

Toplina-plin-termodinamika - dz 6

RJEŠENJA:

① 4

② 64 g bakra sadrži N_A atoma bakra

a) masa jednog atoma = $\frac{64 \text{ g}}{6.02 \cdot 10^{23}} = 1.1 \cdot 10^{-25} \text{ kg}$

b.) $V = \frac{m}{\rho} = \frac{1.1 \cdot 10^{-25}}{8000} = 1.32 \cdot 10^{-29} \text{ m}^3$

$$V = \frac{4}{3} r^3 \pi \Rightarrow \dots d = 0.24 \text{ nm}$$

③

$$\Delta L = \alpha L_0 \Delta T = 1.1 \cdot 10^{-5} \cdot 45 \cdot 25 = 1.2 \cdot 10^{-2} \text{ m} = 1.2 \text{ cm}$$

④

$$W = pV_2 - pV_1 = nR(T_2 - T_1) = \frac{m}{M} R(\Delta T) \quad \text{jer } \Delta t = \Delta T$$

$$= 3196 \text{ J}$$

⑤

Količina topline koju treba dovesti tijelu mase m , sp. topl. kap. c za zagrijavanje (uaduju) za ΔT jednaka je radu električne struje (tad $W = P \cdot t_1$). Dakle, $Q_1 = mc\Delta T$ i $W = P t_1$

$$\text{Stoga } P = \frac{mc\Delta T}{t_1}$$

za promjenu agreg. stanja $Q_2 = m \cdot L_t$ i $W_2 = P \cdot t_2$

$$m L_t = \frac{mc\Delta T}{t_1} \cdot t_2$$

$$L_t = 336000 \frac{\text{J}}{\text{kg}}$$

6.

C žir na 5 cm
D pi na 16 cm

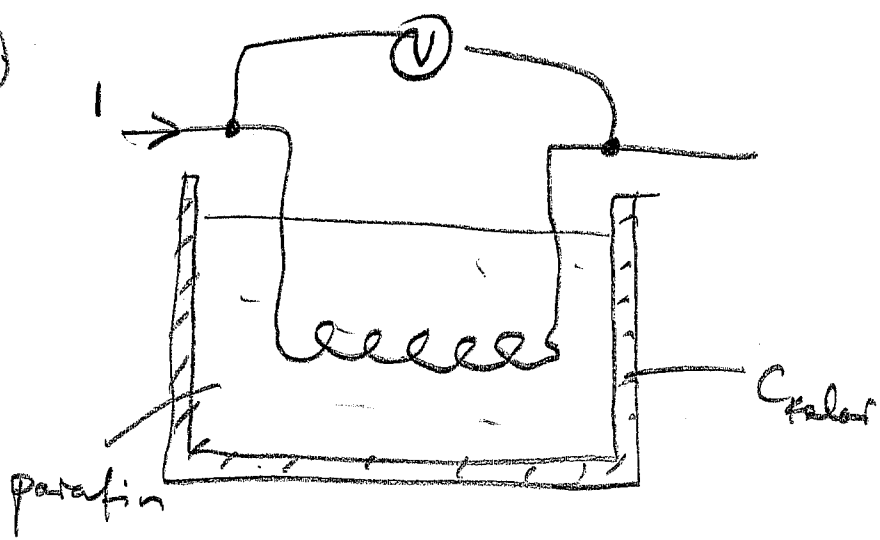
$$\overline{CD} = 11 \text{ cm}$$

ubac. slike!

7.

$$P = \frac{Q}{t} \rightarrow t = \frac{Q}{P} = \frac{mc\Delta T}{P} = 180 \text{ s}$$

8.



Z.O.E.

$$E_{el} = Q_{parafin} + Q_{kalorimetar}$$

$$U \cdot I \cdot t = m_{par} \cdot c_{par} \cdot \Delta t + m_{kal} \cdot c_{kal} \cdot \Delta t$$

$$U = 16 \text{ V}$$

9.

Cu žir $C_{Cu} < C_{Fe}$

10.

24 litre

TOPLA
 $m_1 = 10 \text{ kg}$
 $t_1 = 100^\circ \text{C}$

HLADNA
 $m_2 = ?$
 $t_2 = 15^\circ \text{C}$

$\tau = 40^\circ \text{C}$

1 L vode = 1 kg
 zbog $\rho = 1000 \frac{\text{kg}}{\text{m}^3}$

Richmannovo pravilo smjese

$$m_1 c_1 (t_1 - \tau) = m_2 c_2 (\tau - t_2)$$

$$m_1 = 24 \text{ kg} \rightarrow V_1 = 24 \text{ l}$$

11.

$$Q_V = Q_t + Q_{LV}$$

Q_V = toplotina koja otpušta voda (80°C)

Q_t = troši se na taljenje leda

Q_{LV} = "od leda nastaje voda koja se grije..."

$$m_V c_V \cdot (t_V - \tau) = m_L \cdot L_{t, \text{LED}} + m_{LV} \cdot c_V \cdot (\tau - 0^\circ\text{C})$$

$$\tau = 53.3^\circ\text{C}$$

$$m_{LV} = m_L$$

LV = "ledena voda"
Povratak od leda

12.

$$\underline{\underline{0^\circ\text{C}}}$$

sve isto kao u 11. zadatku... ispada $\tau < 0$ što je fizikalno neprimatljivo i zato $\tau = 0^\circ\text{C}$.

13.

$$Q = +1676 \text{ J}$$

$$W = -838 \text{ J}$$

$$\Delta U = ?$$

$$Q = \Delta U + W$$

$$1676 = \Delta U + (-838)$$

$$\Delta U = \underline{\underline{2514 \text{ J}}}$$

14.

ab Q_c ulazi (cold)

cd Q_h izlazi (hot)

$$\eta_{hl} = \frac{Q_c}{W}$$

$$\eta_{hc} = 5 \Rightarrow 5 = \frac{Q_c}{W}$$

$$Q_c = 5 \text{ W}$$

$$Q_h = Q_c + W$$

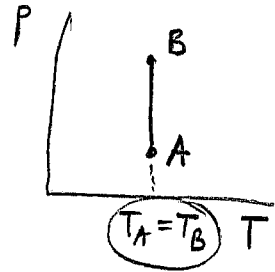
$$Q_h = 5 \text{ W} + W = 6 \text{ W}$$

15.

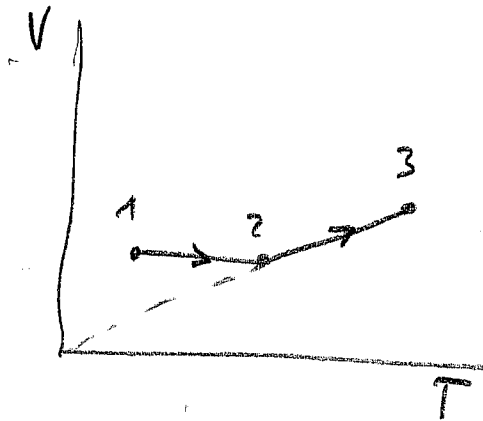
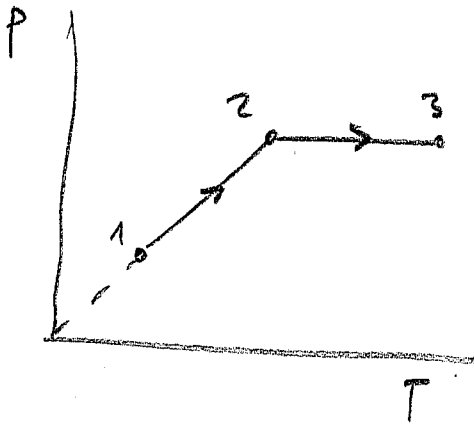
$\Delta Q = \Delta U$ što znači $W = 0$ izohor!

16.

A odgovore većem od hromena
 izotermni proces $P_A V_A = P_B V_B$



17.



18.

- a) $p = 1.1 \cdot 10^5 \text{ Pa}$
- b) $0.9 \cdot 10^5 \text{ Pa}$

" $\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$ " T u Kelvinima !!!
 $20^\circ\text{C} = 293 \text{ K}$

19.

$Q = 200\,000 \text{ J} = 20 \text{ kJ}$
 $15 \text{ kJ} ; 5 \text{ kJ}$

$W = p \Delta V = 100\,000 \cdot 0.15 = 15000 \text{ J} = 15 \text{ kJ}$

$Q = \Delta U + W \Rightarrow \Delta U = Q - W$

$\Delta U = 20 \text{ kJ} - 15 \text{ kJ} = 5 \text{ kJ}$

20.

okolina povećava entropiju.