10.1 $Q = \Delta U + W$ Dane: $m = 1kg$ c_v $\Delta T = T_2 - T_1$

$1{,}009 \frac{kcal}{g \cdot K}$

$1009 \frac{cal}{kg \cdot K}$

$Q = \Delta U = m \cdot c_v \cdot (T_2 - T_1) = m \cdot c_v \cdot \Delta T = 1 \cdot 1009 \cdot 1 = 1009$

$1J = N \cdot m$ $kG \cdot m = 9{,}81 \cdot N \cdot m$

$1kG = 9{,}81\ N$

$1kGm = 9{,}81\ J$

dla $\Delta T = 1°C$

$1\ cal \cong 4{,}17\ J$

$Q = 1 \cdot 1009 \cdot 4{,}17 \cdot 1 =$

10.2

Dane: $m_{H_2O} = 12kg$; $t_1 = 20°C$ $t_2 = 100°C$

$W = 0$

$Q = \Delta U + W$

$c_v = 4182 \frac{J}{kg \cdot K}$

$x[kG \cdot m] = x[J]$

$1kM = 9{,}81 \cdot [J]$

$Q = \Delta U = m \cdot c_v \cdot \Delta t = 12 \cdot 4182 \cdot (100 - 20)$

$Q = 12 \cdot 4182 \cdot 80 = 4014\ 720\ [J]$

$Q = 409\ 248\ [kGm]$

$P = \frac{W}{t} = \frac{4014\ 720}{20 \cdot 60} \left[\frac{J}{s}\right]$

$1kM = 736\ W$

$1kM = 0{,}736\ kW$

$P = 3\ 345{,}6\ W$

$P = 3{,}3456\ kW$

$P = 4{,}55\ KM$

Proporcja

$1kM = 736\ W$

$xkM = 3\ 345{,}6\ W$

$x = \frac{3\ 345{,}6}{736}\ [kM]$

10.3

Dane: $m = 1kg$ $t = 0°C$

$c_t = [\frac{J}{kg}]$ - ciepło topnienia

$c_t = 334 [\frac{J}{g}] = 334 \cdot 10^3 [\frac{J}{kg}]$

$W = m \cdot c_T$

$W = m \cdot 334000\ [kg \cdot \frac{J}{kg}]$

$W = 334\ [kJ]$

$W = 34047\ kGm$

$1kGm = 9{,}81\ J$

$xkGm = 334\ 000\ J$

$xkGm = \frac{334000}{9{,}81} = 34\ 047\ kGm$

silnik $P = 1kM$ $t = ?$

$P = \frac{W}{t} \rightarrow t = \frac{W}{P} = \frac{334000}{736} = 454\ s$

$t = 454\ [s]$

$t = 7{,}56\ [min]$

10.4 Dane: $h = 60m$ $c = 0{,}2 \frac{cal}{g \cdot K} \rightarrow c = 0{,}2 \cdot \frac{4 \cdot J}{\frac{1}{1000} kg \cdot K}$

$E_p = m \cdot g \cdot h$

$E_p =$

$Q = m \cdot c \cdot \Delta T$

$c = 0{,}2 \cdot 4 \cdot 1000 \cdot \frac{J}{kg \cdot K}$

$c = 800 \frac{J}{kg \cdot K}$

$t = 0 \rightarrow T_0$

$mgh = m \cdot c \cdot \Delta T$

$\frac{cal}{g \cdot K} = \frac{4 \cdot J}{\frac{1}{1000} \cdot kg \cdot K}$

$c \cdot \Delta T = g \cdot h$

$\Delta T = \frac{g \cdot h}{c} = \frac{9{,}81 \cdot 60}{800} = 0{,}74 \, [K]$ ✓

10.5

Dane: $T_0 = 20°C$ $T_{top} = 327{,}3°C$ $c_{\text{ołowiu}} = 0{,}03 \frac{cal}{g \cdot K}$

$c_T = 5{,}9 \frac{cal}{g}$

$E_k = \frac{mv^2}{2} + \frac{I\omega^2}{2}$

$c_w = 0{,}03 \cdot 10^3 \cdot 4 \frac{J}{kg \cdot K}$

$c_w = 120 \frac{J}{kg \cdot K}$

$c_T = 5{,}9 \cdot 4 \cdot 10^3 \cdot \frac{J}{kg}$

$c_T = 23600 \frac{J}{kg}$

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

cała energia podczas zderzenia zamienia się w ciepło

$E_k = Q$

$\frac{m \cdot v^2}{2} = \underbrace{m \cdot c_w \cdot \Delta T}_{Q} + \underbrace{m \cdot c_T}_{\text{Q idące na stopienie}} \quad / : m$

$\Delta T = T_n - T_0 \, [°C]$

$\Delta T = 327{,}3 - 20 \, [°C]$

$\Delta T = 307{,}3 \, [°C]$

$\Delta T = 307{,}3 \, [°C]$

$\frac{v^2}{2} = c_w \Delta T + c_T$

$v^2 = 2 \cdot (c_w \Delta T + c_T)$

$v = \sqrt{2 \cdot (c_w \Delta T + c_T)}$

$v = \sqrt{2 \cdot (120 \cdot 307{,}3 + 23600)}$

$v \cong 347{,}8 \, [\frac{m}{s}]$ → co najmniej ✓

10.6 Dane: $m = 2000 t$

$m = 2000 \cdot 10^3 \, kg$

$v = 54 \frac{km}{h}$

$v = 54 \cdot \frac{1000}{3600} \, [\frac{m}{s}]$

$v = 15 \frac{m}{s}$

$E_k = Q$

$\frac{m \cdot v^2}{2} = Q$ $Q = 225 \, MJ$ ✓