

Семиклар 7.

N. 6.3.

$$V = 30 \text{ л}$$

$$T_0 = 0^\circ \text{C}$$

$$\Delta p = 0.71 \text{ атм}$$

$$\rho = 1.33 \text{ г/л}$$

$$M = ?$$

$$\left\{ \begin{array}{l} p_1 V_0 = \frac{m_1}{M} R T_0 \\ p_2 V_0 = \frac{m_2}{M} R T_0 \end{array} \right. \quad \Delta p V_0 = \frac{\Delta m}{M} R T_0$$

$$p_1 = \frac{\rho}{M} R T_0 \Rightarrow M = \frac{\rho R T_0}{p_1}$$

$$\Delta p V_0 = \frac{\Delta m R T_0 \rho}{M} \Rightarrow$$

$$\Rightarrow \Delta m = V_0 \rho \cdot \frac{\Delta p}{p_1} = 302$$

6.3.

$$M, p$$

$$T_1 \rightarrow T_2$$

$$V$$

$$M = ?$$



$$T(x) = dx + \beta$$

$$T(0) = T_1 = \beta$$

$$T(l) = T_2 = l\alpha + T_1$$

$$l = \frac{T_2 - T_1}{\alpha}$$

$$T(x) = T_1 + (T_2 - T_1) \frac{x}{l}$$

$$S \alpha = V$$

$$p V = \frac{m}{M} R T$$

$$dm = p \frac{S dx \cdot M}{R T(x)}$$

$$m = \int_0^l \frac{p V}{\alpha} \frac{dx \cdot M}{R (T_1 + (T_2 - T_1) \frac{x}{l})} = \frac{p V M}{R} \int_0^l \frac{dx}{\alpha T_1 + (T_2 - T_1) \frac{x}{l}}$$

$$= \frac{p V M}{R} \ln \frac{(T_1 + (T_2 - T_1) \frac{l}{l}) \times \frac{1}{\alpha}}{T_1} \Rightarrow$$

$$\Rightarrow m = \frac{p V M}{R (T_2 - T_1)} \ln \frac{T_2}{T_1}$$

6.30

$$Q = 1 \text{ м.м.м.}$$

$$\Delta T = 72 \text{ K}$$

$$Q = 160 \text{ кДж}$$

$$\Delta V = ?$$

$$\gamma = \frac{C_p}{C_v} = ?$$

$$Q = C_v T$$

$$Q = C_p \Delta T \Rightarrow C_p = \frac{Q}{\Delta T}$$

$$C_v = \frac{Q}{\Delta T} - R = \frac{Q - R \Delta T}{\Delta T}$$

$$p V = R T$$

$$C_p = \frac{dQ}{dT} = \frac{dU + p dV}{dT} =$$

$$= C_v + p \frac{R}{T} = C_v + R$$

$$\Delta U = Q - R \Delta T$$

$$\gamma = \frac{Q}{Q - R \Delta T}$$

6.47

$$p = 2 V$$

$$\alpha) \Delta V = ?$$

$$\beta) A = ?$$

$$\gamma) C_v = ?$$

$$V = \frac{p V}{\gamma - 1} = \frac{1 V^2}{\gamma - 1}$$

$$\gamma = \frac{C_p}{C_v}$$

$$C_p = C_v + R$$

$$\gamma C_v = C_p$$

$$C_v = \frac{R}{\gamma - 1}$$

$$\gamma = \frac{\frac{R}{\gamma - 1} + R}{\frac{R}{\gamma - 1}} = \gamma$$

$$\alpha) \Delta U = \frac{2V_0^2}{\gamma - 1} (\gamma^2 - 1)$$

$$\delta) A = \int p dv = \int \frac{1}{2} \frac{dv^2}{v} = \frac{1}{2} \frac{v^2}{v} = \frac{1}{2} v$$

$$= \frac{1}{2} \frac{V_0^2}{\gamma^2 - 1}$$

$$b) C = C_v + \frac{p dv}{dT} = C_v + p \cdot \frac{R}{2T} = p \cdot \frac{R}{2p} + C_v = C_v + \frac{R}{2}$$

6.154.

$$D = 4 \text{ mm/s}$$

$$\Delta S = \frac{\Delta Q}{T}$$

$$\Delta S = 23 \text{ Дж/К}$$

$$\Delta Q = \int p dv = \int \frac{DRT}{v} dv =$$

$$\frac{v_2}{v_1} = ?$$

$$= DRT \ln \frac{v_2}{v_1}$$

$$\Delta S = \frac{\Delta Q}{T} = DR \ln \frac{v_2}{v_1} \Rightarrow \frac{v_2}{v_1} =$$

$$= e^{\frac{\Delta S}{DR}}$$

$$\frac{v_2}{v_1} = \exp\left(\frac{23 \text{ Дж/К}}{4 \text{ мм/с} \cdot 8.31 \cdot 10^{-3} \frac{\text{Дж}}{\text{К} \cdot \text{моль}}}\right) = e^{\frac{2.3}{0.03324}} = 2$$

Домашняя работа.

6.32.

$$V_1 = 2 \text{ моль } O_2$$

$$V_2 = 3 \text{ моль } CO_2$$

$$\gamma = ?$$

$$Q = 0, C^* \Delta T$$

$$Q_1 = V_1 C^* \Delta T, pT$$

$$Q + Q_2 = (V_1 C_{v1} p + V_2 C_{v2} p) T$$

$$C_v = \frac{V_1 C_v + V_2 C_v}{V_1 + V_2}$$

$$C_p = \frac{V_1 C_p + V_2 C_p}{V_1 + V_2}$$

$$\gamma = \frac{V_1 C_p + V_2 C_p}{V_1 C_v + V_2 C_v} = \frac{2 \cdot \frac{5}{2} + 3 \cdot \frac{5}{2}}{2 \cdot \frac{5}{2} + 3 \cdot \frac{5}{2}} =$$

$$= \frac{14 + 24}{10 + 15} = 1.56$$

Ответ: 1.36

11.6

$$W_1 = W_2 = W = 0.5$$

$$C_v = ?$$

$$C_v = C_{v1} W_1 + C_{v2} + C_{v3} W_3$$

$$W_1 = \frac{M_1}{M_1 + M_2}$$

$$W_2 = \frac{M_2}{M_1 + M_2}$$

$$C_v = \frac{C_{v1}}{2} \frac{R}{M_1} W + \frac{C_{v2}}{2} \frac{R}{M_2} W$$

$$i_1 = 3 \quad i_2 = 5$$

$$C_v = \frac{RW}{2} \left(\frac{i_1}{M_1} + \frac{i_2}{M_2} \right) = 526 \frac{\text{Дж}}{\text{К} \cdot \text{моль}}$$

Ответ: 526 Дж/К·моль

11.61

$$T_2 = 290\text{K}$$

$$T_1' = 400\text{K}$$

$$T_1'' = 600\text{K}$$

$$\frac{\eta_2}{\eta_1} = ?$$

$$\eta_1 = \frac{T_1' - T_2}{T_1'} = \frac{400\text{K} - 290\text{K}}{400\text{K}} =$$

$$= 0,275$$

$$\eta_2 = \frac{T_1'' - T_2}{T_1''} = \frac{600\text{K} - 290\text{K}}{600\text{K}}$$

$$= 0,52$$

$$\frac{\eta_2}{\eta_1} = \frac{0,52}{0,275} = 1,9$$

Orbem: 1,9