Oppgave 1

a) $\underline{\underline{D}}$ $v_x = v_{fly} = \text{konstant} \Rightarrow x = v_{fly} \cdot t \Rightarrow t = \dfrac{x}{v_{fly}}$

$$a_y = -g, v_{0y} = 0 \Rightarrow y = -\frac{1}{2}gt^2 = -\frac{1}{2}g\left(\frac{x}{v_{fly}}\right)^2 = -\text{konstant} \cdot x^2$$

b) $n = \dfrac{c_{luft}}{c_{glass}} = \dfrac{f_{luft} \cdot \lambda_{luft}}{f_{glass} \cdot \lambda_{glass}} = \dfrac{\lambda_{luft}}{\lambda_{glass}} = \dfrac{1193\,nm}{755\,nm} \approx \underline{\underline{1,58}}$

c) $p_{slutt} = p_{start} \Rightarrow n \cdot m\left(\frac{1}{5}v\right) = 3mv \Rightarrow n = 3 \cdot 5 = \underline{\underline{15}}$

d)

$$\Delta s_2 = \frac{5a + 10a}{2} \cdot 5 = 37,5\,a \Rightarrow a = \frac{150}{37,5} = 4,0\,m/s^2$$

$$\Delta s_1 = \frac{1}{2}at_1^2 = \frac{1}{2} \cdot 4,0\,m/s^2 \cdot (5,0\,s)^2 = \underline{\underline{50\,m}}$$

e)

Det kommer inn et nøytron i thoriumkjernen. Det resulterende ${}^{233}_{90}Th$ er ustabilt og pga. ubalanse mellom nukleonene går så ett nøytron over til ett proton + ett elektron (+ ett antielektronnøytrino), beta-decay. I den resulterende protaktiumkjernen blir det en ny beta-decay slik at vi ender opp med U-233.

$${}^{1}_{0}n + {}^{232}_{90}Th \rightarrow {}^{233}_{90}Th \rightarrow {}^{233}_{91}Pa + {}^{0}_{-1}e + (\overline{\nu_e} + energi)$$

$$\hookrightarrow {}^{233}_{92}U + {}^{0}_{-1}e + (\overline{\nu_e} + energi)$$

f) $Mg = 50\,kg \cdot 9,81\,m/s^2 = 490,5\,N \qquad mg = 180\,N$

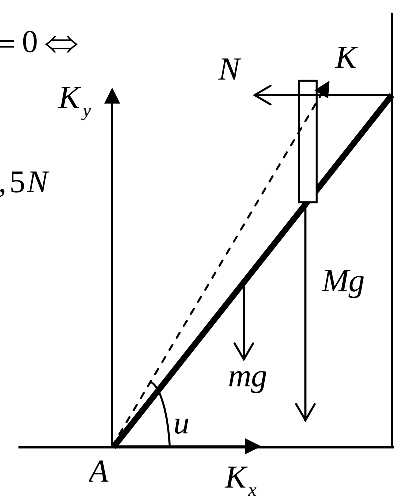
$$N \cdot 4,0\,m \cdot \sin 60,0° - mg \cdot 2,0\,m \cdot \sin 30,0° - Mg \cdot 3,0\,m \cdot \sin 30,0° = 0 \Leftrightarrow$$

$$N = \frac{180\,Nm + 735,75\,Nm}{3,46\,m} \approx 264,7\,N \Rightarrow N = -264,7\,N$$

$$K_x = -N = 264,7\,N \text{ og } K_y = Mg + mg = 490,5\,N + 180\,N = 670,5\,N$$

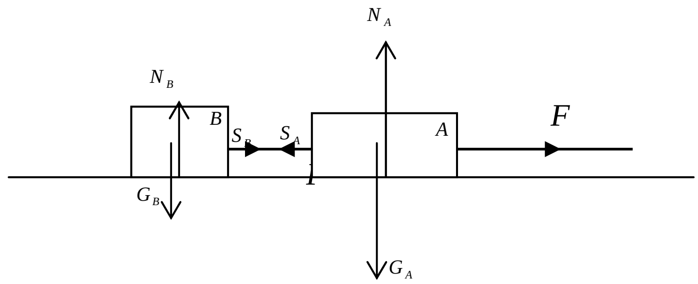
$$K = \sqrt{(264,7)^2 + (670,5)^2}\,N \approx 721\,N \approx \underline{\underline{0,72\,kN}}$$

$$u = \tan^{-1}\left(\frac{670,5}{264,7}\right) \approx \underline{\underline{68°}}$$



Oppgave 2

a)



$$G_A = m_A g = 6,00\,kg \cdot 9,81\,m/s^2 = 58,9\,N$$
$$G_B = m_B g = 4,00\,kg \cdot 9,81\,m/s^2 = 39,2\,N$$
$$N_A = G_A = 58,9\,N$$
$$N_B = G_B = 39,2\,N$$

b) $S = m_B \cdot a = 10,0\,N \qquad F = (m_A + m_B)\cdot a = 10,0\,kg \cdot 2,50\,m/s^2 = \underline{\underline{25,0\,N}}$

c) $S = m_B \cdot g \cdot \sin 30° \approx \underline{\underline{19,6\,N}} \qquad F = (m_A + m_B)\cdot g \cdot \sin 30° \approx \underline{\underline{49,1\,N}}$

d) $$a_{maks} = \frac{S_{maks} - m_B g \sin 30° - \mu m_B g \cos 30°}{m_B} \approx \underline{\underline{5,05\,m/s^2}}$$

Oppgave 3

a) $$Q_V = c_V \cdot m \cdot \Delta T = 4,18 \cdot 10^3 \frac{J}{kg\,K} \cdot 1,15\,kg \cdot 2,9\,K \approx 13940,3\ J \approx \underline{\underline{13,9\ kJ}}$$

b) $$Q_V = Q_{Kjele} = C_{kjele} \cdot \Delta T_{kjele} \Rightarrow C_{kjele} = \frac{Q_V}{\Delta T_{kjele}} \approx \frac{13,9\,kJ}{9,3\,K} \approx \underline{\underline{1,50\frac{kJ}{K}}}$$

c) Med varmetap ville varmekapasiteten vært mindre

$$Q_V = Q_{Kjele} + Q_{tap} \Leftrightarrow Q_{Kjele} = Q_V - Q_{tap} \Rightarrow C_{kjele} = \frac{Q_V - Q_{tap}}{\Delta T_{kjele}} \approx 1,50\frac{kJ}{K} - \frac{Q_{tap}}{\Delta T_{kjele}} < 1,50\frac{kJ}{K}$$

d) Med varmetap og aluminiumskjele

$$C_{kjele} = c_{Al} \cdot m_{Al} = 900\frac{J}{kg\,K} \cdot 1,10\,kg = 990\frac{J}{kg} \qquad Q_{kjele} = C_{kjele} \cdot \Delta T_{kjele} = 990\frac{J}{kg} \cdot 9,3\,K = 9207\,J$$

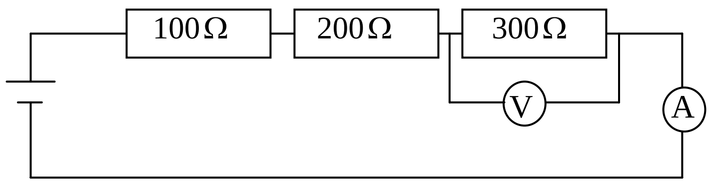
$$Q_{tap} = 13940,3\,J - 9207\,J \approx 4733,3\ J \approx \underline{\underline{4,73\,kJ}}$$

Oppgave 4

a) Ideelle metre måler presist uten å forstyrre kretsen.
For amperemeteret vil det si at det har neglisjerbar resistans, og for voltmeteret vil det si at det har mye større resistans enn resten av kretsen.

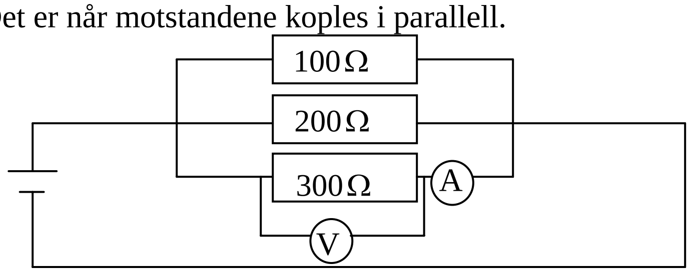
b) Minst mulig strøm går det når det er størst mulig resistans i kretsen.
Det er når motstandene koples i serie.

$$R_{tot} = 100\,\Omega + 200\,\Omega + 300\,\Omega = 600\,\Omega$$



$$I = \frac{U}{R_{tot}} = \frac{12,0\,V}{600\,\Omega} = \underline{\underline{20,0\,mA}}$$

c) Størst mulig strøm går det når det er minst mulig resistans i kretsen.
Det er når motstandene koples i parallell.



$$\frac{1}{R_{tot}} = \frac{1}{100\,\Omega} + \frac{1}{200\,\Omega} + \frac{1}{300\,\Omega} = \frac{11}{600\,\Omega} \Rightarrow R_{tot} \approx 54,55\,\Omega$$

$$I = \frac{U}{R_{tot}} = \frac{12,0\,V}{54,55\ \Omega} = \underline{\underline{220\ mA}}$$

d)

$$I = \frac{12,0\,V}{300\,\Omega} = \underline{\underline{40,0\,mA}}$$

$$P = \frac{U^2}{R} \Rightarrow P(100\,\Omega) = \frac{(12,0\ V)^2}{100\,\Omega} = \underline{\underline{1,44\,W}}$$

$$P(200\,\Omega) = \frac{(12,0\ V)^2}{200\,\Omega} = \underline{\underline{0,720\,W}} \quad P(300\,\Omega) = \frac{(12,0\ V)^2}{300\,\Omega} = \underline{\underline{0,480\,W}}$$

e)

$$U_p = \sqrt{P \cdot R_y} = \sqrt{2,35 \cdot 54,55}\ V \approx 11,32\ V$$

$$I_{tot} = \frac{U_p}{R_y} = \frac{11,32}{54,55}\,A \approx 0,2075\,A$$

$$R_i^{tot} = \frac{\mathcal{E} - U_p}{I_{tot}} = \frac{12,0 - 11,32}{0,2075}\,\Omega \approx 3,277\,\Omega$$

$$R_i = \frac{1}{6} \cdot R_i^{tot} = \underline{\underline{0,546\,\Omega}}$$