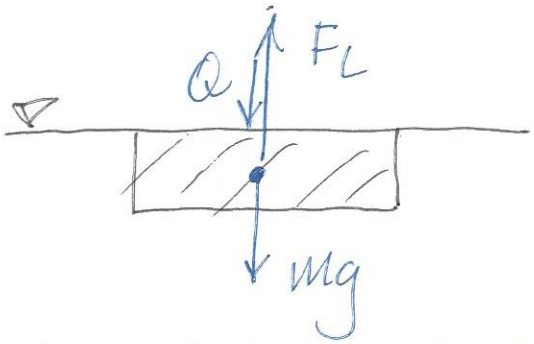
Fysik del A LMA538 & SEE095 211029

OBS: Indatas siffervärden varierar

1/



Last på flotten Q kg

Givet:

$V = B \cdot L \cdot t =$

$= 1.4 \cdot 3.0 \cdot 0.32\ m^3$

$M = 1.0E2\ kg$

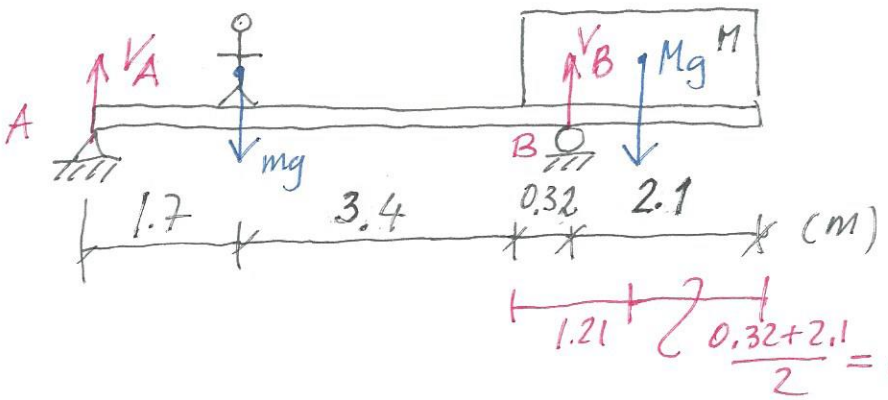
$\rho_v = 997\ kg/m^3$

Jämvikt $\uparrow\ F_L - Qg - mg = 0$

där $F_L = \rho_v V \cdot g \Rightarrow Q = \frac{1}{g}(\rho_v V g - mg) = \rho_v V - m$

$Q = 997 \cdot 1.4 \cdot 3.0 \cdot 0.32 - 1.0 \cdot 10^2 = 1.2 \cdot 10^3\ kg$

2/



Givet:

$M = 4.5E2\ kg$

$m = 92\ kg$

$L_1 = 1.7\ m$

$L_2 = 3.4\ m$

$L_3 = 0.32\ m$

$L_4 = 2.1\ m$

Kraftjämvikt + kraftmoment-jämvikt kring axel vid A $\Rightarrow$

$\uparrow\ V_A + V_B - mg - Mg = 0$ 1)

($H_A = 0$ inga yttre krafter i $\rightarrow$ led)

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2/ forts

A $V_B(1.7+3.4+0,32) - Mg1.7 - Mg(1,7+3.4+0.32+1,21) = 0$ 2/

$V_B \cdot 5,42 - 92 \cdot 9.82 \cdot 1,7 - 4.5 \cdot 10^2 \cdot 9.82 \cdot 6.63 = 0$

$V_B = 5,7 \cdot 10^3$ N

ur 1) fås sedan $V_A = mg + Mg - V_B =$

$V_A = 92 \cdot 9.82 + 4.5 \cdot 10^2 \cdot 9.82 - 5,7 \cdot 10^3 = -3.7 \cdot 10^2$ N

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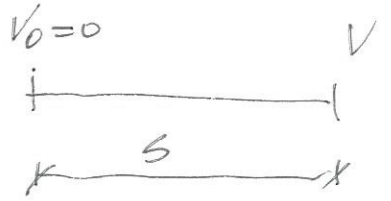
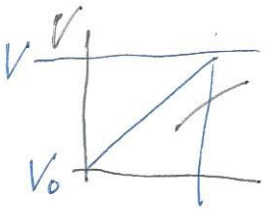
3)



Givet $V_0 = 0$

$V = 0.83$ m/s

$s = 1.2$ mm



$s = \frac{Vt}{2}$ sökt $a = \frac{V - V_0}{t}$

varmed $a = \frac{V}{t} \Rightarrow t = \frac{V}{a} \Rightarrow$

$s = \frac{V \cdot V}{2a}$ och $a = \frac{V^2}{2s}$

$a = \frac{0.83^2}{2 \cdot 1.2 \cdot 10^{-3}} = 2.9 \cdot 10^2$ m/s^2

OBS mycket!

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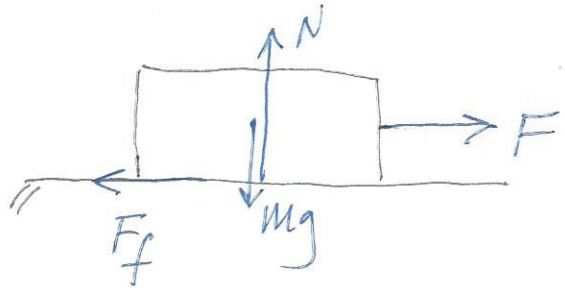
4)



Givet $F = 12\,N$
$m = 2.6\,kg$
$v_0 = 0$
$t = 11.5\,s$
$\mu = 0.37$

Newtons rörelselag + kraftjämvikt

$\rightarrow \quad F - F_f = ma \quad 1)$

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

Lådan glider $\Rightarrow$

$F_f = \mu N \quad 3)$

3) i 2) i 1) $\Rightarrow F - \mu mg = ma$

$a = \dfrac{F - \mu mg}{m}$; $a = \dfrac{v - v_0}{t} = \dfrac{v}{t}$

$\Rightarrow v = at = \dfrac{t(F - \mu mg)}{m} = \dfrac{11.5(12 - 0.37 \cdot 2.6 \cdot 9.82)}{2.6}$

$v = 11\ m/s$

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5)

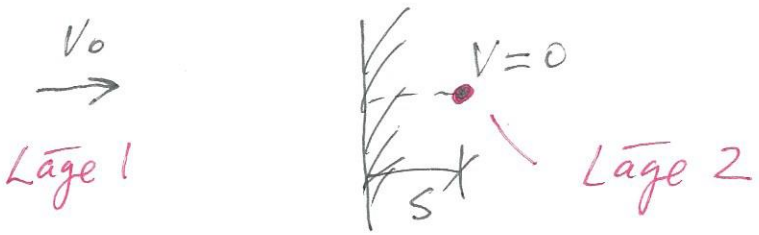
Givet $m = 42\,kg$
$v_0 = 2.0\,m/s$
$v = 5.5\,m/s$
$t = 2.2\,s$

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

$F = \dfrac{m(v - v_0)}{t} = \dfrac{42(5.5 - 2.0)}{2.2}$

$F = 67\,N$

6)



Givet: $v_0 = 95\,m/s$
$m = 25\,g$
$s = 1.6\,cm$

Energiprincipen:

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

($E_{p1} = E_{p2}$ lika, $E_{k2} = 0$)

$$\Rightarrow W_b = F \cdot s = E_{k1} = \frac{1}{2} m v_0^2 \rightarrow$$

$$F = \frac{m v_0^2}{2s} = \frac{25 \cdot 10^{-3} \cdot 95^2}{2 \cdot 1.6 \cdot 10^{-2}} = 7.1 \cdot 10^3\ N$$

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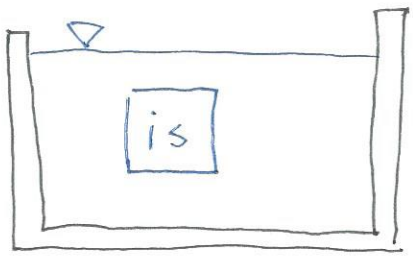
7)



Givet: $V_{is} = 0.14\,dm^3$
$m_V = 0.69\,kg$
$T_V = 56°C$
$c_V = 4.18\,kJ/kg°C$
$c_S = 334\,kJ/kg$
$\rho_{is} = 917\,kg/m^3$

Blandningen får temp. T_x

avgiven värme $m_V c_V (T_V - T_x)$

upptagen värme $\underbrace{\rho_{is} V_{is}}_{m_{is}} c_S + \rho_{is} V_{is} c_V (T_x - 0)$

$$\Rightarrow m_V c_V (T_V - T_x) = \rho_{is} V_{is} c_S + \rho_{is} V_{is} c_V T_x$$

$$T_x = \frac{m_V c_V T_V - \rho_{is} V_{is} c_S}{m_V c_V + \rho_{is} V_{is} c_V} = \frac{0.69 \cdot 4.18 \cdot 56 - 917 \cdot 0.14 \cdot 10^{-3} \cdot 334}{0.69 \cdot 4.18 + 917 \cdot 0.14 \cdot 10^{-3} \cdot 4.18}$$

$T_x = 34°C$ (c_V, c_S i kJ)

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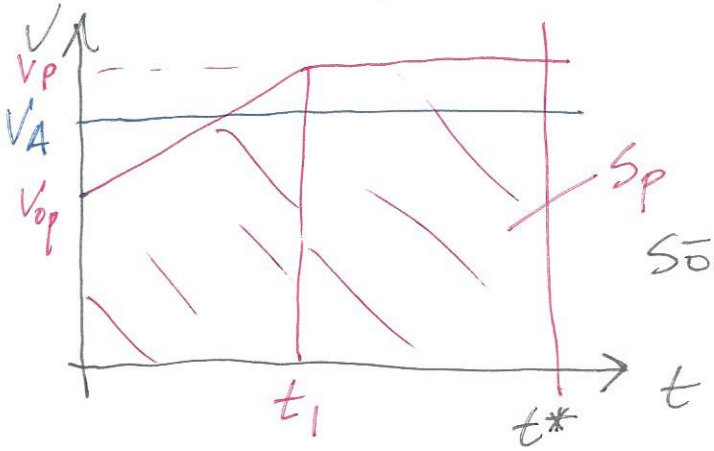
8) V-t diagram:

Givet $V_A = 120$ km/h
$V_{0P} = 70$ km/h
$V_P = 130$ km/h
$a = 1{,}9\ m/s^2$



Sökt t_*, och sträckan

Anna V_A = konstant $\Rightarrow$ $S_A = V_A \cdot t_*$ 1)

polis $S_p = \frac{V_{0p}+V_p}{2} t_1 + V_p (t_* - t_1)$ 2)

t_1 fås ur $a = \frac{V_p - V_{0p}}{t_1} \Rightarrow t_1 = \frac{V_p - V_{0p}}{a}$ sätt in i 2)

$$S_p = \frac{V_0 + V_p}{2}\left(\frac{V_p - V_{0p}}{a}\right) + V_p\left(t_* - \frac{(V_p - V_{0p})}{a}\right)$$

$$S_A = S_p \Rightarrow V_A t_* = \frac{(V_p - V_0)^2}{2a} + V_p t_* - \frac{V_p (V_p - V_{0p})}{a}$$

$$t_* = \frac{\frac{V_p(V_p - V_{0p})}{a} - \frac{(V_p - V_0)^2}{2a}}{V_P - V_A}$$

$$t_* = \frac{\left[\left(\frac{130}{3.6}\right)\left(\frac{130}{3.6} - \frac{70}{3.6}\right)/1.9\right] - \left[\left(\frac{130}{3.6} - \frac{70}{3.6}\right)^2 / 2 \cdot 1.9\right]}{\left(\frac{130}{3.6} - \frac{120}{3.6}\right)} = 26\text{s}$$

$$S_A = V_A \cdot t_* = \frac{120}{3.6} \cdot 26 = 8.7 \cdot 10^2\ \text{m}$$

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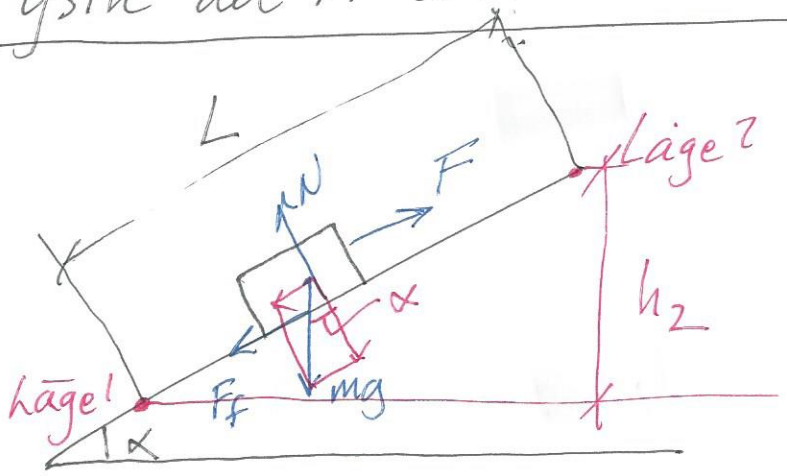
9)



Givet $m = 41\ kg$
$L = 9.0\ m$
$\alpha = 23°$
$\mu = 0.27$

Energiprincipen

$$E_p + E_{k1} + W = E_{p2} + E_{k2} + W_f$$

$$0 + \cancel{E_{k2}} + W = mgh_2 + \cancel{E_{k2}} + F_f \cdot L$$

($h_2 = L\sin\alpha$)

Jämvikt ↖ $N - mg\cos\alpha = 0$

Lådan glider: $F_f = \mu \cdot N \Rightarrow$

$$F_f = \mu mg\cos\alpha$$

$\Rightarrow$ Arbetet $W = mgL\sin\alpha + \mu mgL\cos\alpha$

$$= mgL(\sin\alpha + \mu\cos\alpha) =$$

$$= 41 \cdot 9.82 \cdot 9.0(\sin 23° + 0.27\cos 23°)$$

$$= 2.3 \cdot 10^3\ N$$

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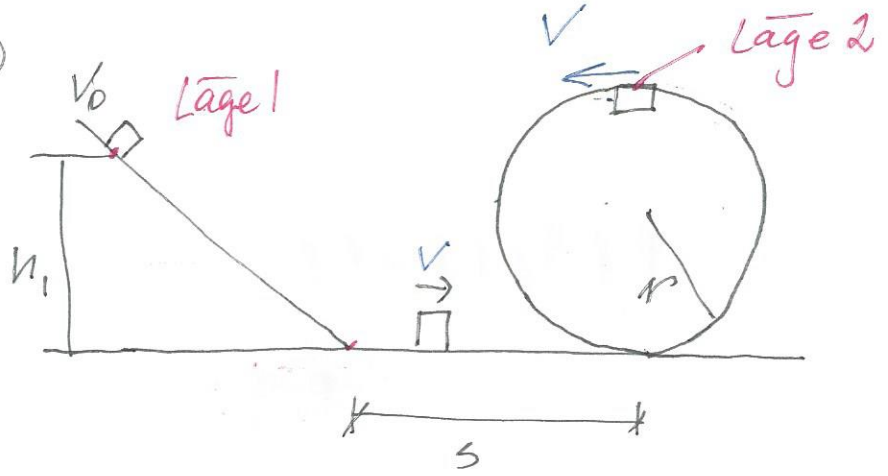
10



Givet $m = 3.1$ kg
$s = 4.1$ m
$r = 1.9$ m
$v_0 = 0$ m/s

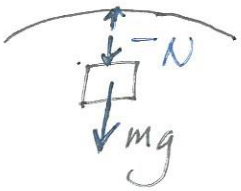
Fartvinnan loopen: Energiprincipen

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

$$mgh + 0 = mg(2r) + \frac{1}{2}mv^2$$

$$gh = 2gr + \frac{1}{2}v^2 \qquad 1)$$

Kring högsta punkten gör klossen en cirkulär centralrörelse med $v \approx$ konstant



Rörelseekvationen

$$\downarrow \quad mg + N = ma_c = m\frac{v^2}{r}$$

$$\Rightarrow N = \frac{mv^2}{r} - mg$$

klossen tappar kontakt, $N = 0 \Rightarrow$

$$\frac{mv^2}{r} = mg \Rightarrow v^2 = gr$$ i 1) ovan

$$gh = 2gr + \frac{1}{2}gr \Rightarrow h = \frac{5}{2}r = 4.8\,\text{m}$$