Boyle-Mariotte $p \cdot V = \text{const}$ $(T = \text{const})$

Gay-Lussac $\frac{V}{T} = \text{const}$ $(p = \text{const})$

Thermische Zustandsgleichung des idealen Gases:

$p \cdot V = N k_B T$ N = Teilchenzahl

$k_B = 1.38 \cdot 10^{-23} \frac{J}{K}$

$p \cdot V = \left(\frac{N}{N_A}\right)(N_A k_B) T$

$p \cdot V = n R T$

$R = N_A k_B = 8.3145 \frac{kJ}{kmol\ K}$ universelle Gaskonstante

$p V = m \cdot \frac{1}{m} R T = m \left(\frac{R}{m}\right) T = m R_i T$ spezifische Gaskonstante

$p V = m R_i T$ $R_i = \frac{R}{m}$

Molvolumen V_m

$$V_m = \frac{V}{n}$$

Normbedingungen: $p_0 = 1.01325\ \text{bar}$ $T_0 = 273.15\ \text{K}$

$$pV = nRT \Rightarrow V_m = \frac{V}{n} = \frac{RT}{p}$$

$$V_{m,0} = R\frac{T_0}{p_0} = 22.414\ \frac{\text{m}^3}{\text{kmol}} = 22.414\ \frac{\text{l}}{\text{mol}}$$

Volumen-Ausdehnung

$$\gamma = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_p$$

$$V = \frac{nR}{p}T \Rightarrow \left(\frac{\partial V}{\partial T}\right)_p = \frac{nR}{p}$$

$$\Rightarrow \boxed{\gamma = \frac{nR}{pV} = \frac{nR}{nRT} = \frac{1}{T}}$$