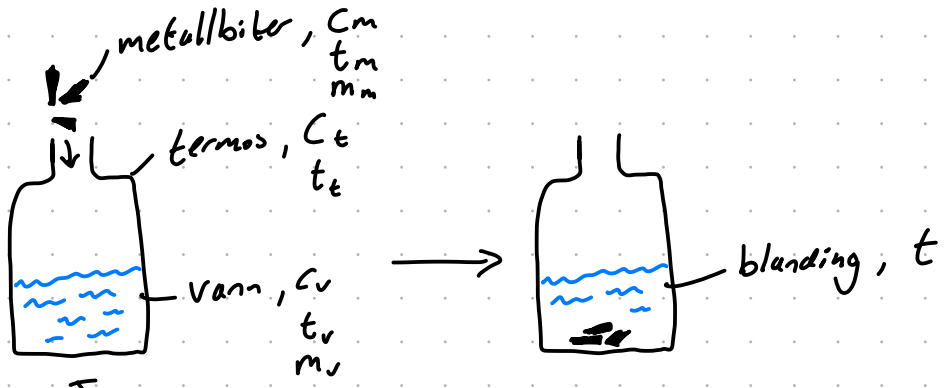
10.1



$C_t = 55 \frac{J}{K}$

$t_t = 19{,}1\,°C$

$c_v = 4{,}2 \frac{kJ}{kg\,K}$

$t_v = 19{,}1\,°C$

$m_v = 40{,}0\,g = 0{,}040\,kg$

$t_m = 97\,°C$

$m_m = 50{,}0\,g = 0{,}050\,kg$

$t = 25\,°C$

$c_m = ?$

Prosesser

metall $t_m = 97\,°C$ → Avkjøling, $Q = c_m m_m \Delta t_m$ → metall $t = 25\,°C$

Vann $t_v = 19{,}1\,°C$ → Oppvarming, $Q = c_v m_v \Delta t_v$ → Vann $t = 25\,°C$

termos $t_t = 19{,}1\,°C$ → Oppvarming, $Q = C_t \Delta t_t$ → termos $t = 25\,°C$

$$Q_{avkjøling} = Q_{oppvarming}$$

$$c_m m_m \Delta t_m = c_v m_v \Delta t_v + C_t \Delta t_t$$

$\Delta t_v = \Delta t_t = \Delta t$

$$\underline{c_m} = \frac{(c_v m_v + C_t)\,\Delta t}{m_m\,\Delta t_m}$$

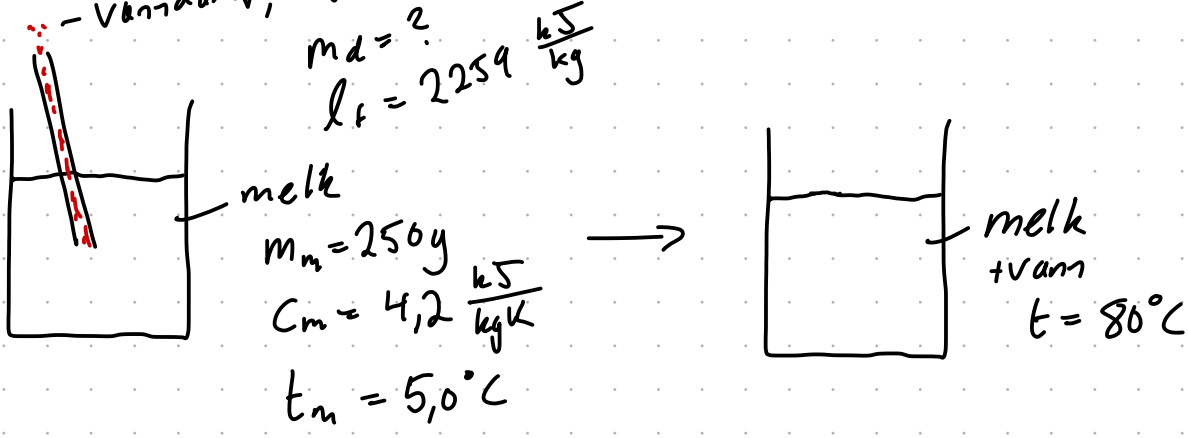
$$= \frac{\left(4{,}2 \frac{kJ}{kg\,K} \cdot 0{,}040\,kg + 55 \frac{J}{K}\right) \cdot (25 - 19{,}1)\,K}{0{,}050\,kg \cdot (97 - 25)\,K}$$

$$= \frac{(168 + 55)\frac{J}{K} \cdot 5{,}9\,K}{0{,}050\,kg \cdot 72\,K} = 365{,}5 \frac{J}{kg\,K} = \underline{0{,}37 \frac{kJ}{kg\,K}}$$

$C_{tinn} = 0{,}23 \frac{kJ}{kg\,K}$

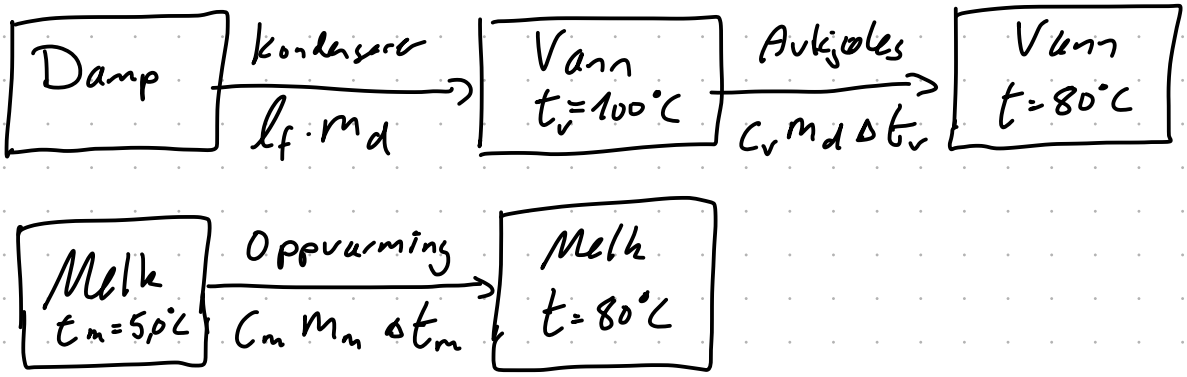
$C_{sink} = 0{,}39 \frac{kJ}{kg\,K}$, så metallbiterne er nok av sink.

10.2



a) $Q = c_m \cdot m_m \cdot \Delta t_m = 4,2 \frac{kJ}{kgK} \cdot 0,250\,kg \cdot (80-5)K = \underline{79\,kJ}$

b) Prosesser:



$$Q_{kond.} + Q_{AVKS.} = Q_{OPPV.}$$

$$l_f \cdot m_d + c_v m_d \Delta t_v = c_m m_m \Delta t_m \quad , \; c_v = c_m = c$$

$m_d = ?$

$$m_d (l_f + c\,\Delta t_v) = c\, m_m \Delta t_m$$

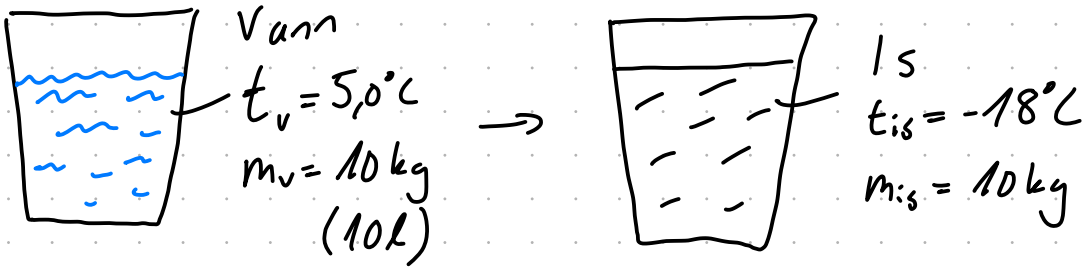
$$m_d = \frac{c\, m_m \Delta t_m}{l_f + c\,\Delta t_v}$$

$$= \frac{4,2 \frac{kJ}{kgK} \cdot 0,25\,kg \cdot (80-5)K}{2259 \frac{kJ}{kg} + 4,2 \frac{kJ}{kgK} \cdot (100-80)K} = \frac{78,75\,kJ}{2343 \frac{kJ}{kg}}$$

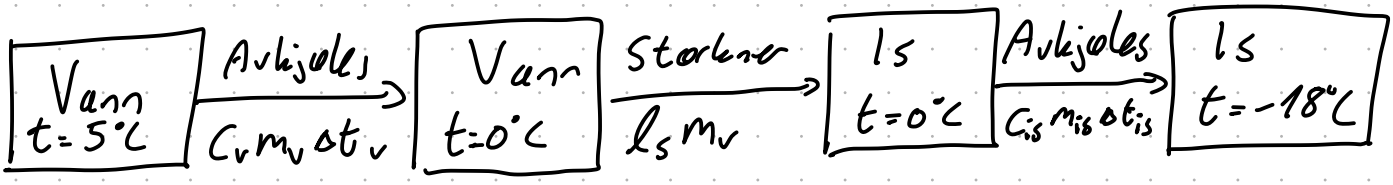
$m_d = 0,0336\,kg$ $\qquad \underline{m_d = 34g}$

c) Vi bruker vanndamp fordi det skummer melken og det blir godt. Også fordi kondenseringen avgir myk varme og bidrar til effektiv oppvarming.

10.3



a) Energi: Hentet fra vannet regnes ut fra følgende 3 prosesser:



$$Q = c_v m_v \Delta t_v + l_s m_v + c_{is} m_{is} \Delta t_{is}$$

$$= m_v \left(c_v \cdot \Delta t_v + l_s + c_{is} \Delta t_{is} \right)$$

$$= 10\,kg \left(4{,}2 \frac{kJ}{kgK} \cdot (5-0)K + 334 \frac{kJ}{kg} + 2{,}1 \frac{kJ}{kgK} \cdot (0+18)K \right)$$

$$= 10\,kg \cdot 392{,}8 \frac{kJ}{kg} = 3928\,kJ$$

$$\underline{Q = 3{,}9\,MJ}$$

b) Effektfaktor: $f = 3{,}0$. $f = \frac{Q_H}{W}$

Energiregnskap: $Q_H = Q_L + W$

Q_H : Avgitt varme
Q_L : Hentet varme
W : Elektrisk energi

$$f = \frac{Q_H}{W} = \frac{Q_L + W}{W} = \frac{Q_L}{W} + 1$$

$$f - 1 = \frac{Q_L}{W}$$

$$W = \frac{Q_L}{f-1} = \frac{3928\ kJ}{3{,}0 - 1} = \frac{3928}{2}\ kJ = 1964\ kJ$$

$$\underline{W = 2{,}0\ MJ}$$

c) $Q_H = Q_L + W = (3{,}9 + 2{,}0)\ MJ$

$$Q_H = 5{,}9\ MJ$$

$$Q_H = \frac{5{,}9\ MJ}{3{,}6\ \frac{MJ}{kWh}} = \underline{1{,}6\ kWh}$$