

6. V toplotno izolirani posodi je 1 kg vode pri temperaturi 280 K. V posodo z vodo potopimo aluminijasto kocko, segreto na 350 K in počakamo, da se vzpostavi ravnovesje. Kakšna je pri tem relativna sprememba prostornine kocke? Koefficient linearnega raztezka za aluminij je $22,9 \cdot 10^{-6} \text{ K}^{-1}$, specifična toplota vode $c_p = 4200 \text{ J}/(\text{kg} \cdot \text{K})$, specifična toplota aluminija pa je $880 \text{ J}/(\text{kg} \cdot \text{K})$. Masa Al. kocke je 0.2 kg.

$$m_v = 1 \text{ kg}, m_{Al} = 0.2 \text{ kg}$$

$$T_v = 280 \text{ K}$$

$$T_{Al} = 350 \text{ K}$$

$$\alpha_{Al} = 22,9 \cdot 10^{-6} \text{ K}^{-1}$$

$$c_{p,v} = 4200 \text{ J}/(\text{kg} \cdot \text{K})$$

$$c_{p,Al} = 880 \text{ J}/(\text{kg} \cdot \text{K})$$

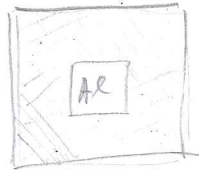
$$dV = \beta V \cdot dT$$

$$dL = \alpha L \cdot dT$$

$$dV = (L+dL)^3 - L^3 \approx 3L^2 dL = 3L^2 \alpha L \cdot dT$$

$$\beta = \frac{dV}{V} \frac{1}{dT} = \frac{3L^2 \alpha L \cdot dT}{L^3 \cdot dT} = 3\alpha$$

$$\beta = 3\alpha$$



$$c_{p,Al} \cdot m_{Al} (T_{Al} - T_0) = c_p \cdot m_v (T_0 - T_v)$$

$$T_0 = \frac{c_{p,Al} \cdot m_{Al} \cdot T_{Al} + c_p \cdot m_v \cdot T_v}{(c_{p,Al} \cdot m_{Al} + c_p \cdot m_v)} = \underline{\underline{282.8 \text{ K}}}$$

$$\frac{\Delta V}{V} = \beta \Delta T = 3\alpha \cdot (T_0 - T_{Al}) = \underline{\underline{-4,6 \cdot 10^{-3} \checkmark}}$$

67.2

V izolirani posodi zmešamo 0.5 kg pare pri 373 K, 1 kg vode pri 293 K in 0.2 kg ledu pri 273 K. Kaj dobimo?

$$c_p = 4200 \text{ J/kg}\cdot\text{K}, q_t = 3.3 \cdot 10^5 \text{ J/kg}, q_{izp} = 2.27 \cdot 10^6 \text{ J/kg}$$

$$m_p = 0.5 \text{ kg} \quad T_p = 373 \text{ K}$$

$$m_v = 1 \text{ kg} \quad T_0 = 293 \text{ K}$$

$$m_l = 0.2 \text{ kg}, T_1 = 273 \text{ K}$$

$$\underline{m_v + m_l = 1.2 \text{ kg}}$$

$$\Delta m_p q_{izp} = m_l q_t + c_p m_l \cdot 100 \text{ K} + c_p m_v \cdot 80 \text{ K}$$

$$\Delta m_p = \frac{0.2 \cdot 3.3 \cdot 10^5 + 4200 \cdot 0.2 \cdot 100 + 4200 \cdot 80}{2.27 \cdot 10^6}$$

$$\Delta m_p = \underline{0.214 \text{ kg}}$$

$$\underline{\text{Vode:}} \quad \Delta m_p + m_v + m_l = \underline{1.41 \text{ kg}}$$

fri 373K

$$\underline{\text{pare:}} \quad m_p - \Delta m_p = \underline{0.29 \text{ kg}}$$

1. Koliko energije dobimo, če popijemo pol litra hladnega piva ($T = 8^{\circ}\text{C}$)? Temperatura v želodcu je 38°C , kilogram piva pa odda pri presnovi $3 \cdot 10^6$ J. Za specifično toploto in gostoto piva vzemite kar ustrezne vrednosti za vodo.

1903

$$\Delta T = 38 - 8 = 30 \text{ K}$$

$$m_p = 0,5 \text{ kg}$$

$$Q = 3 \cdot 10^6 \text{ J}$$

$$c_p = 4200 \text{ J/(kg} \cdot \text{K)}$$

$$Q = -m_p c_p \Delta T + m_p Q_p$$

$$= m_p (-c_p \Delta T + Q_p)$$

$$Q = 0,5 \text{ kg} \left(\frac{-4200 \text{ J/kg} \cdot 30 \text{ K}}{\text{kg} \cdot \text{K}} + 3 \cdot 10^6 \text{ J/kg} \right)$$

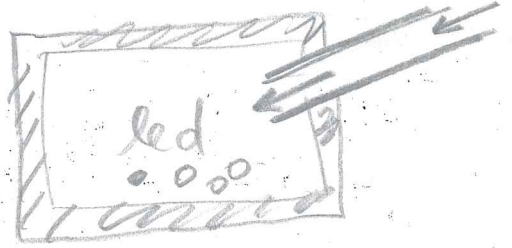
$$= 0,5 \text{ kg} \left(-0,126 \cdot 10^6 \text{ J/kg} + 3 \cdot 10^6 \text{ J/kg} \right)$$

$$= 0,5 \text{ kg} \cdot 2,874 \cdot 10^6 \text{ J/kg}$$

$$= \underline{\underline{1,437 \cdot 10^6 \text{ J}}}$$

4. Koliko vode s temperaturo 50°C mora ^{morati} napeljati v izolirano posodo z 2 kg ledu pri temperaturi 0°C , da se bo ravno ves led stalil? 1995
($q_{\text{tal}} = 3,3 \cdot 10^5 \text{ J/kg}$, $c_p = 4200 \text{ J/kgK}$) A-L

$$T_v = 50^{\circ}\text{C}, \Delta T_v = 50 \text{ K}$$
$$m_l = 2 \text{ kg}, T_e = 0^{\circ}\text{C}$$



$$c_p \cdot m_v \cdot \Delta T_v = m_l \cdot q_{\text{tal}}$$



$$m_v = \frac{m_l \cdot q_{\text{tal}}}{c_p \cdot \Delta T_v} = \underline{\underline{3,14 \text{ kg}}}$$