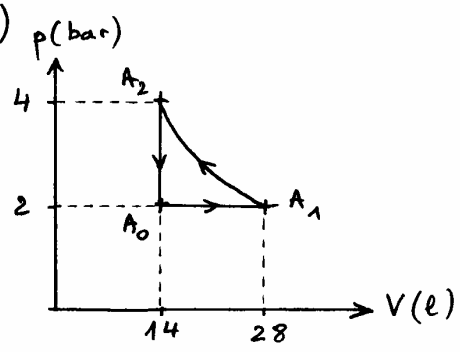
1) a)



b) $p_1 V_1 = nRT_1$

$\Rightarrow T_1 = \frac{p_1 V_1}{nR} = \frac{2p \cdot V_0^m}{R} = 673,562654$

$\boxed{T_1 = 674\ K}$

$p_2 V_2 = nRT_2$

$\Rightarrow p_2 = \frac{nRT_2}{V_2} = \frac{RT_1}{V_0^m} = 400000$

$\boxed{p_2 = 4,00.10^5\ Pa = 4,00\ bar}$

2) $A_0 \to A_1$ transfo isobare

$Q(A_0 \to A_1) = \Delta H(A_0 \to A_1) = C_p (T_1 - T_0) = \frac{nR\gamma}{\gamma - 1}(T_1 - T_0)$ Or $n = 1$ mol

$\boxed{Q(A_0 \to A_1) = \frac{R\gamma}{\gamma - 1}(T_1 - T_0) = 9,80\ kJ}$

A.N. $T_0 = 336,781\,3327 = 337\ K$

$Q = 9800,000\ J$

$W(A_0 \to A_1) = -\int_0^1 p\, dV = -p_0(V_1 - V_0) = -p_1 V_1 - p_0 V_0 = -nR(T_1 - T_0)$

$\boxed{W(A_0 \to A_1) = -R(T_1 - T_0) = -2,80\ kJ}$ $= -2800,000\ J$

$A_1 \to A_2$ transfo isotherme $\quad \Delta U(A_1 \to A_2) = 0 = W + Q$

$W(A_1 \to A_2) = -\int_1^2 p\, dV = -nRT_1 \ln \frac{V_2}{V_1} = -RT_1 \ln \frac{V_0^m}{2V_0^m}$

$\boxed{W(A_1 \to A_2) = RT_1 \ln 2 = 3,88\ kJ}$ $(3881,624\ J)$

$\boxed{Q(A_1 \to A_2) = -RT_1 \ln 2 = -3,88\ kJ}$

$A_2 \to A_0$ transfo isochore

$Q(A_2 \to A_0) = \Delta U(A_2 \to A_0) = C_v (T_0 - T_2)$

$\boxed{Q(A_2 \to A_0) = \frac{R}{\gamma - 1}(T_0 - T_1) = -7,00\ kJ}$ $= -7000,000\ J$

$\boxed{W(A_2 \to A_0) = 0}$

3) Le premier principe sur le cycle s'écrit $\Delta U = 0$

$\Delta U = W(A_0 \to A_1) + W(A_1 \to A_2) + W(A_2 \to A_0) + Q(A_0 \to A_1) + Q(A_1 \to A_2) + Q(A_2 \to A_0)$

$= -R(T_1 - T_0) + RT_1 \ln 2 + 0 + \frac{R\gamma}{\gamma - 1}(T_1 - T_0) - RT_1 \ln 2 + \frac{R}{\gamma - 1}(T_0 - T_1)$

$= \left(\frac{R\gamma}{\gamma - 1} - R - \frac{R}{\gamma - 1}\right)(T_1 - T_0) = \frac{R}{\gamma - 1}(\gamma - \gamma + 1 - 1)(T_1 - T_0)$

$\boxed{\Delta U = 0}$ Le premier principe est vérifié