

Решение

$$1. \left. \begin{array}{l} \text{ЗСИ: } mU_1 = Mu + mU_2 \\ \text{ЗСЭ: } \frac{Mu^2}{2} = Mgl(1 - \cos \alpha) \end{array} \right\} u = \frac{(U_2 - U_1)}{M}; \quad \cos \alpha = 1 - \frac{m^2(U_1 - U_2)^2}{2M^2gl}.$$

I $\cos \alpha_I \approx 61.$
 II $\cos \alpha_{II} \approx 31.$

$$2. P = a - bV; \quad \Delta P = b\Delta V; \quad V_2 - V_1 = \frac{1}{b}(P_1 - P_2); \quad A_{12} = \frac{1}{2}(P_1 + P_2)(V_2 - V_1) = \frac{P_1^2 - P_2^2}{2b}.$$

I $A_{12I} = 3 \text{ МДж.}$
 II $A_{12II} = 5 \text{ МДж.}$

$$3. m_{\text{CB}}\lambda_{\text{CB}} + m_{\text{CB}}c_{\text{CB}}t_2 = \lambda m_{\text{Л}} \rightarrow m_{\text{Л}} = \frac{m_{\text{CB}}(\lambda_{\text{CB}} + c_{\text{CB}}t_2)}{\lambda}; \quad V_{\text{Л}} = \frac{m_{\text{Л}}}{\rho_{\text{Л}}}; \quad V_{\text{В}} = \frac{m_{\text{В}}}{\rho_{\text{В}}};$$

$$V_{\text{СВОБ}} = V - \frac{m_{\text{CB}}}{\rho_{\text{CB}}} - V_{\text{Л}} - V_{\text{В}} = V - \frac{m_{\text{CB}}}{\rho_{\text{CB}}} + \frac{m_{\text{CB}}(\lambda_{\text{CB}} + c_{\text{CB}}t_2)}{\lambda} \left(\frac{1}{\rho_{\text{Л}}} - \frac{1}{\rho_{\text{В}}} \right).$$

I $V_{\text{СВОБ}I} = 34 \text{ см}^3.$
 II $V_{\text{СВОБ}II} = 47 \text{ см}^3.$

$$4. \text{Замкнутый ключ } P = IR_1 = \left(\frac{\varepsilon}{r + R_1} \right)^2 R_1 \quad (1)$$

$$\text{Разомкнутый ключ } P = I_2^2(R_1 + R_2) = \left(\frac{\varepsilon}{r + R_1 + R_2} \right)^2 (R_1 + R_2) \quad (2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{R_1}{(r + R_1)^2} = \frac{R_1 + R_2}{r + R_1 + R_2} \Rightarrow r = \sqrt{R_1(R_1 + R_2)}$$

I $r_I = 6 \text{ Ом.}$

II $r_{II} = 12 \text{ Ом.}$

$$5. \frac{1}{F/n} + \frac{1}{f} = \frac{1}{F} \rightarrow f = -\frac{F}{n-1} < 0; \text{ мнимое с увеличением } \Gamma = -\frac{n}{n-1} = \frac{f}{d}.$$

I $\Gamma_I = -2.$

II $\Gamma_{II} = -3.$