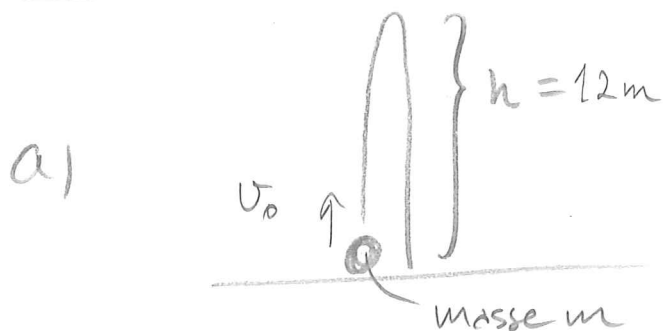


Fysikk, tre terminsordninga

Eksamen februar 2018

Løysingsforslag

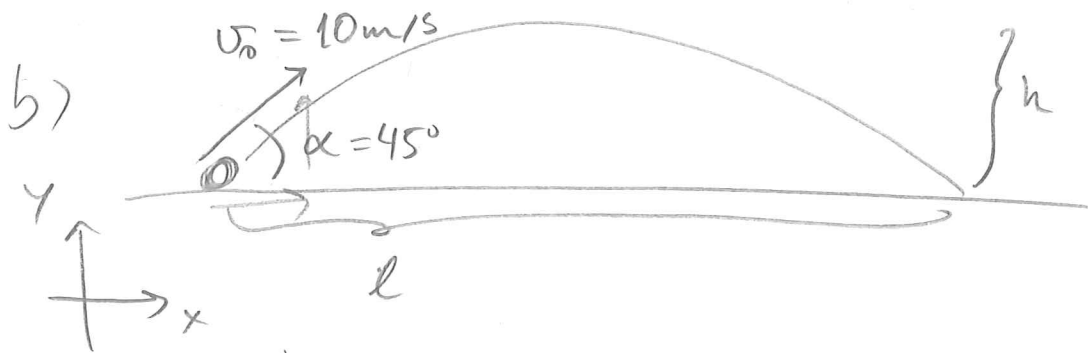
Oppg. 1



Energibevaring

$$\frac{1}{2}mv_0^2 = mgh$$

$$v_0 = \sqrt{2gh} = \sqrt{2 \cdot 9.81 \text{ m/s}^2 \cdot 12 \text{ m}}$$
$$= 15.344 \text{ m/s} \approx \underline{15 \text{ m/s}}$$



Høgde $y = v_{0y}t - \frac{1}{2}gt^2$ der t er tida og

$$v_{0y} = v_0 \sin \alpha$$

Lengde $x = v_{0x}t$ der $v_{0x} = v_0 \cos \alpha$

Finn landingstidspunkt:

$$y = 0$$

$$v_0 \sin \alpha t - \frac{1}{2}gt^2 = 0$$

$$t (v_0 \sin \alpha - \frac{1}{2}gt) = 0$$

$$t = 0 \text{ eller } v_0 \sin \alpha - \frac{1}{2}gt = 0$$

$t = 0$ er uinteressant her

$$\frac{1}{2}gt = v_0 \sin \alpha$$

$$t = \frac{2v_0 \sin \alpha}{g}$$

Maksimal lengde:

$$l = v_0 \cos \alpha \cdot \frac{2v_0 \sin \alpha}{g} = \frac{2v_0^2 \cos \alpha \sin \alpha}{g}$$

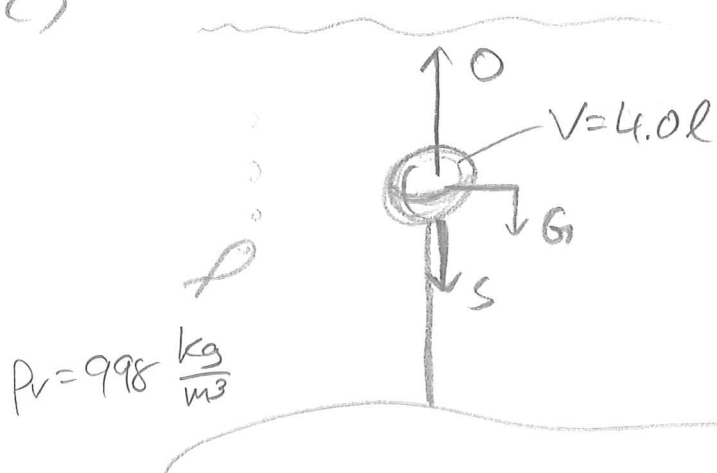
$$= \frac{2 \cdot (10 \text{ m/s})^2 \cdot \cos 45^\circ \cdot \sin 45^\circ}{9.81 \text{ m/s}^2} = 10.1937 \text{ m} \approx \underline{10 \text{ m}}$$

For å finne høyde h , kan vi bruke energibevaring som i a):

$$\frac{1}{2}mv_{0y}^2 = mgh$$

$$h = \frac{(v_0 \sin \alpha)^2}{2g} = \frac{(10 \text{ m/s} \cdot \sin 45^\circ)^2}{2 \cdot 9.81 \text{ m/s}^2} = 2.5484 \text{ m} \approx \underline{2.5 \text{ m}}$$

c)



Tyngdekraft:

$$G = mg = 0.400 \text{ kg} \cdot 9.81 \text{ m/s}^2 = 3.924 \text{ N} \approx \underline{3.9 \text{ N}}$$

Oppdrift:

$$O = p_r V g =$$

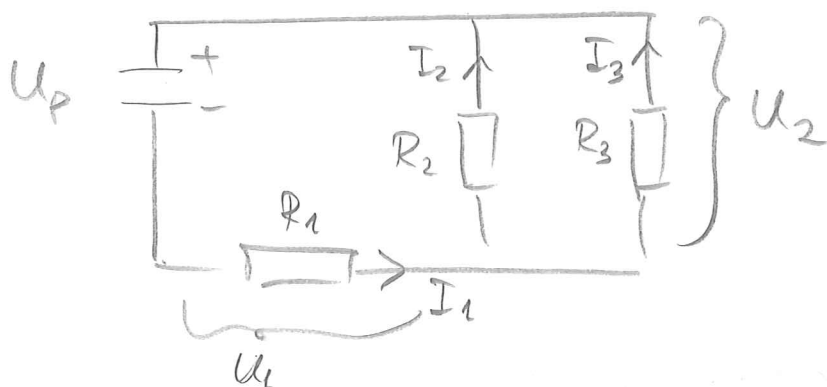
$$998 \frac{\text{kg}}{\text{m}^3} \cdot 4.0 \cdot 10^{-3} \text{ m}^3 \cdot 9.81 \text{ m/s}^2 = 39.1615 \text{ N} \approx \underline{39 \text{ N}}$$

Snordraget S kan vi bestemme ved Newtons første lov:

$$0 = S + G$$

$$S = 0 - G = 39.1615 \text{ N} - 3.924 \text{ N} = 35.2375 \text{ N} \approx \underline{35 \text{ N}}$$

Oppg 2



a) Ohms lov: $U_1 = R_1 I_1$, $I_1 = \frac{U_1}{R_1} = \frac{3.6 \text{ V}}{1.0 \Omega} = \underline{3.6 \text{ A}}$

Effekt:

$$P = U_1 I_1 = U_1 \cdot \frac{U_1}{R_1} = \frac{U_1^2}{R_1} = \frac{(3.6 \text{ V})^2}{1.0 \Omega} = 12.96 \text{ W} \approx \underline{13 \text{ W}}$$

b) Spennings over hver av komponentene i parallellkoplinga er den same.

Kirchhoffs andre lov gir at

$$U_p = U_1 + U_2$$

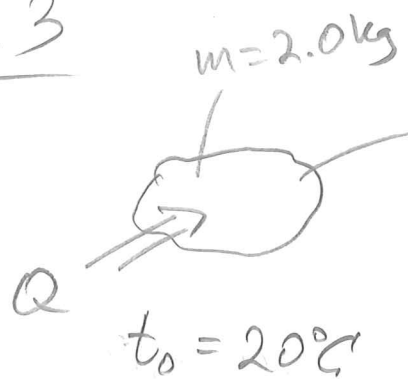
$$U_2 = U_p - U_1 = 10 \text{ V} - 3.6 \text{ V} = \underline{6.4 \text{ V}}$$

Strømmene er igjen bestemt ved Ohms lov:

$$I_2 = \frac{U_2}{R_2} = \frac{6.4 \text{ V}}{3.2 \Omega} = \underline{2.0 \text{ A}}$$

$$I_3 = \frac{U_2}{R_3} = \frac{6.4 \text{ V}}{4.0 \Omega} = \underline{1.6 \text{ A}}$$

Oppg. 3



spesifikk varmekap: $c_{\text{ly}} = 130 \frac{\text{J}}{\text{kg} \cdot \text{K}}$

smeltevar: $L_{\text{ly}} = 25 \cdot 10^3 \frac{\text{J}}{\text{kg}}$

Smeltepunkt: $t_s = 328^\circ\text{C}$

Varme:

$$Q = c_{\text{ly}} m (t_s - t_0) + L_{\text{ly}} m =$$

$$m (c_{\text{ly}} (t_s - t_0) + L_{\text{ly}}) =$$

$$2.0 \text{ kg} (130 \frac{\text{J}}{\text{kg} \cdot \text{K}} (328 - 20.0) \text{K} + 25 \cdot 10^3 \frac{\text{J}}{\text{kg}}) =$$

$$130080 \text{ J} \approx \underline{130 \text{ kJ}}$$

Oppg. 4

a) Energi: $E = hf$ der f er frekvensen

Lysfart: $c = f \lambda$, der λ er bølglengde

$$f = \frac{E}{h} = \frac{2.0 \cdot 10^{-13} \text{ J}}{6.63 \cdot 10^{-34} \text{ Js}} = 3.0166 \cdot 10^{20} \frac{1}{\text{s}} \approx \underline{3.0 \cdot 10^{20} \text{ Hz}}$$

$$\lambda = \frac{c}{f} = \frac{ch}{E} = \frac{3.00 \cdot 10^8 \text{ m/s} \cdot 6.63 \cdot 10^{-34} \text{ Js}}{2.0 \cdot 10^{-13} \text{ J}} = 9.9450 \cdot 10^{-13} \text{ m} \approx \underline{9.9 \cdot 10^{-13} \text{ m}}$$

b) Energien er gitt ved massesmillet:

$$\Delta E = \Delta m c^2 = (1.0087 + 235.0439 - 140.9144 - 91.9262 - 3 \cdot 1.0087) \cdot 1.6605 \cdot 10^{-27} \text{ kg} \cdot (3.00 \cdot 10^8 \text{ m/s})^2 =$$

$$2.7782 \cdot 10^{-11} \text{ J} \approx \underline{2.78 \cdot 10^{-11} \text{ J}}$$

Oppg. 5

a) Den ideelle gass-love:

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

der p er trykk, V er volum og T er absolutt temperatur. Med fritt stempel vil vi ha at $P_1 = P_2 = P_0$.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$T_2 = \frac{V_2}{V_1} T_1 = \frac{1.7\text{ l}}{1.2\text{ l}} \cdot 300\text{ K} = \underline{425\text{ K}}$$

b) Endring i indre energi:

$$\Delta U = Q - W$$

der $Q = 126\text{ J}$ er mottatt varme og

W er arbeidet utført av gassen.

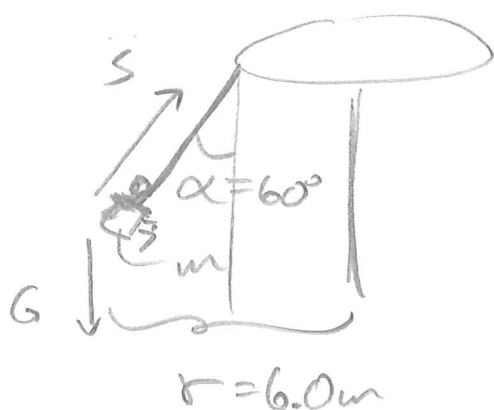
Siden trykket er konstant, er dette arbeidet like

$W = F \Delta x = P_0 A \Delta x = P_0 \Delta V = P_0 (V_2 - V_1)$ der F er kraften på stempelet fra gassen.

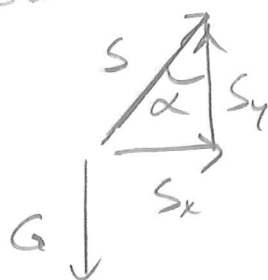
$$\Delta U = Q - W = Q - P_0 (V_2 - V_1) =$$

$$126\text{ J} - 1.01 \cdot 10^5\text{ Pa} \cdot (1.7 - 1.2) \cdot 10^{-3}\text{ m}^3 = \underline{75.5\text{ J}}$$

Oppg. 6



Dekomponering:



Newtons 1. lov i y -retning: $S_y = G = mg$

Sentripetalkraft: $S_x = m \frac{v^2}{r}$ der v er farten.

$$\text{Ses: } \frac{S_x}{S_y} = \tan \alpha$$

$$S_x = S_y \tan \alpha$$

Med $S_y = mg$ og $S_x = m \frac{v^2}{r}$:

$$m \frac{v^2}{r} = mg \tan \alpha$$

$$v = \sqrt{g r \tan \alpha} = \sqrt{9.81 \text{ m/s}^2 \cdot 6.0 \text{ m} \cdot \tan 60^\circ}$$
$$= 10.0970 \text{ m/s} \approx \underline{10 \text{ m/s}}$$