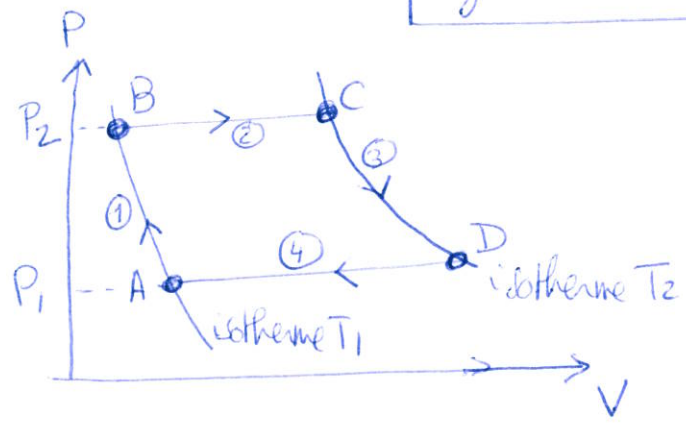
Cycle d'Ericsson

1/



on a $T_1 = T_A = \frac{P_A V_A}{nR} = 300{,}7$ K

$V_B = \frac{nRT_1}{P_2} = 10\ \ell$

$V_C = \frac{nRT_2}{P_2} = 40\ \ell$

$V_D = 200\ \ell$

3/ • $W_1 = -\int_A^B P\,dV = -nRT_1 \int_A^B \frac{dV}{V} = nRT_1 \ln\left(\frac{V_A}{V_B}\right)$

or $\frac{V_A}{V_B} = \frac{P_B}{P_A} = x$ donc $W_1 = nRT_1 \ln(x)$

(1ᵉ principe)

avec la 1ᵉ loi de Joule on a $U_B = U_A$ donc $Q_1 = -W_1 = -nRT_1 \ln(x)$

• $W_2 = -\int_B^C P\,dV = -P_2(V_C - V_B) = -nR(T_2 - T_1)$

$Q_2 = C_p(T_2 - T_1) = \frac{nR\gamma}{\gamma - 1}(T_2 - T_1)$

• $W_3 = -\int_C^D P\,dV = -nRT_2 \int_C^D \frac{dV}{V} = -nRT_2 \ln\left(\frac{V_D}{V_C}\right) = -nRT_2 \ln(x)$

$Q_3 = -W_3$

• $W_4 = -\int_D^A P\,dV = P_1(V_A - V_D) = nR(T_2 - T_1)$

$Q_4 = C_p(T_1 - T_2) = -\frac{nR\gamma}{\gamma - 1}(T_2 - T_1)$

$\sum_{i=1}^{4} W_i = -24{,}07$ kJ

(b) $W_1 + W_2 + W_3 + W_4 = -nR(T_2 - T_1)\ln(x) < 0$ c'est un moteur

(c) $\eta = \frac{-W}{Q_3 + Q_2} = \frac{(T_2 - T_1)\ln x}{T_2 \ln x + \frac{\gamma}{\gamma - 1}(T_2 - T_1)} = 0.285$ (à comparer à $\eta_{carnot} = 1 - \frac{T_1}{T_2} = 0.75$)