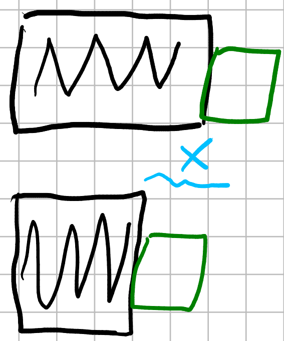
IFYT1001, Nicolai H. Brand 2022

Øving 3

①



$m = 4{,}00\,kg$

$k = 200\,N/m$

$x = 0{,}025\,m$

a) $W = \Delta E_p = \frac{1}{2}kx^2$

$= \frac{1}{2} \cdot 200\frac{N}{m} \cdot (0{,}025\,m)^2$

$= \underline{\underline{0{,}063\,J}}$

b) Energi er bevart

$E_{før} = E_{etter}$

$W = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2W}{m}} = \sqrt{\frac{2 \cdot 0{,}063\,J}{4{,}00\,kg}} = \underline{\underline{0{,}176\,m/s}}$

②

$m = 5{,}5\,kg$

$F(x) = 6{,}0\,N - (2{,}0\frac{N}{m})x + (6{,}0\frac{N}{m^2})x^2$

$X_0 = 0m$ $X = 8,6m$

$W = E_{mek}$

$\Delta F \cdot s = \frac{1}{2}mv^2$

$\int_{x_0}^{x} F(x)dx = \frac{1}{2}mv^2$

$$\left[(6,0x - x^2 + 2x^3)N\right]_0^{8,6m} = \frac{1}{2}mv^2$$

$$V = \sqrt{\frac{2(6,0N \cdot 8,6m - (8,6m)^2 + 2N(8,6m)^3)}{5,6kg}}$$

$V = \underline{\underline{21m/s}}$

3 $K = 450\ N/m$ $m = 1,80kg$ $h = 3,60m$

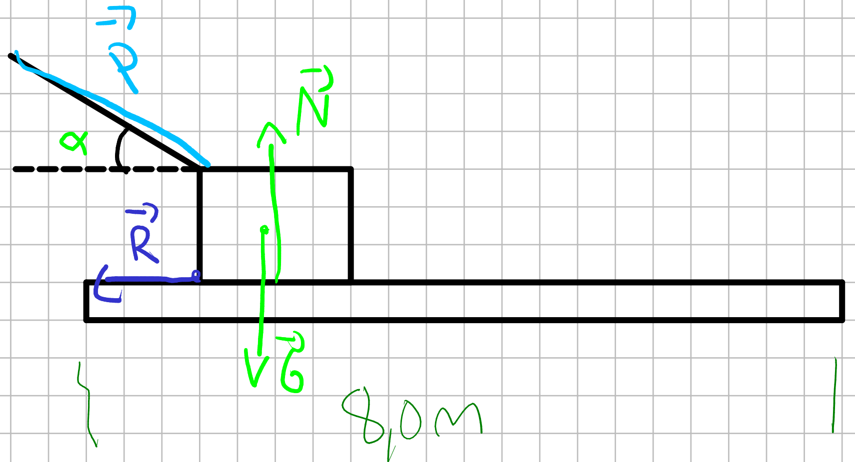
$E_{før} = E_{etter}$

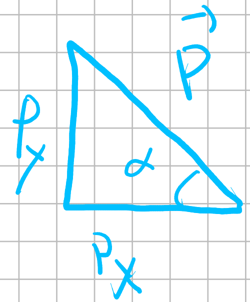
$\frac{1}{2}kx^2 = mg(h+x)$ (Ingen bevegelsesenergi fordi $V = 0$ i toppunktet)

Andregradsuttrykk hvor geogebra gir: $\underline{\underline{X = 0,57m}}$

④ $P = 150\,N \quad m = 20{,}0\,kg \quad s = 8{,}0\,m$

$V_0 = 0{,}459\,m/s \quad v = 1{,}92\,m/s \quad \alpha = 30^\circ$





a) $\sum F_x = ma$

$P_x - R = ma$

$R = -ma + P_x$

$\cos\alpha = \frac{P_x}{\vec{P}}$

$\underline{P_x = \vec{P}\cos\alpha}$

$v^2 - v_0^2 = 2as$

$a = \frac{v^2 - v_0^2}{2s}$

$W_R = -Rs$

$= -(-ma + P_x)\cdot s$

$= -\left[-\frac{m(v^2 - v_0^2)}{2s} + \vec{P}\cos\alpha\right]s$

$= \frac{m(v^2 - v_0^2)}{2} - \vec{P}\cdot s\cdot\cos\alpha$

$= \frac{20{,}0\,kg\,((1{,}92\,m/s)^2 - (0{,}459\,m/s)^2)}{2} - 150\,N\cdot\cos(30^\circ)\cdot 8\,m$

$= \underline{-1103\,N} = \underline{\underline{-1{,}1\cdot 10^3\,N}}$

b) $R = \mu N$

$W_R = R \cdot s = \mu N$

$\mu = \frac{W_R}{smg} = \frac{1103 N}{8{,}0 m \cdot 20 kg \cdot 9{,}81 m/s^2} = \underline{\underline{0{,}46}}$

c)

$\underline{P_R = \frac{W_R}{t}}$

$s = \frac{1}{2}(v_0 + v) \cdot t$

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

$P_R = \frac{W_R(v_0+v)}{2s}$

$= \frac{1103 N (0{,}459 m/s + 1{,}92 m/s)}{2 \cdot 8{,}0 m}$

$= \underline{\underline{164 W}}$

5

$s = 1270 m$ $h = 170 m$ $P = 2000 \cdot 10^6 W$

$G \cdot 0{,}92$ er brukbart $t = 1$

$$P = \frac{W}{t} = \frac{W}{1}$$

$$P = G \cdot h \cdot 0{,}92$$

$$P = mgh \cdot 0{,}92$$

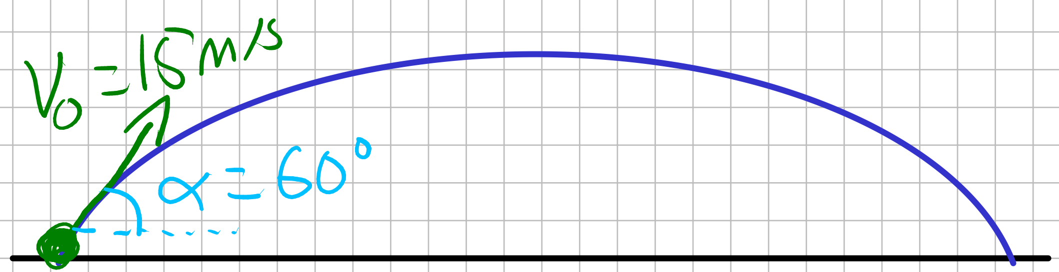
$$m = \frac{P}{gh \cdot 0{,}92}$$

Dette gir et svar i liter. Antar 1 l ≈ 1 kg

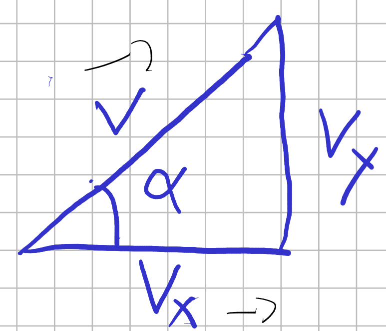
må da dele på 1000 for å få m^3.

$$m = \frac{P}{gh \cdot 0{,}92 \cdot 1000} = \underline{\underline{1{,}1\ km^3\ p/s}}$$

6



Energi er bevart



$$E_0 = E_{toppunkt}$$

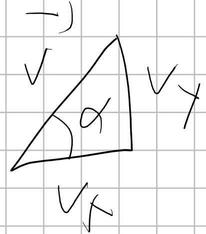
$$\frac{1}{2} m V_y^2 = mgh_{topp}$$

$$V_y = \vec{V} \sin\alpha$$

$$h_{topp} = \frac{(\vec{V} \sin\alpha)^2}{2g} = \frac{(15\ m/s \cdot \sin 60°)^2}{2 \cdot 9{,}81\ m/s^2} = \underline{\underline{86\ m}}$$

(7)

x:



$$S = V_x t$$

$$t = \frac{S}{\cos\alpha V}$$

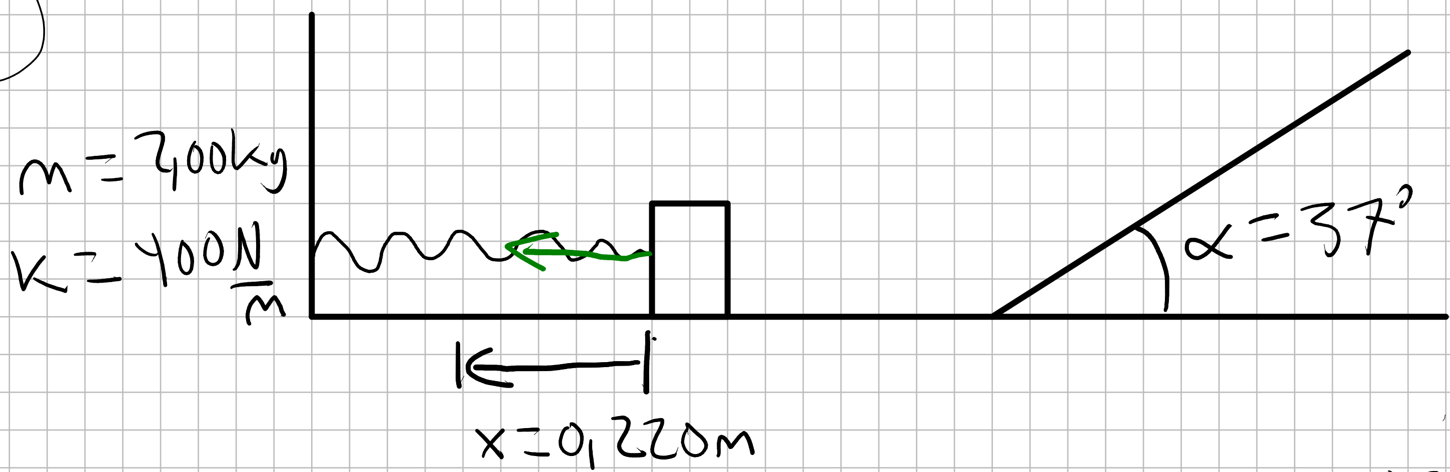
$$\cos\alpha = \frac{V_x}{V}$$

$$V_x = \cos\alpha \vec{V}$$

$\cos 0 = 1$, $\cos 90° = 0$

Altså gir større α mindre $\cos\alpha$ som igjen gir større t. Dermed er D riktig.

(8)



a) Energi bevart

$$\int_0^{0{,}220 m} kx\,dx = \frac{1}{2}kx^2\Big]_0^{0{,}220}$$

$$E_0 = E_1$$

$$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$$

$$V = \sqrt{\frac{k}{m}} \cdot x = \sqrt{\frac{400 \frac{N}{m}}{2{,}00 kg}} \cdot 0{,}220 m = 3{,}11 m/s$$

b) Energi bevart

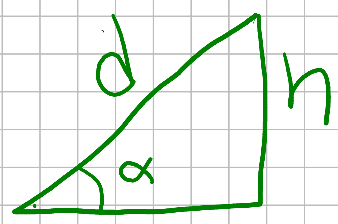
$E_0 = E_1$

$\frac{1}{2}kx^2 = mgh_1$ vet $V = 0$ i toppunktet.

Bruker $\frac{1}{2}kx^2$ over $\frac{1}{2}mv^2$

$$h = \frac{kx^2}{2mg}$$

$$= \frac{400\frac{N}{m} \cdot (0{,}220m)^2}{2 \cdot 2{,}00kg \cdot 9{,}81\,m/s^2} = \underline{0{,}493} \quad \text{høyde}$$



$$\sin\alpha = \frac{h}{d} \Rightarrow d = \frac{h}{\sin\alpha}$$

$$d = \frac{0{,}493}{\sin 37{,}0°} = \underline{\underline{0{,}820m}}$$

c)

Det er et lukket system hvor energien er bevart. Den potensielle energien blir omgjort til mekanisk energi, og så potensiell energi i toppunktet på skråplanet. Ettersom legemet begynner å bevege seg nedover skråplanet og tilbake på et horisontalt plan,
er nå all den potensielle energien i toppunktet tilbake til mekanisk energi. Når legemet så presset tilbake mot fjæra vil den da presset like langt inn som den begynte ettersom energien vi startet med er bevart, og ingenting har gått bort.