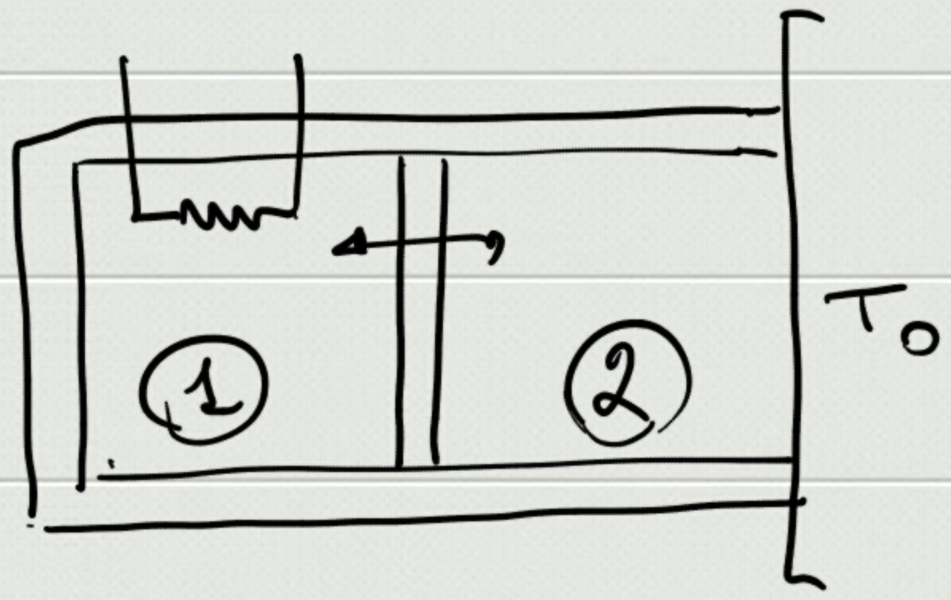


monoatomico

$V_{01} = V_{02} = V_0 = 0.054\ m^3$

$p_{01} = p_{02} = p_0 = 1.013 \cdot 10^5\ Pa$

quasi-statico

$T_{01} = T_{02} = T_0 = 273.15\ K$

T_2, W_2, T_1, Q_1

$p_2 = 7.69 \cdot 10^5\ Pa$

$T_2 = T_0$

$V_2 = \frac{nRT_2}{p_2}$ $\quad n = \frac{p_0 V_0}{RT_0}$

$W_2 = nRT_0 \ln \frac{V_2}{V_0}$ $\quad * \quad = -1.1 \cdot 10^4\ J$

$\stackrel{!}{=} p_2 (V_2 - V_0)$

$\stackrel{!}{=} nc_V (T_2 - T_0) + nc_p (T_2 - T_0)$

$\stackrel{!}{=} \frac{1}{2} (p_2 - p_0)(V_2 - V_0)$

$T_1 = \frac{p_1 V_1}{nR}$

$= 387\ K$

$p_1 = p_2$ $\quad 2V_0 = V_1 + V_2$

$\Rightarrow V_1 = 2V_0 - V_2$

$$Q_1 = m c_v (T_1 - T_0) + m c_p (T_1 - T_0)$$

$$\overset{!}{=} -Q_2$$

$$\overset{!}{=} m c_v (T_1 - T_0) - W_2 \qquad *$$

$$\overset{!}{=} m c_v (T_1 - T_0) + p_1 (v_1 - v_0)$$

$$Q_1 = W_1 + \Delta U_1$$

$$\hookrightarrow m c_v (T_1 - T_0)$$

$$W_{TOT} = 0$$

$$\overset{!}{=} W_1 + W_2 \quad \Big\{ \; W_1 = -W_2$$

$$Q_1 = 1.19 \cdot 10^5 \; J$$

$n = 1$ mono $T_0 = 300\,K$ $V_0 = 10^{-2}\,m^3$

(adiabatico rigido)

$$p_0 = \frac{nRT_0}{V_0} = 2.49 \cdot 10^5\ Pa$$

$$Q = 500 \cdot 4.186\ J \qquad (Q_{ASS})$$

T_1, p_1

$$Q = nR(T_1 - T_0)$$

$$Q = nc_p(T_1 - T_0)$$

$$Q = nc_v(T_1 - T_0) \quad * \Rightarrow T_1 = T_0 + \frac{Q}{nc_v}$$

$$T_1 = \frac{p_1 V_0}{nR} \quad * \quad = 468\,K$$

$$p_1 = \frac{nRT_1}{V_0} = 3.86 \cdot 10^5\ Pa$$

espansione adiab. rev. $V_2 = 10\, V_0$

$W_{1,2} = ?$

$W_{1,2} = p_2(V_2 - V_0)$ $\quad pV^\gamma = cost$

$W_{1,2} = p_2 V_2$

$W_{1,2} = -mc_v(T_2 - T_1)$; $TV^{\gamma-1} = cost$

$W_{1,2} = \int p\, dV$ $\quad \underline{pV^\gamma = cost = p_1 V_1^\gamma}$

$Q_{1,2} = 0 \Rightarrow W_{1,2} = -\Delta U_{1,2}$

$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1} \Rightarrow T_2 = T_1 \left(\frac{V_1}{V_2}\right)^{\gamma-1} =$ ($V_1 = V_0$)

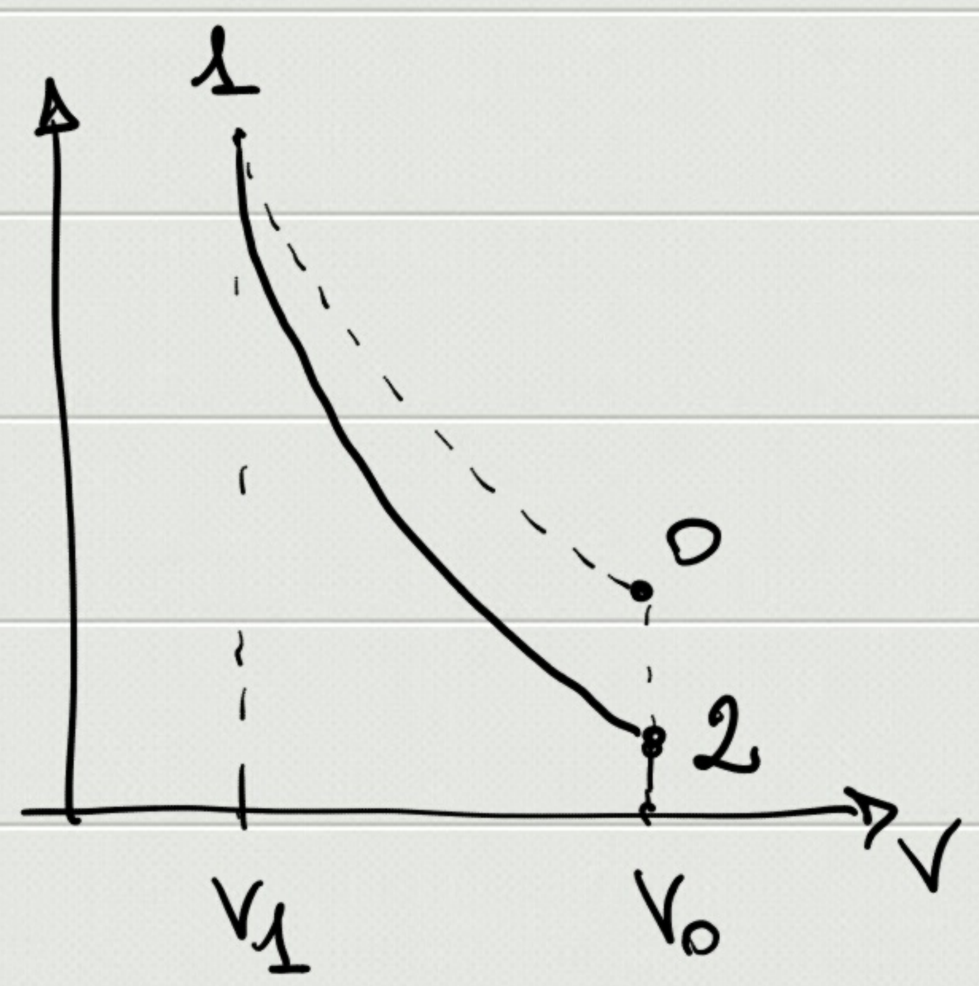
$= 101\ K$

$\Rightarrow W_{1,2} = 4550\ J$

$n = 1$

$T_0 = 300\,K$

$p_0 = 10^5\,Pa$



01 → compr. isoterma

$V_1 = \frac{1}{8} V_0$

12 → adiab. rev. $V_2 = V_0$ $p_2 = \frac{1}{5} p_0$

$T_1 = T_0$, T_2 , $\gamma = \frac{c_p}{c_v}$, ΔU_{02}

$$T_2 = \frac{p_2 V_2}{nR} = \frac{\frac{p_0}{5} V_0}{nR} = \frac{1}{5} \frac{nRT_0}{nR} = \frac{1}{5} T_0 = 60\,K$$

$$V_0 = \frac{nRT_0}{p_0}$$

$$p_1 V_1^{\gamma} = p_2 V_2^{\gamma} \Rightarrow \left(\frac{V_2}{V_1}\right)^{\gamma} = \frac{p_1}{p_2}$$

$\frac{V_0}{V_1} = 8$

$$\Rightarrow \gamma \ln\left(\frac{V_2}{V_1}\right) = \ln\left(\frac{p_1}{p_2}\right) \Rightarrow \gamma = \frac{\ln\left(\frac{V_2}{V_1}\right)}{\ln\left(\frac{p_1}{p_2}\right)} = 1.77$$

$$p_0 V_0 = p_1 V_1 \Rightarrow p_1 = \frac{p_0 V_0}{V_1} \Rightarrow \frac{p_1}{p_2} = \frac{p_0 V_0 / V_1}{\frac{1}{5} p_0} = 5 \frac{V_0}{V_1} = 40$$

$$\Delta U_{02} = m c_v (T_2 - T_0) = -2591 \text{ J}$$

$$\frac{c_v}{R} = \frac{1}{\gamma - 1} \Rightarrow c_v = \frac{R}{\gamma - 1}$$