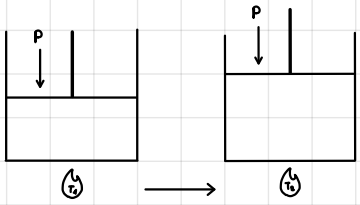
ESERCITAZIONE

ESERCIZIO 2

$n = 3$ mol $\qquad T_1 = 300\ K$

$C_V = \frac{5}{2} R$ $\qquad T_2 = 400\ K$

$p = 1$ atm $= 1{,}1035 \cdot 10^5$ Pa



1) $\Delta U = n C_V (T_2 - T_1) = \dots = 6235{,}5$ J

2) $W = p(V_2 - V_1) = nR(T_2 - T_1) = 2494{,}2$ J

3) $\Delta S_g = \int \frac{\delta Q}{T} = \int \frac{p\,dV}{T} + \int \frac{nC_V\,dT}{T} = nR \ln\left(\frac{V_B}{V_A}\right) + nC_V \ln\left(\frac{T_2}{T_1}\right) = nR \ln\left(\frac{pV_B}{pV_A}\right) + nC_V \ln\left(\frac{T_2}{T_1}\right) = nR \ln\left(\frac{nRT_2}{nRT_1}\right) + nC_V \ln\left(\frac{T_2}{T_1}\right) = n \ln\left(\frac{T_2}{T_1}\right)(R + C_V) = nC_p \ln\left(\frac{T_2}{T_1}\right)$

$\cong 25{,}11 \frac{J}{K}$

$Q = \Delta U + L = \dots = 8729{,}7$ J

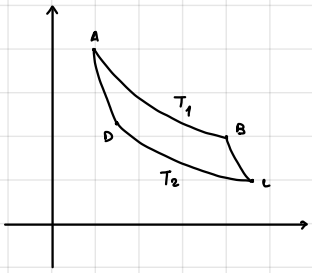
$\Delta S_s = \int \frac{\delta Q}{T} = -\frac{Q}{T_2} = -21{,}82$ J/K

4) $\Delta S_U = \Delta S_g + \Delta S_s = 3{,}29 \frac{J}{K}$

ESERCIZIO 3

$T_1 = 300\ K \qquad T_2 = 400 K$

$\Delta S_A = 3$ cal/K



1) $\eta = 1 - \frac{T_1}{T_2} = \frac{1}{4} = 25\ \%$

2) $W_{BC} = -\Delta U_{BC} = nC_V(T_2 - T_1)$ } si annullano

$W_{DA} = -\Delta U_{DA} = nC_V(T_1 - T_2)$ }

$W_{AB} = nRT_1 \ln\left(\frac{V_B}{V_A}\right)$

↳ $\Delta S_A = \int \frac{p\,dV}{T} = nR \ln\left(\frac{V_B}{V_A}\right) \Rightarrow W_{AB} = \Delta S_A T_1 = 1200$ cal

$W_{CD} = nRT_2 \ln\left(\frac{V_D}{V_C}\right)$

↳ $\eta = 1 + \frac{Q_C}{Q_A} \rightarrow Q_C = (\eta - 1) Q_A = \dots = -300$ cal $\Rightarrow W_{CD} = Q_A = -300$ cal

$W = Q_A + Q_C = W_{AB} + W_{CD} = 300$ cal $= 1255{,}8$ J

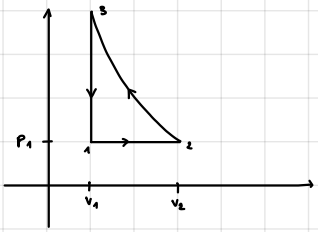
3) $\Delta S_2 = \frac{Q_C}{T_2} = -3$ cal/K $= -\Delta S_1$

ESERCIZIO 5

$n = 1$ mol $\qquad W = ?$

$C_V = \frac{3}{2} R \qquad Q = ?$

$V_1, p_1, V_2 = 2V_1 \qquad \Delta S = 0$



$W_{12} = P_1(V_2 - V_1) = P_1 V_1$ $\qquad \rightarrow \quad W = W_{12} + W_{23} = P_1 V_1 (1 + 2 \ln 2)$

$W_{23} = nRT_2 \ln\left(\frac{V_3}{V_2}\right) = RT_2 \ln(2) = 2P_1V_1 \ln(2)$

$Q_{12} = C_p (T_2 - T_1) = C_p P_1 V_1 \left(\frac{2 - P_1V_1}{R}\right) = \frac{5}{2} R \left(\frac{P_1V_1}{R}\right) = \frac{5}{2} P_1V_1$

$Q_{23} = W_{23}$ $\qquad \longrightarrow \quad Q = \frac{5}{2} P_1V_1 - \frac{3}{2} P_1V_1 + 2P_1V_1 \ln 2 =$

$Q_{31} = nC_V(T_1 - T_3) = C_V(T_1 - T_2) = \frac{3}{2} R \left(\frac{P_1V_1 - 2P_1V_1}{R}\right) = -\frac{3}{2} P_1V_1$ $\qquad = P_1V_1 + 2P_1V_1 \ln 2 = P_1V_1(1 + 2\ln 2) = L$