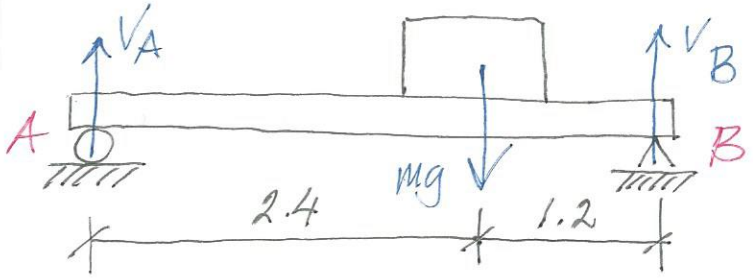
Fysik del A LMA538 & SEE095 230105

1)



Givet:
$m = 300$ kg
måtT (m)

Ställ upp kraftjämvikt för brädan, och kraftmomentjämvikt för axel genom A

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

$\circlearrowleft_A \quad V_B \cdot 3.6 - mg \cdot 2.4 = 0 \quad 2)$

$2) \Rightarrow V_B = \frac{mg \cdot 2.4}{3.6} = \frac{300 \cdot 9.82 \cdot 2.4}{3.6} = 2.0 \text{ kN}$

$1) \Rightarrow V_A = mg - V_B = 300 \cdot 9.82 - 1.96 \cdot 10^3 =$

$= 0.99 \text{ kN}$

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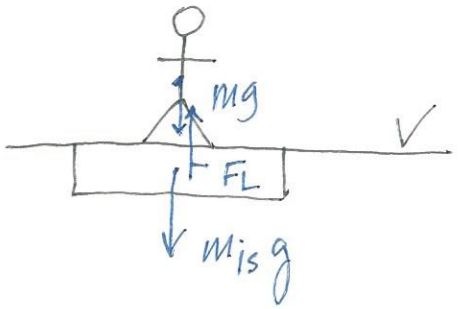
2)



Givet: $V = 0.50\ m^3$

$\rho_{is} = 917\ kg/m^3$

$\rho_V = 1000\ kg/m^3$

$m_{is} = \rho_{is} V$

Vertikal jämvikt

$\uparrow \quad F_L - mg - m_{is}g = 0$

där $F_L = m_V g = \rho_V \cdot V \cdot g$ (lyftkraften)

$\Rightarrow \quad \rho_V V g = mg + \rho_{is} V g$

$m = (\rho_V - \rho_{is})V =$

$= (1000 - 917) \cdot 0.50 = 42\ kg$

3( )

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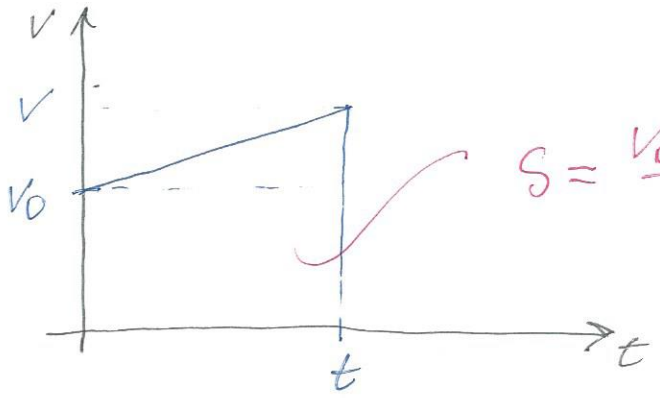
Givet: $s = 90$ m

$t = 5$ s

$v_0 = 48$ km/h $= \frac{48}{3.6}$ m/s

3) Rita v-t diagram



$s \approx \frac{v_0 + v}{2} t$

$s = \frac{v_0 + v}{2} t$; $a = \frac{v - v_0}{t} \Rightarrow$

$s = \frac{v_0 t}{2} + \frac{t}{2}(v_0 + at) = v_0 t + \frac{1}{2} a t^2 \Rightarrow$

$a = \frac{2s - v_0 t}{t^2} * 2 = \frac{2 \cdot 90 - \left(\frac{48}{3.6}\right) \cdot 5}{5^2} * 2 = \cancel{4.5}$ m/s^2

1.867

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4/

Givet: $v_1 = 17\ m/s$

$h = 11\ m$

Använd energiprincipen

$$mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2$$

$h_1 = h$, $h_2 = 0$

$$v_2^2 = 2gh_1 + v_1^2$$

$$v_2 = \sqrt{2gh_1 + v_1^2} = \sqrt{2 \cdot 9.81 \cdot 11 + 17^2} = 22\ m/s$$

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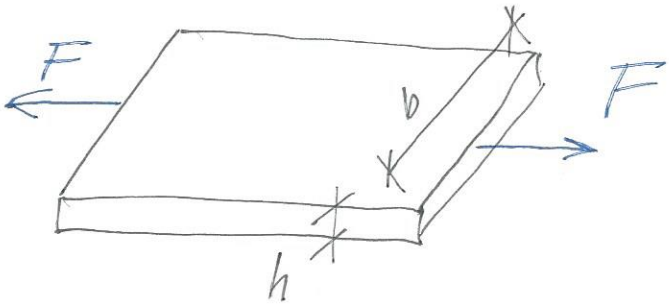
5)



Givet $b = 4{,}5\,cm$

$h = 2{,}2\,cm$

$\sigma_{till} = 120\,N/mm^2$

Spänningen $\sigma = \frac{F}{A} = \frac{F}{b \cdot h}$

Tillåten spänning $= \sigma_{till} \Rightarrow \sigma \leq \sigma_{till}$

$$\frac{F}{b \cdot h} \leq \sigma_{till} \Rightarrow F = \sigma_{till} \cdot b \cdot h = 120 \cdot 45 \cdot 22$$

$$F \leq 1.2 \cdot 10^5\,N$$

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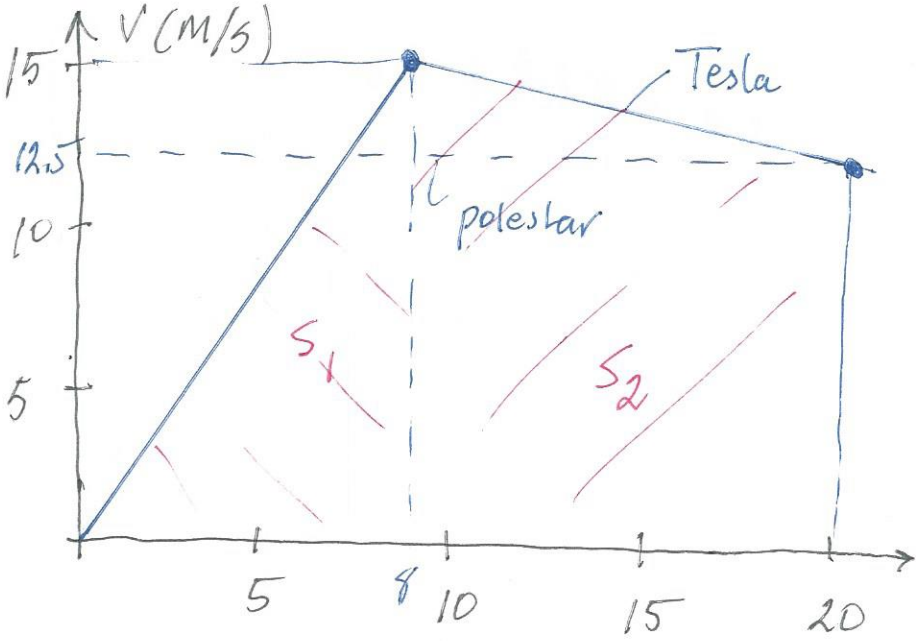
6)



Givet: Vt diagram

V-t diagram $\Rightarrow$ Teslans sträcka $\left(S = \frac{V_0+V}{2} t\right)$

Del 1 start till $t = 8s$: $S_1 = \frac{0+15}{2} 8$.

Del 2 $t = 8s$ inbromsning till $t = 20s$: $S_2 = \frac{15+12.5}{2}(20-8)$

$$S_{Tesla} = \frac{15}{2} 8 + \frac{15+12.5}{2} \cdot 12 = 225 \text{ m}$$

Polestar har konstant hastighet $\Rightarrow$

$$S_{polestar} = V \cdot t = 12.5 \cdot 20 = 250 \text{ m}$$

$\Rightarrow$ Polestar kommer först, avståndet är 25 m

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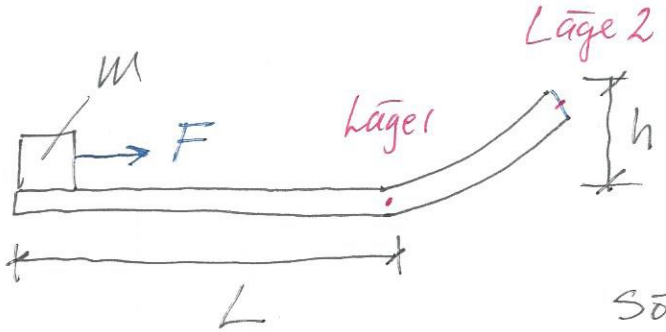
7)



Givet $L = 10\ m$
$m = 250\ kg$
$F = 6000\ N$
$h = 2\ m$

Sökt: raketens fart i läge 2

Horisontell del:

Newtons rörelselag

$$\rightarrow \quad F = m \cdot a \Rightarrow a = \frac{F}{m} = \frac{6000}{250} = 24\ m/s^2$$

Hastigheten (farten) v_1 fås ur

$v_1 = v_0 + at = at$, där $L = \frac{v_0 + v_1}{2} t \Rightarrow$

$$v_1^2 = 2aL$$

Energiprincipen $\Rightarrow$

$$\underbrace{mgh_1}_{=0} + \frac{1}{2} m v_1^2 = \underbrace{mgh_2}_{=h} + \frac{1}{2} m v_2^2$$

$$v_2^2 = v_1^2 - gh = 2aL - gh \Rightarrow$$

$$v_2 = \sqrt{2aL - gh} = \sqrt{2 \cdot 24 \cdot 10 - 9.82 \cdot 2} = 21\ m/s$$

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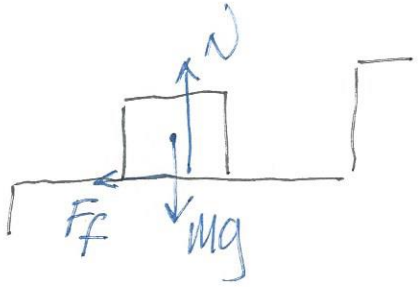
8)



Givet: $m = 250\ kg$

$v_0 = 70\ km/h = \frac{70}{3.6}\ m/s$

$\mu = 0.30$

Söht bromssträcka så att lådan inte glider

Rörelseekv, vertikal jämviht för lådan

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

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

Lådan glider då friktionen är fullt utvecklad; F_f är maximal

$F_f = \mu N \quad 3)$, i $2) \Rightarrow F_f = \mu mg \Rightarrow$

$a = -\mu g$

Bromssträckan $s = \frac{v_0 + v}{2} t = \frac{v_0 t}{2}$ där

$a = \frac{v - v_0}{t} = -\frac{v_0}{t} \Rightarrow v_0^2 = -2as$

$s = -\frac{v_0^2}{2a} = \frac{v_0^2}{2\mu g} = \frac{\left(\frac{70}{3.6}\right)^2}{2 \cdot 0.3 \cdot 9.82} = 64\ m$

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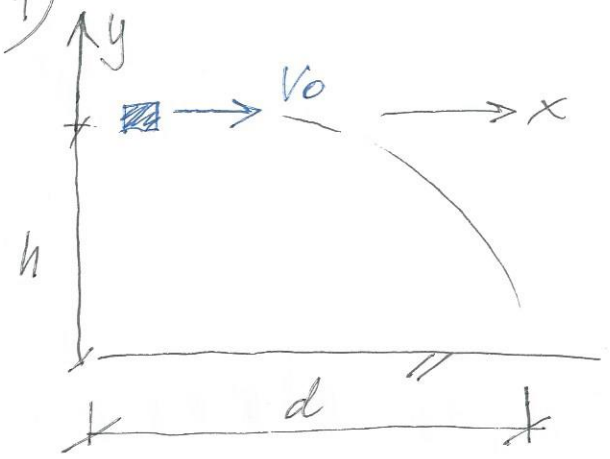
9)



Givet:

$h = 110$ m

$d = 120$ m

Paketets rörelse x-led $s_x = v_{0x} \cdot t = v_0 t$ 1)

y-led $s_y = v_{0y} t + \frac{1}{2} a_y t^2$ 2)

med $a_y = -g$, $v_{0y} = 0$ fås

$s_y = -h = -\frac{1}{2} g t^2 \Rightarrow t = \sqrt{\frac{2h}{g}}$ i 1) $\Rightarrow$

$v_0 = \frac{s_x}{t} = d\sqrt{\frac{g}{2h}} = 120\sqrt{\frac{9.82}{2 \cdot 110}} = 25$ m/s

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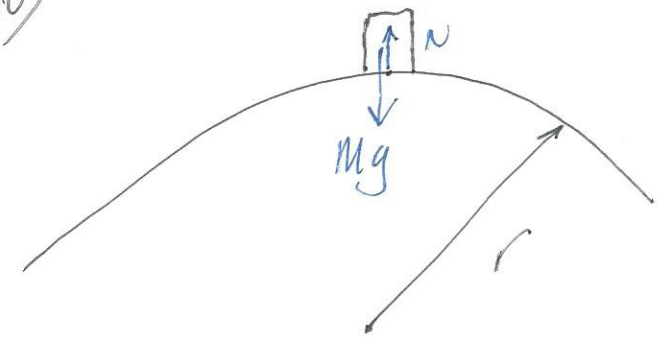
10)



Givet: $m = 2.0\,kg$

$v = 3.5\,m/s$

$r = 2.4\,m$

Newtons rörelselag $\Rightarrow$

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

$$N = mg - m\frac{v^2}{r} = 2.0\left(9.82 - \frac{3.5^2}{2.4}\right)$$

$$N = 9.4\,N$$