

Physics hour

1) Maxwell-Boltzmann-Verteilung

$$\langle v \rangle = \sqrt{\frac{8k_B T}{\pi \cdot m}} \quad ; \quad T_1 = 300 \text{ K} \rightarrow T_2 = 600 \text{ K} = 2 \cdot 300 \text{ K} = 2 \cdot T_1$$

$$\langle v_2 \rangle = \sqrt{\frac{8k_B T_2}{\pi \cdot m}} = \sqrt{\frac{8k_B 2 \cdot T_1}{\pi \cdot m}} = \sqrt{2} \underbrace{\sqrt{\frac{8k_B T_1}{\pi \cdot m}}}_{\langle v_1 \rangle} = \sqrt{2} \cdot \langle v_1 \rangle$$

2) Zustandsänderung I

- isochor : $V = \text{const}$
- isobar : $p = \text{const}$
- adiabatisch : $Q = \text{const}$

3) Zustandsänderung III

$$pV = Nk_B T \rightarrow Nk_B = \frac{p \cdot V}{T} = \text{const} \Rightarrow \frac{p_1 \cdot V_1}{T_1} = \frac{p_2 \cdot V_2}{T_2}$$

$$\Rightarrow V_2 = V_1 \cdot \frac{p_1}{p_2} \cdot \frac{T_2}{T_1} = 10 \text{ dm}^3 \cdot \frac{1 \text{ bar}}{2 \text{ bar}} \cdot \frac{600 \text{ K}}{300 \text{ K}} = 10 \text{ dm}^3 \cdot \frac{1}{2} \cdot 2 = 10 \text{ dm}^3$$

$\downarrow$
 $(0,1 \text{ m})^3 = \frac{1}{1000} \text{ m}^3$

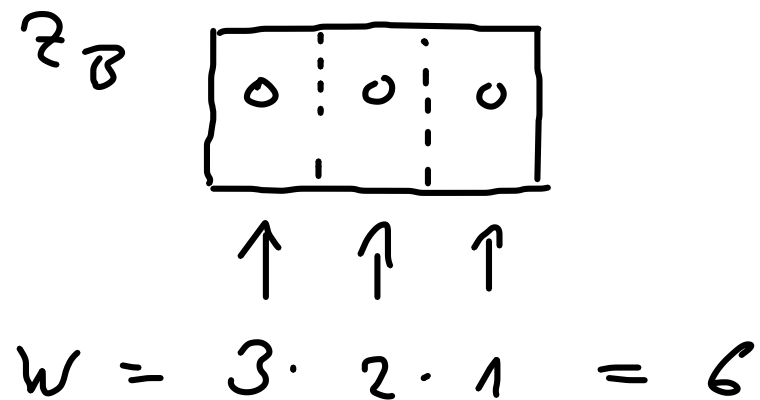
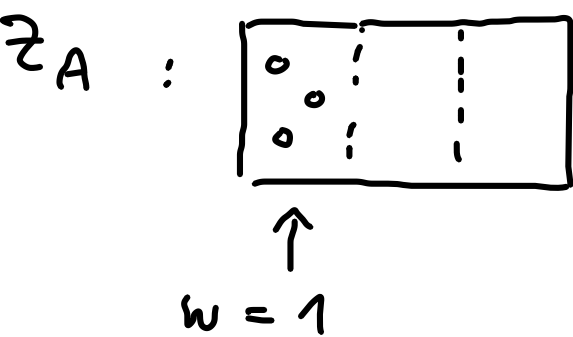
4) Atomzahl

$$N = \frac{p \cdot V}{k_B T} = \frac{p_1 \cdot V_1}{k_B \cdot T_1} = \frac{10^5 \text{ Pa} \cdot 10 \cdot 10^{-3} \text{ m}^3}{1,38 \cdot 10^{-23} \frac{\text{J}}{\text{K}} \cdot 300 \text{ K}} = 2,4 \cdot 10^{23}$$

5) Innere Energie

$$U = \frac{3}{2} N k_B T \rightarrow \Delta U = \frac{3}{2} N k_B \Delta T = \frac{3}{2} \cdot 2,4 \cdot \cancel{10^{23}} \cdot 1,38 \cdot \cancel{10^{-23}} \frac{\text{J}}{\text{K}} \cdot 600 \text{ K} \\ = 3,0 \text{ kJ}$$

6) Entropie mikroskopisch



$$S(\mathcal{Z}_A) = k_B \cdot \ln(1) = 0 \quad S(\mathcal{Z}_B) = k_B \cdot \ln(6) = 1,8 \cdot k_B$$

$$\Delta S = 1,8 \cdot k_B$$

7) Reversible isothermal Expansion

$$\Delta S = N k_B \cdot \ln \left(\frac{V_2}{V_1} \right) = 3 \cdot k_B \cdot \ln(3) = 3,3 \cdot k_B$$