

BDÚ #4

vdW plyn $a = 0,137 \text{ J} \cdot \text{m}^3 \cdot \text{mol}^{-2}$

$$b = 38,7 \cdot 10^{-6} \text{ m}^3 \cdot \text{mol}^{-1}$$

izotermická expanze $V_1 = 10 \text{ dm}^3 = 0,01 \text{ m}^3$

na $V_2 = 5V_1 = 0,05 \text{ m}^3$

$$P_1 = 300 \text{ kPa} = 3 \cdot 10^5 \text{ Pa}$$

$$n = 1 \text{ mol}$$

① nevyřetně

$$W = \int_1^2 dW = - \int_{V_1}^{V_2} p_2 dV = \underset{\substack{\uparrow \\ \text{nevyřetně} \\ \text{děj}}}{p_2} (V_2 - V_1)$$

vdW $\left(p + \frac{an^2}{V^2}\right)(V - nb) = nRT$
↓ pro 1 mol

$$\left(p + \frac{a}{V^2}\right)(V - b) = RT$$

$$\Rightarrow p = \frac{RT}{V - b} - \frac{a}{V^2}$$

$$W = - \left(\frac{RT}{V_2 - b} - \frac{a}{V_2^2} \right) (V_2 - V_1) =$$

$$T \approx \frac{pV}{nR} \approx \frac{P_1 V_1}{nR} \approx 361 \text{ K}$$

$$\underline{\underline{\dot{=} -2,4 \text{ kJ}}}$$

② Urethane

$$W = \int_1^2 dW = - \int_{V_1}^{V_2} p_{\text{ext}} dV = - \int_{V_1}^{V_2} \left(\frac{RT}{V-b} - \frac{a}{V^2} \right) dV =$$

pro 1 mol
↓
 V_2

$$= -RT \ln \left(\frac{V_2-b}{V_1-b} \right) + a \left(\frac{1}{V_2} - \frac{1}{V_1} \right) =$$

$$= -RT \ln \left(\frac{5V_1-b}{V_1-b} \right) - aV_1 \frac{4}{5} =$$

$$T \approx 361 \text{ K}$$

$$\underline{\underline{\approx -4,84 \text{ kJ}}}$$