0.997\cdot 10^3\cdot 11\cdot 10^{-3}\cdot 9.82 - 5.0\cdot 9.82 = 59\,N$$

3)



Givet: $v_0 = 0$

$v = 43 \text{ km/h} = \frac{43}{3.6} \text{ m/s}$

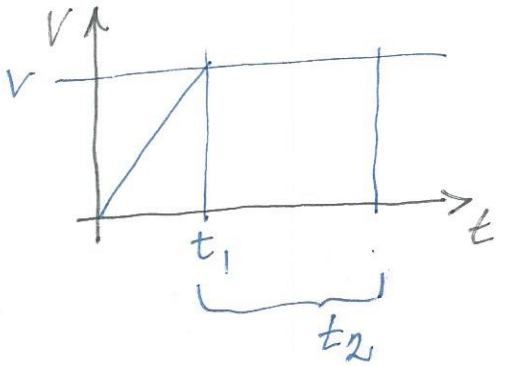
Fritt fall, $a = g$

sökt tid

För accelerationen a: $a = \frac{v - v_0}{t} \Rightarrow$

$$t = \frac{v - v_0}{a} = \frac{v}{a} = \frac{43}{3.6 \cdot 9.82} = 1.2 \text{ s}$$

4) Rita v-t diagram:



Givet $v_{max} = 120 \text{ km/h}$

$a = 8.2 \text{ m/s}^2$

$t_1 = 3.5 \text{ s}$

$s_2 = 240 \text{ m}$

Sökt s då geparden har v m/s

Acceleration: $a = \frac{v - v_0}{t_1} \Rightarrow v = a t_1$

Total sträcka $s_2 = \frac{v \cdot t_1}{2} + v \cdot t_2 = \frac{a t_1^2}{2} + a t_1 t_2$

$$\Rightarrow t_2 = \frac{s_2}{a t_1} - \frac{a t_1^2}{2 a t_1} = \frac{s_2}{a t_1} - \frac{t_1}{2} = 6.6 \text{ s}$$

kontroll $v = 28.7 \text{ m/s} < v_{max} = 120 \text{ km/h} = 33.3 \text{ m/s}$

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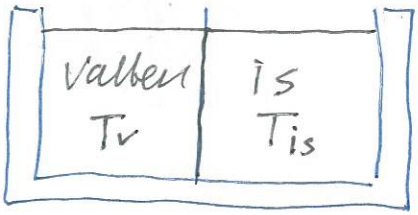
5)



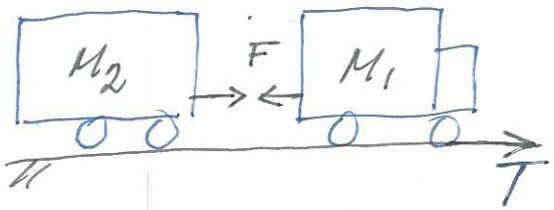
Givet: $m_{is} = 550\,g$
$T_{is} = 0°C$
$m_V = 430\,g$
$T_V = 51°C$
$C = 4{,}19\,kJ/kg°C$
$C_{is} = 334\,kJ/kg$

Sökt: mängd is som smälter
antag x kg is smälter
Energi som kan avges:
$m_V \cdot C \cdot \Delta T = m_V C (T_V - 0)$
Energi som kan upptas
$x C_{is}$

Energibalans: $m_V C \cdot T_V = x \cdot C_{is}$

$$\Rightarrow x = \frac{m_V C T_V}{C_{is}} = \frac{430 \cdot 4.19 \cdot 10^3 \cdot 51}{334 \cdot 10^3} = 275\,g \Rightarrow \frac{275}{550} = 50\%$$

6)



Givet $T = 1.9 \cdot 10^4\,N$
$M_1 = 1.9 \cdot 10^4\,kg$
$M_2 = 3.5 \cdot 10^4\,kg$

Rörelseekv för fordonet:

$$\rightarrow \quad T = (M_1 + M_2)a \Rightarrow$$

$$a = \frac{T}{M_1 + M_2} = \frac{1.9 \cdot 10^4}{1.9 \cdot 10^4 + 3.5 \cdot 10^4} = 0.35\,m/s^2$$

För släpet:

$$\rightarrow \quad F = M_2 a = \frac{M_2 T}{M_1 + M_2} = 3.5 \cdot 10^4 \cdot 0.35 = 1.2 \cdot 10^4\,N$$

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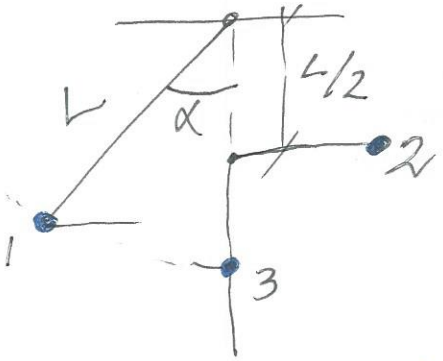
7)



Givet $m = 0.95\,kg$

$L = 0.92\,m$

Sökt vinkeln α

$v = 0$ i läge 2

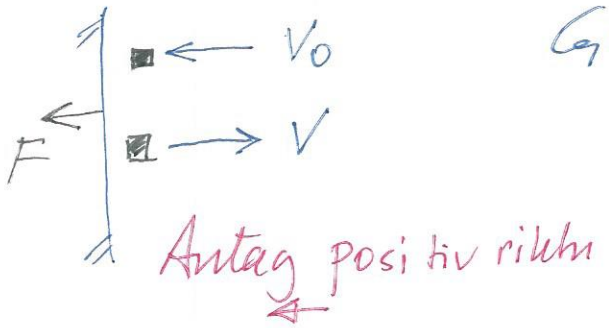
Använd energiprincipen

$$E_{p1} + E_{k1} = E_{p3} + E_{k3} = E_{p3} + E_{k3}$$

$$mgL\cos\alpha + 0 = 0 + \frac{1}{2}mv_3^2 = mg\frac{L}{2} + 0$$

$$\cos\alpha = \frac{1}{2} \rightarrow \alpha = \arccos\frac{1}{2} = 60^\circ$$

8)



Givet: $m = 0.165\,kg$

$v_0 = 32\,m/s$

$v = 2.2\,m/s$

$t = 0.016\,s$

Impulslagen:

$$I = F \cdot t = mv - mv_0 \Rightarrow$$

Sökta kraften $F = \dfrac{m(v - v_0)}{t}$

$$F = \frac{0.165(32 - (-2.2))}{0.016} = 3.5 \cdot 10^2\,N$$

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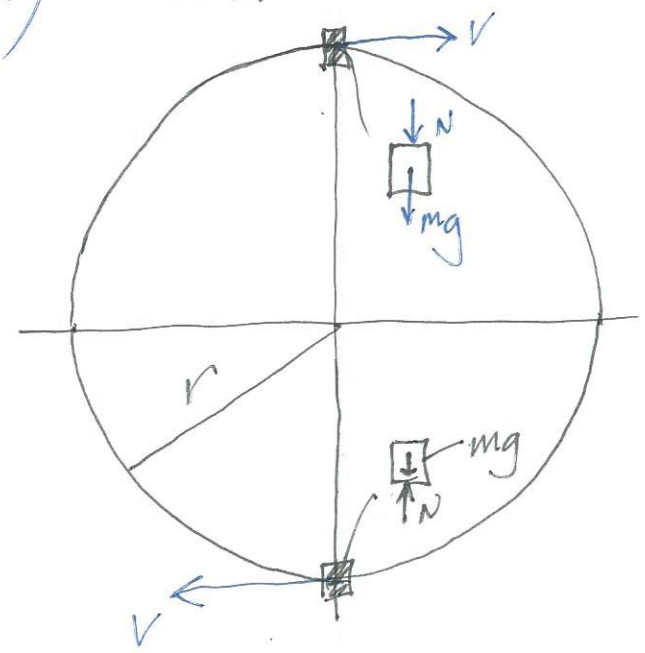
a) Från sidan



Givet: $m = 58\,g$

$r = 24\,m$

$V = 63\ km/h = \frac{63}{3.6}\ m/s$

Sökt: Normalkraften N på hamstern

Använd rörelseekv Newtons andra lag:

högst upp: ↓ $N + mg = ma_c = m\frac{v^2}{r}$

$$N = m\frac{v^2}{r} - mg = 0.058\left(\frac{1}{24}\left(\frac{63}{3.6}\right)^2 - 9.82\right) = 0.17\,N$$

längst ner: ↑ $N - mg = ma_c = m\frac{v^2}{r}$

$$N = m\frac{v^2}{r} + mg = 0.058\left(\frac{1}{24}\left(\frac{63}{3.6}\right)^2 + 9.82\right) = 1.3\,N$$

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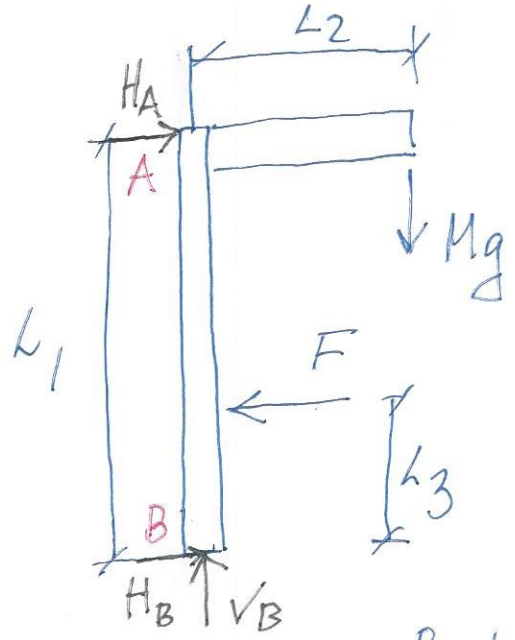
10)



Givet $M = 4.7 \cdot 10^2$ kg
$L_1 = 6.7$ m
$L_2 = 1.5$ m
$L_3 = 1.7$ m
$F = 2.0 \cdot 10^2$ N

Inför krafter på kranen från sköden vid A och B

Kraftjämvikt och momentjämvikt kring axel genom B $\Rightarrow$

$\rightarrow \quad H_A + H_B - F = 0 \quad 1)$

$\uparrow \quad V_B - Mg = 0 \quad 2)$

$\circlearrowleft_B \quad F \cdot L_3 - H_A L_1 - Mg L_2 = 0 \quad 3)$

$2) \Rightarrow V_B = M \cdot g = 4.7 \cdot 10^2 \cdot 9.82 = 4.6 \cdot 10^3$ N

$3) \Rightarrow H_A = \frac{1}{L_1}(F \cdot L_3 - M \cdot g L_2) =$

$= \frac{2.0 \cdot 10^2 \cdot 1.7 - 4.7 \cdot 10^2 \cdot 9.82 \cdot 1.5}{6.7} = -9.8 \cdot 10^2$ N

$1) \Rightarrow H_B = F - H_A = 2.0 \cdot 10^2 + 9.8 \cdot 10^2 = 11.8 \cdot 10^2$ N

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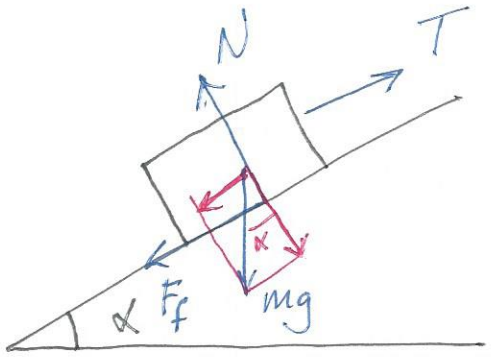
11)



Givet $m = 140$ kg
$\alpha = 29^\circ$
$T = 1.3 \cdot 10^3$
$\mu = 0.37$
$t = 2.0$ s

Rita krafter på lådan. Sökt sträckan s
Newtons första och andra lag ⇒

↗ $T - F_f - mg\sin\alpha = ma$ 1)

↑ $N - mg\cos\alpha = 0$ 2)

Fullt utbildad friktion:

$F_f = \mu N$ 3)

3) i 2) ⇒ $F_f = \mu mg\cos\alpha$ i 1) ⇒

$T - \mu mg\cos\alpha - mg\sin\alpha = ma$ ⇒

$a = \frac{T}{m} - g(\mu\cos\alpha + \sin\alpha) =$

$= \frac{1.3\cdot10^3}{140} - 9.82(0.37\cos25^\circ + \sin25^\circ) = 1.3\ m/s^2$

1.34

Sträckan $s = v_0 t + \frac{1}{2}at^2 = \frac{1}{2}at^2 =$

$= \frac{1}{2}\,1.3\cdot2.0^2 = 2.6\ m$