7.04 $N = 2{,}5 \cdot 10^{25}$ i en m^3

$\rho = 1{,}2 \frac{kg}{m^3}$

$t = 20°C, T = (273 + 20)K = 293K$

$v_y = 50 \frac{km}{h} = 50 \cdot \frac{10^3 m}{3600 s} = 13{,}88 \frac{m}{s}$

a) $E_{ky} = \frac{1}{2} M v_y^2 = \frac{1}{2} \cdot \rho \cdot V \cdot v_y^2 = \frac{1}{2} \cdot 1{,}2 \frac{kg}{m^3} \cdot 1 m^3 \cdot \left(13{,}88 \frac{m}{s}\right)^2 = 115{,}5 J$

$= \underline{0{,}12 kJ}$

b) $E_k = \frac{5}{2} NkT = \frac{5}{2} \cdot 2{,}5 \cdot 10^{25} \cdot 1{,}38 \cdot 10^{-23} \frac{J}{K} \cdot 293K = \underline{0{,}25 MJ}$

7.06 a) $\Delta U = Q + W$

$Q = 1200J \quad W = 400J \quad \Delta U = 1200J + 400J = \underline{1600J}$

b) $Q = -800J$, $V = konst \Rightarrow W = 0$

$\Delta U = Q = \underline{-800J}$

7.08 $W = 80J$ adiabatisk, dvs $Q = 0$

$\Delta U = W = \underline{80J}$

7.10 a) $Q = cm\Delta T = 0{,}45 \frac{kJ}{kgK} \cdot 1kg \cdot 1K = \underline{0{,}45 kJ}$

b) $Q = cm\Delta T = 0{,}45 \frac{kJ}{kgK} \cdot 4{,}0kg \cdot 5{,}0K = \underline{9{,}0 kJ}$

c) $Q = cm\Delta T = 0{,}45 \frac{kJ}{kgK} \cdot 10kg \cdot (250 - 20)K = 1035 kJ$

$= \underline{1{,}0 MJ}$

7.11 a) $c = \frac{Q}{m\Delta T}$ der ΔT er temp. økningen når legemet tilføres varmen Q.

$C \approx 0$ $m_v = 0{,}480\,kg$ $P = 150\,W$ tid $= 100\,s$

$\Delta T = (31{,}2 - 16{,}5)\,K = 14{,}7\,K$

b) $c = \frac{Q}{m\Delta T} = \frac{P \cdot tid}{m \cdot \Delta T} = \frac{150\,W \cdot 100\,s}{0{,}480\,kg \cdot 14{,}7\,K} = 2125{,}8\,\frac{J}{kgK} = \underline{2{,}13\,\frac{kJ}{kgK}}$

c) benzen $c_b = 1{,}74\,\frac{kJ}{kgK}$

$Q_b = c\,m\,\Delta T = 1{,}74 \cdot 10^3\,\frac{J}{kgK} \cdot 0{,}480\,kg \cdot 14{,}7\,K = 12277\,J$

$Q_{tilført} - Q_b = 150\,W \cdot 100\,s - 12277\,J = 2723\,J = \underline{2{,}72\,kJ}$

7.12 $m_v = 4{,}0\,kg$

$m_{Al} = 0{,}60\,kg$

$\Delta T = (98 - 8{,}0)\,K = 90\,K$

$P = 1{,}00 \cdot 10^3\,\frac{J}{s}$

$P \cdot t = Q_{Al} + Q_v$

$t = \frac{Q_{Al} + Q_v}{P}$

$t = \frac{c_{Al} \cdot m_{Al} \cdot \Delta T + c_v m_v \cdot \Delta T}{P} = \frac{(900 \cdot 0{,}60 + 4180 \cdot 4{,}0)\,90k}{1{,}00 \cdot 10^3\,\frac{J}{s}} = 1553\,s$

$= \underline{26\,min}$

7.13 $C_k = 50\,\frac{J}{K}$ $C_b = ?$ $m_v = 0{,}15\,kg$ $t_1 = 40{,}0°C$

$m_b = 0{,}57\,kg$ $t_{b1} = 20{,}0°C$

$t = 38{,}0°C$

a) $Q_{avgitt} = Q_{mottatt}$

$Q_v + Q_k = Q_b$

$c_v m_v \Delta t_v + C_k \Delta t_k = c_b m_b \Delta t_b$

$c_v m_v (t_1 - t) + C_k (t_1 - t) = c_b m_b (t - t_{b1})$

$[c_v m_v + C_k](t_1 - t) = c_b m_b (t - t_{b1})$

$$\frac{[c_v m_v + C_k](t_1 - t)}{m_b (t - t_{b1})} = c_b$$

$$c_b = \frac{[4180\,\frac{J}{kgK} \cdot 0{,}15\,kg + 50\,\frac{J}{K}](40{,}0°C - 38{,}0°C)}{0{,}57\,kg \cdot (38{,}0 - 20{,}0)°C}$$

$$c_b = \frac{677\,\frac{J}{K} \cdot 2{,}0°C}{10{,}26\,kg°C} = 131{,}96\,\frac{J}{kg°C} = \underline{0{,}13\,\frac{kJ}{kgK}}$$

b) $Q_{avgitt} = Q_{mottatt}$

$Q_v + Q_k = Q_b + Q_{omg}$

$Q_v + Q_k - Q_{omg} = c_b m_b \Delta t_b$

$$\frac{Q_v + Q_k - Q_{omg}}{m_b \Delta t_b} = c_b$$

Vi ser at telleren blir mindre enn i a). Følgelig vil vi få en lavere verdi for c_b enn i a).

7.14 $v = 100\frac{km}{h} = 27{,}777\frac{m}{s}$

$E_k = \frac{1}{2} m v^2$

$Q = c_j \cdot m_j \cdot \Delta t$

$Q = E_k$

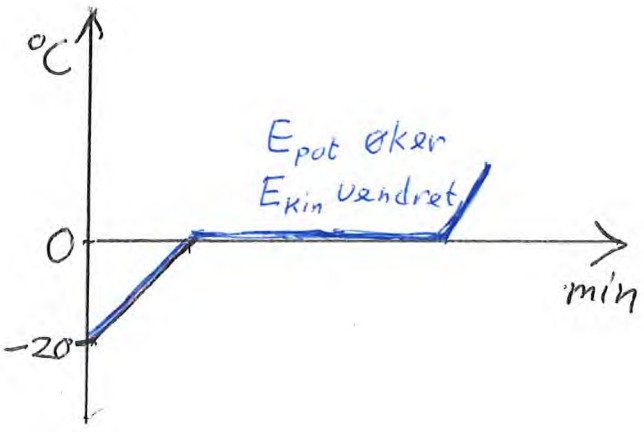
$c_j \cdot m_j \cdot \Delta t = \frac{1}{2} m_j v^2$

$\Delta t = \frac{v^2}{2 \cdot c_j} = \frac{(27{,}777\frac{m}{s})^2}{2 \cdot 449\frac{J}{kg \cdot k}} = \underline{0{,}86K}$

7.18 $Q = L_s \cdot m = 397\frac{kJ}{kg} \cdot 10^3 kg = 397 \cdot 10^6 J$

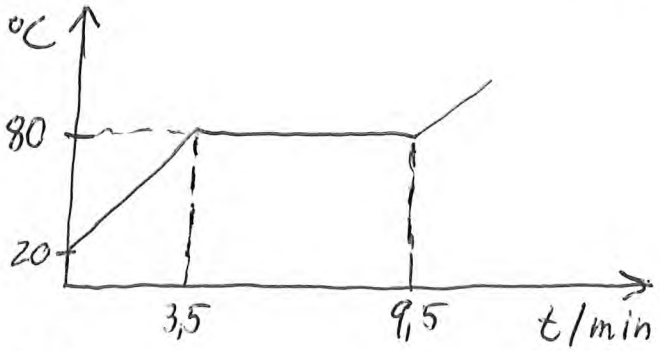
$1kWh = 3{,}6 \cdot 10^6 J$ $\quad Q = \frac{397 \cdot 10^6}{3{,}6 \cdot 10^6} kWh = \underline{110kWh}$

7.19



$M = 10kg$

7.20 $P = 80\,W$ $m = 0{,}200\,kg$ naftalen



$t = (9{,}5 - 3{,}5) \cdot 60\,s$
$= 6{,}0 \cdot 60\,s = 360\,s$

$Q = P \cdot t = 80\,\frac{J}{s} \cdot 360\,s$
$= \underline{2{,}88 \cdot 10^4\,J}$

$0{,}14\,\frac{MJ}{kg}$

$Q = L_s \cdot m$
$L_s = \frac{Q}{m} = \frac{2{,}88 \cdot 10^4\,J}{0{,}200\,kg} = \underline{1{,}4 \cdot 10^5\,\frac{J}{kg}}$

7.22 $A = 365\,km^2$ $V = 56\,km^3$ $1\,m^3 \rightarrow 10\,kg$
(Wh i svar)

a) $\Delta T = 10\,K$ $h = 10\,m$
$V = A \cdot h = 365 \cdot (10^3\,m)^2 \cdot 10\,m = 365 \cdot 10^7\,m^3$
dvs $m = 365 \cdot 10^7 \cdot 10^3\,kg = 365 \cdot 10^{10}\,kg$

$Q = c\,m\,\Delta T = 4{,}2 \cdot 10^3\,\frac{J}{kgK} \cdot 365 \cdot 10^{10}\,kg \cdot 10\,K$
$= 4{,}2 \cdot 365 \cdot 10^{14}\,J = 1533 \cdot 10^{14}\,J = 1{,}533 \cdot 10^{17}\,J$
$= \frac{1{,}533 \cdot 10^{17}\,J}{3600\,J/Wh} = 4{,}258 \cdot 10^{13}\,Wh$
$= 43 \cdot 10^{12}\,Wh = \underline{43\,TWh}$

b) $h = 0{,}30\,m$ $V = Ah = 365 \cdot (10^3\,m)^2 \cdot 0{,}30\,m = 109{,}5 \cdot 10^6\,m^3$
$m = 109{,}5 \cdot 10^6 \cdot 10^3\,kg = 109{,}5 \cdot 10^9\,kg$

$Q = L \cdot m = 334 \cdot 10^3\,\frac{J}{kg} \cdot 109{,}5 \cdot 10^9\,kg = \frac{3{,}657 \cdot 10^{16}\,J}{3600\,J/Wh} = 1{,}0 \cdot 10^{13}\,Wh$
$\underline{10\,TWh}$

ny bok

7.27 $W = 16{,}6\,kJ$ $Q_L = 9{,}70\,kJ$ $\eta = \frac{W}{Q_H} = \frac{W}{W+Q_L}$

$Q_H = W + Q_L$

$\eta = \frac{16{,}6\,kJ}{(16{,}6+9{,}70)\,kJ} = 0{,}631 = \underline{63{,}1\%}$

7.28 $T_H = 235°C$ $T_L = ?$ $\eta_c = 23{,}6\%$ Carnotmaskin

$\eta_c = 1 - \frac{T_L}{T_H}$ $T_H = (273+235)K = 508K$

$0{,}236 = 1 - \frac{T_L}{508K}$

$\frac{T_L}{508K} = 1 - 0{,}236$

$T_L = 508K \cdot 0{,}764 = \underline{388K} = (388-273)°C = \underline{115°C}$

7.29 $E = 40\,kWh$ $\eta = 0{,}94$ $P = ?$ $t = 4{,}0h$

$P \cdot t \cdot \eta = E$

$P = \frac{E}{t \cdot \eta} = \frac{40\,kWh}{4{,}0h \cdot 0{,}94} = 10{,}63\,kW \approx \underline{11\,kW}$

7.32 $P = ?$ $P_e = 1{,}2\,kW$ $P_L = 1{,}8\,kW$ $f = \frac{Q_H}{W} = \frac{P}{P_e}$

a) $Q_H = Q_L + W$

$P \cdot t = P_0 \cdot t + P_e \cdot t$ P_0 er effekt fra "otelofta" dvs. varmereservoaret

$P = P_L + P_e$

$P = (1{,}8 + 1{,}2)\,kW = \underline{3{,}0\,kW}$

b) $f = \frac{Q_H}{W} = \frac{P \cdot t}{P_e \cdot t} = \frac{P}{P_e} = \frac{3{,}0\,kW}{1{,}2\,kW} = \underline{2{,}5}$

c) $f = \frac{P_L}{P_e} = \frac{1{,}8\,kW}{1{,}2\,kW} = \underline{1{,}5}$