Spezifische Wärme von Wasser

Soll Wasser um 1 K erhitzt

dann 35-mal ein 5kg-Gewicht um 15 cm gehoben

totale Arbeit = $35 \cdot mgh = 35 \cdot 5\,kg \cdot 10\,m/s^2 \cdot 0.15\,m$

$\hat{=} 260\,J$

$\Rightarrow$ spez. Wärme von Wasser $\hat{=} 5\,\frac{kJ}{kg \cdot K}$

Überström-Versuch im von der Waals Gas

$U_{anf} = U_{end}$ $\qquad U = C_V T - \frac{a}{V}$

$$C_V T_{anf} - \frac{a}{V_{anf}} = C_V T_{end} - \frac{a}{V_{end}}$$

$$T_{end} - T_{anf} = \Delta T = \frac{1}{C_V}\left(\frac{a}{V_{end}} - \frac{a}{V_{anf}}\right) = \frac{a}{C_V}\,\frac{V_{anf} - V_{end}}{V_{end} V_{anf}}$$

$V_{anf} = V_1$ $\quad V_{end} = V_1 + V_2$

$$= -\frac{a}{C_V}\,\frac{V_2}{V_1(V_1+V_2)}$$

Joule-Thomson Effekt für van der Waals Gas

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

$$p = \frac{RT}{} - \frac{a}{}$$

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

$$H = U + pV = C_V T - \frac{a}{V} + V\left(\frac{RT}{V-b} - \frac{a}{V^2}\right)$$

$$H_1 = H_2$$

$$C_V T_1 - \frac{2a}{V_1} + V_1 \frac{RT_1}{V_1 - b} = C_V T_2 - \frac{2a}{V_2} + V_2 \frac{RT_2}{V_2 - b}$$

$$T_1\left(C_V + R\frac{V_1}{V_1 - b}\right) - \frac{2a}{V_1} = T_2\left(C_V + R\frac{V_2}{V_2 - b}\right) - \frac{2a}{V_2}$$

$$\frac{V_1}{V_1 - b} = \frac{1}{1 - b/V_1} \cong 1 + \frac{b}{V_1}$$

$$T_1(C_V + R) - \frac{2a}{V_1} + \frac{RT_1 b}{V_1} = T_2(C_V + R) - \frac{2a}{V_2} + \frac{RT_2 b}{V_2}$$

$$(T_2 - T_1)(C_V + R) = -\frac{2a}{V_1} + \frac{2a}{V_2} + \frac{RT_1 b}{V_1} - \frac{RT_2 b}{V_2}$$

$\frac{RT}{V} = p$; $\frac{RT_1 b}{V_1} \rightarrow p_1$; $\frac{RT_2 b}{V_2} \rightarrow p_2$

$$(T_2 - T_1)(C_V + R) = -\frac{2a}{RT}(p_1 - p_2) + b(p_1 - p_2) \qquad T \cong \frac{T_1 + T_2}{2}$$

$$T_2 - T_1 = \frac{(p_1 - p_2)}{C_V + R}\left(b - \frac{2a}{RT}\right)$$

$\frac{}{C_V + R}\left(5 - \overline{RT}\right)$

Carnot-Prozess

$$W = R \cdot \ln \frac{V_2}{V_1} \cdot (T_1 - T_2)$$

$$Q_1 = RT_1 \ln \frac{V_2}{V_1} \qquad Q_2 = RT_2 \ln \frac{V_1}{V_2}$$

$$\frac{Q_1}{T_1} = R \ln \frac{V_2}{V_1} \qquad \frac{Q_2}{T_2} = R \ln \frac{V_1}{V_2} = -\frac{Q_1}{T_1}$$

$$\sum_{i=1}^{4} \frac{Q_i}{T_i} = \frac{Q_1}{T_1} + \frac{Q_2}{T_2} = \frac{Q_1}{T_1} - \frac{Q_1}{T_1} = 0$$