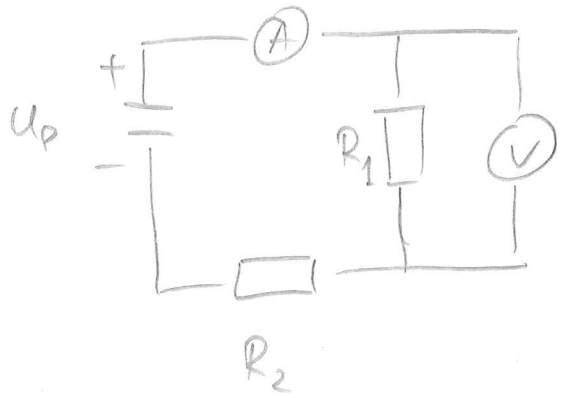
Nov -16, oppg. 2

a)



$R_1 = 3.0\,\Omega$

$R_2 = 2.4\,\Omega$

$U_p = 12\,V$

Total motstand: $R = R_1 + R_2$

Ohms lov: $U_p = RI$, der I er strømmen

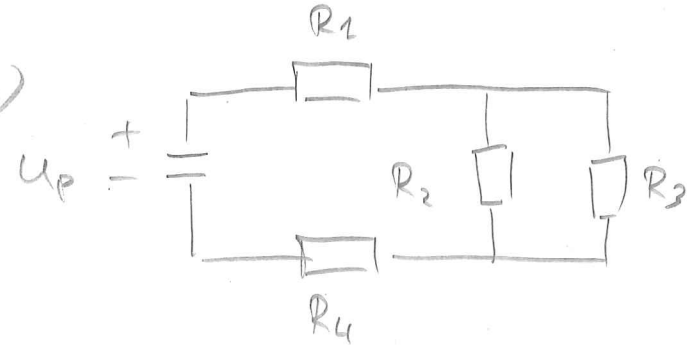
$$I = \frac{U_p}{R} = \frac{U_p}{R_1 + R_2} = \frac{12\,V}{(3.0 + 2.4)\,\Omega} = 2.222\,A \approx 2.2\,A$$

Spenningsfall over R_1:

$U_1 = R_1 I = 3.0\,\Omega \cdot 2.222\,A = 6.663\,V \approx 6.7\,V$

Amperemeteret viser 2.2A og voltmeteret viser 6.7V.

b)



$R_1 = 3.0\,\Omega$

$R_2 = 12\,\Omega$

$R_3 = 6.0\,\Omega$

$R_4 = 1.0\,\Omega$

$U_p = 12\,V$

Resultantres. i parallellkopling: R_{par}

$$\frac{1}{R_{par}} = \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{12\,\Omega} + \frac{1}{6.0\,\Omega} = 0.25\,\Omega^{-1}$$

$$R_{par} = \frac{1}{0.25\,\Omega^{-1}} = 4.0\,\Omega$$

Total resultantres.:

$$R = R_1 + R_{par} + R_4 = (3.0 + 4.0 + 1.0)\,\Omega = \underline{8.0\,\Omega}$$

Straum i kretsen: $I = \frac{U_p}{R}$

Effekt: $P = U_p I = U_p \cdot \frac{U_p}{R} = \frac{U_p^2}{R} = \frac{(12\,V)^2}{8.0\,\Omega} = \underline{18\,W}$

c)

Is, $m_{is} = 2.7\,kg$

$t_{is} = 0°C$

Effekt $P = 2.3 \cdot 10^3\,W$

Gryta tar ikkje til seg varme.

Smeltevarme for is: $l_s = 334 \cdot 10^3\,J/kg$

Varme som trengs for å smelte isen:

$Q = l_s m_{is}$.

Til for å: $Q = Pt$, der t er tida

$Pt = l_s m_{is}$

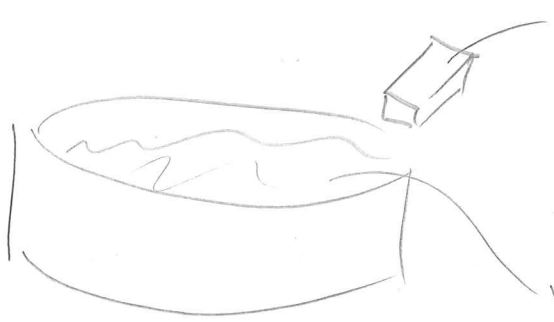
$$t = \frac{l_s m_{is}}{P} = \frac{334 \cdot 10^3\,\frac{J}{kg} \cdot 2.7\,kg}{2.3 \cdot 10^3\,W} = 392.087\,s =$$

6.535 min

$0.535\,\text{min} \cdot 60\,\text{s/min} = 32.09\,\text{s} \approx 32\,\text{s}$

Det tar <u>6 min og 32 s</u>.

d)



Jern, $m_j = 1.4\,\text{kg}$

$t_j = 700\,°\text{C}$

$c_j = 452\,\frac{\text{J}}{\text{kg}\cdot\text{K}}$

Vatn, $V_v = 200\,\text{l} = 0.200\,\text{m}^3$

$t_v = 20\,°\text{C}$

$\rho_v = 998\,\frac{\text{kg}}{\text{m}^3}$

$c_v = 4.18\cdot10^3\,\frac{\text{J}}{\text{kg}\cdot\text{K}}$

Varmen som jernet avgir er lik varmen som vatnet tar imot.

$$c_j m_j (t_j - t) = c_v V_v \rho_v (t - t_v)$$

der t er sluttemperaturen

$$c_j m_j t_j - c_j m_j t = c_v V_v \rho_v t - c_v V_v \rho_v t_v$$

$$c_v V_v \rho_v t + c_j m_j t = c_j m_j t_j + c_v V_v \rho_v t_v$$

$$t(c_v V_v \rho_v + c_j m_j) = c_v V_v \rho_v t_v + c_j m_j t_j)$$

$$t = \frac{c_v V_v \rho_v t_v + c_j m_j t_j}{c_v V_v \rho_v + c_j m_j} =$$

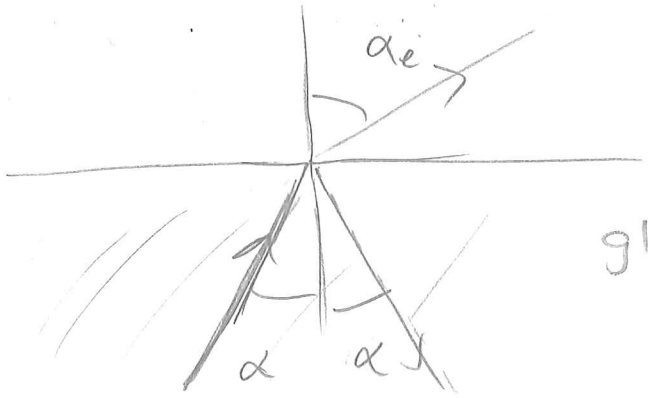
$$\frac{4.18\cdot10^3\,\frac{\text{J}}{\text{kg}\cdot\text{K}} \cdot 0.200\,\text{m}^3 \cdot 998\,\frac{\text{kg}}{\text{m}^3} \cdot 20\,°\text{C} + 452\,\frac{\text{J}}{\text{kg}\cdot\text{K}} \cdot 1.4\,\text{kg} \cdot 700\,°\text{C}}{4.18\cdot10^3\,\frac{\text{J}}{\text{kg}\cdot\text{K}} \cdot 0.200\,\text{m}^3 \cdot 998\,\frac{\text{kg}}{\text{m}^3} + 452\,\frac{\text{J}}{\text{kg}\cdot\text{K}} \cdot 1.4\,\text{kg}} =$$

$20.515°C \approx \underline{20.5°C}$

Temperaturen økte bare en halv grad.

Oppg. 4

b)



$\alpha = 35°$

Refleksjonsvinkelen er lik innfallsvinkelen

$\alpha = \underline{35°}$

Snells lov:

$$n_l \sin\alpha_l = n_g \sin\alpha$$

$$\sin\alpha_l = \frac{n_g}{n_l}\sin\alpha = 0.8833$$

$$\alpha_l = \arcsin 0.8833 = 62.044° \approx \underline{62°}$$

c) Totalrefleksjon: Når α er større enn grensevinkelen α_{gr}, som er bestemt ved at $n_g \sin\alpha_{gr} = n_l \sin 90° = 1.00$

$$\sin \alpha_{gr} = \frac{1.00}{n_g} = \frac{1.00}{1.54} = 0.6494$$

$$\alpha_{gr} = \arcsin 0.6494 = 40.493^\circ \approx 40^\circ$$

Vi får <u>bedre</u> reflelesion når <u>$\alpha > 40^\circ$</u>.