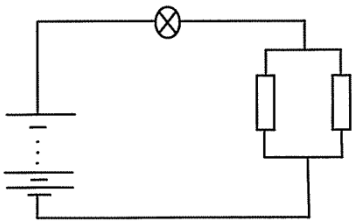
1

a) ${}^{218}_{84}Po \rightarrow {}^{4}_{2}He + {}^{214}_{82}Pb$ ${}^{214}_{82}Pb \rightarrow {}^{0}_{-1}e + {}^{214}_{83}Bi$

b) $\Delta m = m_{Po} - m_{\alpha} - m_{Pb} = (218{,}00897 - 4{,}002603 - 213{,}99980)u = 0{,}006567u = 1{,}09 \cdot 10^{-29}kg$
Frigjort energi: $\Delta E = \Delta mc^2 = (1{,}09 \cdot 10^{-29} \cdot (3{,}00 \cdot 10^{8})^2)J =$ $\underline{9{,}81 \cdot 10^{-13}J}$

c) $hf = E_4 - E_1 \Leftrightarrow \frac{hc}{\lambda} = -\frac{B}{16} + \frac{B}{1} \Leftrightarrow \lambda = \frac{6{,}63 \cdot 10^{-34} \cdot 3 \cdot 10^{8}}{2{,}18 \cdot 10^{-18}(1 - \frac{1}{16})} m =$ $\underline{97{,}3nm}$

d)

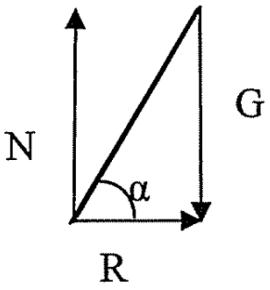


e) $P_L = U_L \cdot I \Leftrightarrow I = \frac{P_L}{U_L} = \frac{9}{6}A =$ $\underline{1{,}5A}$

f) $\varepsilon = 5 \cdot 1{,}5V = 7{,}5V$
$U_{par} = 7{,}5V - 6{,}0V = 1{,}5V$ $I_1 = \frac{1{,}5}{10}A = 0{,}15A$
$I_2 = (1{,}5 - 0{,}15)A = 1{,}35A$
$U_{par} = R_2 \cdot I_2 \Leftrightarrow R_2 = \frac{U_{par}}{I_2} = \frac{1{,}5}{1{,}35}\Omega =$ $\underline{1{,}1\Omega}$

2

a) Termodynamikkens 1. Lov sier at øking av indre energi er arbeid pluss varme. Her gjør vi et arbeid på systemet, varmeutvekslingen er liten og dermed øker indre energi og dermed temperaturen. Friksjon gir også varme og høgre temperatur.



b) v = 50km/h = 13,9m/s.
$tan\alpha = \frac{G}{R} = \frac{mg}{m\frac{v^2}{r}} = \frac{gr}{v^2} = \frac{9{,}81 \cdot 50}{13{,}9^2}$ $\underline{\alpha = 68{,}5^{\circ} \approx 69^{\circ}}$

c) v_{jo}= 36km/h=10m/s, $s_{jo} = v_{jo} \cdot t \Rightarrow t_{jo} = \frac{300}{10}s = 30s$ v_o=30km/h=8,33m/s.

$$s_o = v_0 + \frac{1}{2}at^2 = 300m + 30m \Longrightarrow \frac{1}{2} \cdot 0{,}20\frac{m}{s^2} \cdot t^2 + 8{,}33\frac{m}{s} \cdot t - 330m = 0$$

Andregradslikning gir: t = 29,3s eller t = -112,6s Ola vinner

d) v_o=30km/h = 8,33m/s, m_o=85 kg, m_d=55kg, v_d=0m/s.
Bevegelsesmengde bevart:
$(m_o+m_d)v = m_o v_o + m_d v_d$ $v = \frac{85 \cdot 8{,}33 + 0}{85 + 55}\frac{m}{s} =$ $\underline{5{,}1 \text{ m/s} = 18 \text{ km/h}}$

3.a) Energibev. $\frac{1}{2}kx^2 = \frac{1}{2}mv^2 \Longrightarrow v = \sqrt{\frac{kx^2}{m}} = \sqrt{\frac{30 \cdot 0{,}30^2}{0{,}040}}\frac{m}{s} =$ $\underline{8{,}2\ m/s}$

b) $v_{0y} = 12\ \frac{m}{s} \cdot sin30^{\circ} = 6{,}0m/s$ $v_{0x} = 12\frac{m}{s} \cdot cos30^{\circ} = 10{,}4\ m/s$
Bevegelseslikning:

$$2a_y y = v_y^2 - v_{oy}^2 \Longrightarrow y = \frac{0 - 6^2}{2 \cdot (-9{,}81)}m = 1{,}83m$$

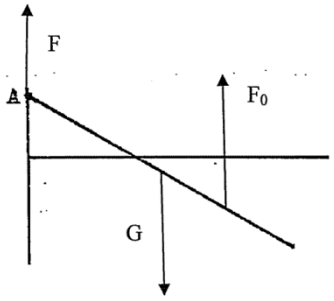
Maks høgd: (0,45+1,83)m = $\underline{2{,}28m \approx 2{,}3m}$

c) y = -0,45m.
Bevegelseslikning: $y = v_{0y}t + \frac{1}{2}at^2 \Leftrightarrow \frac{1}{2}at^2 + v_{0y}t - y = 0 \Rightarrow -4{,}905\frac{m}{s^2} + 6{,}0\frac{m}{s}t + 0{,}45m = 0$
$\Rightarrow t_1$=-0,07s og t_2 = 1,29s
Kastelengda blir: x = (10,4·1,29)m=$\underline{13{,}4m \approx 13m}$

d) $\frac{1}{2}mv_o^2 + mgh = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{v_o^2 + 2gh} = \sqrt{12^2 + 2 \cdot 9{,}91 \cdot 0{,}45}\ \frac{m}{s} = 12{,}36\ \mathrm{m/s}$

$cos\alpha = \frac{10{,}4}{12{,}35} \Rightarrow \alpha = 32{,}8^\circ$ Hastigheten danner 32,8°≈33°med horisonten på skrå nedover.

4a)



b)Oppdrift: $F_o = \rho V g = (1{,}025 \cdot 10^3 \cdot 4 \cdot 0{,}223 \cdot 0{,}048 \cdot 9{,}81)N =$ $431N \approx 0{,}43kN$

c) Moment om A.

$G \cdot 3m \cdot cos\alpha = F_o \cdot 4m \cdot cos\alpha$

$G = \frac{430{,}5N \cdot 4}{3} = 574N$

$m = \frac{574}{9{,}81} kg = 58{,}5\mathrm{kg}$

Massetetthet: $\rho = \frac{58{,}5}{6 \cdot 0{,}223 \cdot 0{,}048}\ \frac{kg}{m^3} =$ $911\ kg/m^3 \approx 0{,}91 \cdot 10^3 kg/m^3$

d) Trykk: $p_1 = p_0 + \rho gh = (1{,}013 \cdot 10^5 + 1025 \cdot 9{,}81 \cdot 2)Pa =$ $121kPa \approx 0{,}12MPa$

e) V_1=25cm^3, T_1=(35+273)K = 308K, p_1=121,4kPa, p_2=101,3kPa, T_2=(20+273)K = 293K

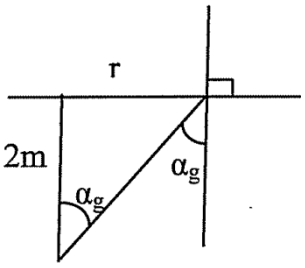
Tilstandslikning: $\frac{p_1 \cdot V_1}{T_1} = \frac{p_2 \cdot V_2}{T_2} \Leftrightarrow V_2 = \frac{p_1 \cdot V_1 \cdot T_2}{T_1 \cdot p_2} = \frac{121{,}4 \cdot 25 \cdot 293}{308 \cdot 101{,}3} cm^3 =$ 28,5cm^3≈29cm^3

f)

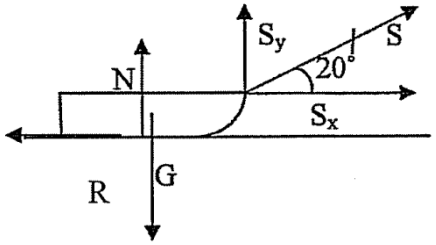
Snell: $1{,}33 \cdot \sin\alpha_g = 1 \cdot \sin 90^\circ$

$sin\alpha_g = \frac{1}{1{,}33}$ $\quad \alpha_g = 48{,}75^\circ$

$tan\alpha_g = \frac{r}{2{,}00m} \Leftrightarrow r = 2{,}00m \cdot tan 48{,}75^\circ =$ 2,28m



5a) Arbeid: W = S·s·cos20°=70N·200m·cos20°=13,2kJ≈13kJ



b) N.1.L. Friksjonskraft: R = S_x = 70N·cos20° = 65,8N≈66N

c) N.1.L. vert. N + S·sin 20° = G

N = G - S·sin 20° = (70·9,81-70sin20°)N = 662,8N

Friksjonstall: $\mu = \frac{R}{N} = \frac{65{,}8}{662{,}8} =$ 0,099

d) G = (70·9,81)N = 687N≈0,69kN

N.1.L hor.: S·cos20° = 0,11·N (1)

N.1.L vert.: S·sin20° + N = mg ⇔N = mg - S·sin20° (2)

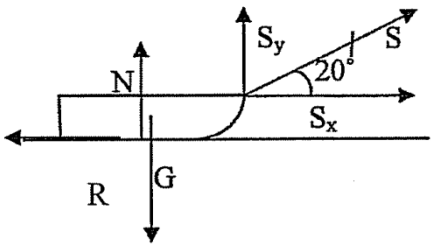
(2) inn i (1) gir: S·cos20° = 0,11· (mg - S·sin20°)

S·cos20° + 0,11·S·sin20°= 0,11· mg

Snordrag: $S = \frac{0{,}11 \cdot 687N}{cos20^\circ + 0{,}11 sin20^\circ}$ = 77,3N ≈ 77N

(2) gir: Normalkraft: N = 687N – 77,3N·sin 20° = 660N≈0,66kN

Friksjonskraft: R = 0,11 · 660N = 72,6N≈73N



e) Varme: Q = $c_i \cdot m_i \cdot 2K + l_s \cdot m_i + c_v \cdot m_i \cdot 37K$ = (2100·0,005·2+334000·0,005+4180·0,005·37)J = 2,5kJ