Exercise 8-3

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ideal gas: $PV = nRT$

1 kmol	1 kmol
$V_i = 12\,L$ $V_f = 7\,L$	$V_i = 2\,L$ $V_f = 7\,L$

$T = 0\,^\circ C = 273{,}15\,K$

diathermal walls → heat can go through, matter cannot

$\Delta F = ?$

$dF = -SdT - PdV$

diathermal wall → $dT = 0$

$P = \frac{nRT}{V}$

$dF = -\frac{nRT}{V}dV$

$\Delta F = -nRT\ln\left(\frac{V_f}{V_i}\right)$

$\Delta F_1 = -1 \times 8{,}314 \times 10^3 \times 273{,}15 \ln\left(\frac{7}{12}\right)$

$\Delta F_2 = -1 \times 8{,}314 \times 10^3 \times 273{,}15 \ln\left(\frac{7}{2}\right)$

$\Delta F = \Delta F_1 + \Delta F_2 = -8{,}314 \times 10^3 \times 273{,}15 \times \left(\ln\left(\frac{49}{24}\right)\right)$

$= -1{,}62 \cdot 10^6\,J$