7.14

$E_K = \frac{1}{2}mv^2 = Q = c \cdot m \cdot \Delta t$

$100\ km/h = 100 \frac{10^3\ m}{3600\ s} = \frac{100}{3{,}6} \left[\frac{m}{s}\right]$

$\frac{1}{2}mv^2 = c \cdot m \cdot \Delta t \quad / : m$

$c = 0{,}45 \cdot 10^3 \left[\frac{J}{kg \cdot K}\right]$

$\frac{v^2}{2} = c \cdot \Delta t \quad / : c$

$\Delta t = \frac{v^2}{2 \cdot c} = \frac{\left(\frac{100}{3{,}6}\right)^2}{2 \cdot 0{,}45 \cdot 10^3} \left[\frac{\frac{m^2}{s^2}}{\frac{J}{kg \cdot K}}\right]$

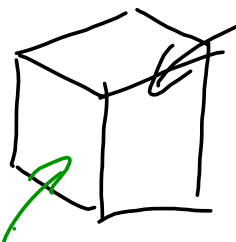
$\Delta t = \frac{771{,}6}{0{,}9 \cdot 10^3} \left[\frac{kg \cdot m/s^2 \cdot m \cdot K}{J}\right]$

$kg \cdot m/s^2 \cdot m$

$N \cdot m = J$

$\Delta t = \frac{771{,}6}{0{,}9} \cdot 10^{-3}\ [K] = 0{,}84\ [K]$

7.18



Aluminium

$m = 1\,\text{tonn} = 1000\,\text{kg}$

Skal smeltes: fra fast til flytende

Fasevarme: Smeltevarme: $L_s = 395\ \frac{kJ}{kg}$

$$Q = L_s \cdot m = 395 \cdot 10^3 \left[\frac{kJ}{kg} \cdot kg\right]$$

$$Q = 395\,[MJ]$$

må gjøres om til kWh

$W \cdot s = J$ $\quad 1\,h = 3600\,s$

$s = \frac{h}{3600}$

$\frac{Wh}{3600} = J$

$Wh = 3600\,J = 3{,}6 \cdot 10^3\,J$

$1\,kWh = 10^3\,Wh = 3{,}6 \cdot 10^3 \cdot 10^3\,J = 3{,}6 \cdot 10^6\,J = 3{,}6\,MJ$

$MJ = \frac{1\,kWh}{3{,}6}$

$$Q = 395\,[MJ] = 395\left[\frac{kWh}{3{,}6}\right] = 110\,[kWh]$$

7.20

$P = 80\,[W]$

tid: $\Delta t = (9{,}5 - 3{,}5)\,min = 6{,}0\,min = 6{,}0 \cdot 60\,[s]$

(leser av kurven)

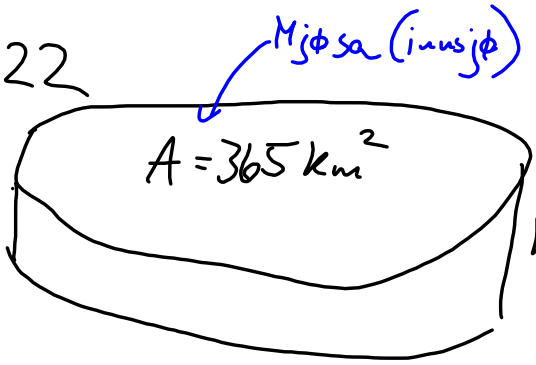
$= 360\,[s]$

$E = P \cdot \Delta t = 80\,[W] \cdot 360\,[s] = 28{,}8 \cdot 10^3\,[J] = 28{,}6\,[kJ]$

$E = Q = L \cdot m$

$L = \frac{Q}{m} = \frac{28{,}6\,[kJ]}{0{,}200\,[kg]} = 144\,\left[\frac{kJ}{kg}\right]$

7.22



$c_v = 4{,}2 \frac{kJ}{kg \cdot K}$ ← spesifikk varme-kapasitet

$L_v = 334 \frac{kJ}{kg}$ ← spesifikk smeltekapasitet

a) $\Delta t = 10°C = 10\,K$

$m \Rightarrow V = A \cdot h = 365\,km^2 \cdot 10\,m = 365 \cdot 10^6\,m^2 \cdot 10\,m$

$km^2 = (10^3)^2\,m^2 = 10^6\,m^2$

$V = 3650 \cdot 10^6\,m^3$

$1\,m^3 = 1000\,kg = 10^3\,kg$ (vann)

$m = 3650 \cdot 10^6 \cdot 10^3\,[kg] = 3{,}65 \cdot 10^3 \cdot 10^6 \cdot 10^3\,[kg]$

$= 3{,}65 \cdot 10^{12}\,[kg]$

vannet i Mjøsa

$Q_{10} = c \cdot m \cdot \Delta t = 4{,}2 \cdot 365 \cdot 10^{12} \cdot 10 \left[\frac{kJ}{kg \cdot K} \cdot kg \cdot K\right]$

$Q_{10} = 153{,}3 \cdot 10^{12}\,[kJ]$

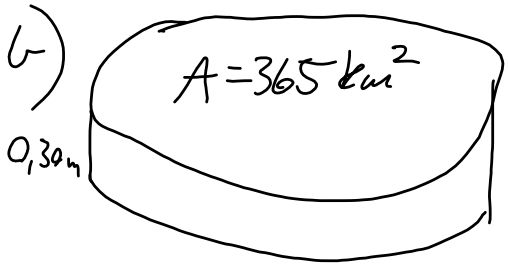
$1\,kJ = \frac{1}{3{,}6}\,Wh$

$Q_{10} = 153{,}3 \cdot 10^{12} \left[\frac{Wh}{3{,}6}\right] = 42{,}58 \cdot 10^{12}\,[Wh]$

$= 43\,[TWh]$

7.22

b)



$m \Rightarrow V = 365 \cdot 10^6 [m^2] \cdot 0{,}3 [m] = 109{,}5 \cdot 10^6 [m^3]$

(10^6 [m²] ↑ km²)

$m = 109{,}5 \cdot 10^6 \cdot 10^3 [kg] = 109{,}5 \cdot 10^9 [kg]$

(↑ m³)

$Q = L \cdot m = 334 \left[\frac{kJ}{kg}\right] \cdot 109{,}5 \cdot 10^9 [kg]$

$= 36{,}6 \cdot 10^{15} [J] = 36{,}6 \cdot 10^{12} [kJ]$

$= \frac{36{,}6}{3{,}6} \cdot 10^{12} [Wh] = 10{,}2 [TWh]$

c) $L_f = 2259 \frac{kJ}{kg}$

5 mm

$5 mm \Rightarrow m = 365 \cdot 10^6 \cdot 5 \cdot 10^{-3} \cdot 10^3 [kg] = 1825 \cdot 10^6 [kg]$

$Q = L_f \cdot m = 2259 \left[\frac{kJ}{kg}\right] \cdot 1825 \cdot 10^6 [kg]$

$= 4122675 [kJ] = \frac{4122675}{3{,}6} [Wh]$

$= 1{,}1 [TWh]$