Exercice 3 :

Compression isotherme Gaz Parfait monoatomique

$m = 8g$ $\Delta Q = 0$ $M = 40 g \cdot mol^{-1}$

$P_1 = 1 bar$ $P_2 = 10 bar$ $1 bar = 10^5 Pa$

$T_1 = 298 K$ $T_2 = 298 K$

$V_1 = ?$ $V_2 = ?$

$P_1 V_1 = n R T_1$ $n = \frac{m}{M} = \frac{8}{40} = 0,2$ moles

$\Leftrightarrow V_1 = \frac{n R T_1}{P_1}$

$\Leftrightarrow V_1 = \frac{0,2 \times 8,314 \times 298}{10^5} = 0,00496$

$V_2 = \frac{n R T_2}{P_2} = \frac{0,2 \times 8,314 \times 298}{10^6} = 0,000496$

$V_1 = 4,96 \ell$

$V_2 = 0,496 \ell$

↓

2) $\delta W = -P \cdot dV$

$\iff \int \delta W = \int_{V_1}^{V_2} -P\,dV$

$\iff \int \delta W = \int_{V_1}^{V_2} -nRT \frac{dV}{V}$

$\iff \int \delta W = -nRT \int_{V_1}^{V_2} \frac{dV}{V}$ or $\frac{dV}{V} = \ln\left(\frac{V_2}{V_1}\right)$

$\iff \int \delta W = -nRT \ln\left(\frac{V_2}{V_1}\right)$

$\iff \int \delta W = -0{,}2 \times 8{,}314 \times 298 \times \ln\left(\frac{0{,}495}{4{,}95}\right)$

$= 1141\ J > 0$

le système reçoit du travail

$\Delta U = Q + W$

et ΔU ne dépends que de T en isotherme

donc $\Delta U = 0$, ainsi $W = -Q$

$Q = -1141\ J$