

33. Koliko kockica leda temperature $0\text{ }^{\circ}\text{C}$, stranice 2 cm , treba rastaliti u 1 l vode da bi ju ohladili s $26,5\text{ }^{\circ}\text{C}$ na $10\text{ }^{\circ}\text{C}$? Specifična toplina taljenja leda je 333 kJkg^{-1} , specifični toplinski kapacitet vode je $4190\text{ Jkg}^{-1}\text{K}^{-1}$, gustoća vode je 10kgm^{-3} , a leda 920 kgm^{-3} . Gubitak topline u okolinu valja zanemariti!
- A. 10 B. 15 C. 25 D. 20 E. 5

$$t_L (\text{temperatura leda}) = 0\text{ }^{\circ}\text{C}$$

$$a (\text{stranica kockice leda}) = 2\text{ cm} = 2 \cdot 10^{-2}\text{ m}$$

$$\lambda (\text{specifična toplina taljenja}) = 333\text{ kJkg}^{-1} = 333\text{ }000\text{ Jkg}^{-1} = 3,33 \cdot 10^5\text{ Jkg}^{-1}$$

$$c_v (\text{specifični toplinski kapacitet vode}) = 4190\text{ Jkg}^{-1}\text{K}^{-1}$$

$$\rho_v (\text{gustoća vode}) = 10^3\text{ kgm}^{-3}$$

$$\rho_L (\text{gustoća leda}) = 920\text{ kgm}^{-3}$$

$$V_v (\text{volumen vode}) = 1\text{ l} = 10^{-3}\text{ m}^3$$

$$t_1 (\text{voda}) = 26,5\text{ }^{\circ}\text{C}$$

$$t_2 (\text{voda}) = 10\text{ }^{\circ}\text{C}$$

$$\left. \begin{array}{l} t_1 (\text{voda}) = 26,5\text{ }^{\circ}\text{C} \\ t_2 (\text{voda}) = 10\text{ }^{\circ}\text{C} \end{array} \right\} \text{voda se hladi } \Delta t = t_1 - t_2 = 26,5\text{ }^{\circ}\text{C} - 10\text{ }^{\circ}\text{C} = 16,5\text{ }^{\circ}\text{C} = 16,5\text{ K}$$

$$N (\text{broj kockica leda}) = ?$$

$$\text{Masa vode } m_v = \rho_v \cdot V_v = 10\text{ kgm}^{-3} \cdot 10^3\text{ m}^3 = 10^0\text{ kg} = 1\text{ kg}$$

$$Q_v = m_v \cdot c_v \cdot \Delta t = 1\text{ kg} \cdot 4190\text{ Jkg}^{-1}\text{K}^{-1} \cdot 16,5\text{ K} = 69\text{ }135\text{ J}$$

$$Q_L = Q_v$$

$$Q_L = m_L \cdot \lambda \quad /: \lambda \quad \Rightarrow \quad m_L = \frac{Q_L}{\lambda} = \frac{69\text{ }135\text{ J}}{3,33 \cdot 10^5\text{ Jkg}^{-1}} = 0,2\text{ kg}$$

Masa leda potrebog za taljenje je $0,2\text{ kg}$. Izračunajmo masu jedne kockice leda m :

$$m = \rho_L \cdot V = \rho_L \cdot a^3 = 920\text{ kgm}^{-3} \cdot (2 \cdot 10^{-2}\text{ m})^3 = 920\text{ kgm}^{-3} \cdot 8 \cdot 10^{-6}\text{ m}^3 = 7,36 \cdot 10^{-3}\text{ kg}$$

Pomoću omjera potrebne mase leda izračunajmo potreban broj kockica:

$$N = \frac{m_L}{m} = \frac{0,2\text{ kg}}{7,36 \cdot 10^{-3}\text{ kg}} = 27 \quad \text{odgovor C.}$$