

# Formula sheet

$$\left(P + \frac{a}{v^2}\right)(v - b) = RT \quad PV^\gamma = \text{constant}$$

$$B \equiv -V \left(\frac{\partial P}{\partial V}\right) = \frac{1}{\kappa} \quad \alpha \equiv \frac{1}{L} \left(\frac{\partial L}{\partial T}\right)_T \quad \beta \equiv \frac{1}{V} \left(\frac{\partial V}{\partial T}\right)_P$$

$$\frac{1}{2} m \overline{v^2} = \frac{3}{2} kT \quad \gamma \equiv \frac{c_P}{c_V} = \frac{f + 2}{f}$$

$$b = \frac{2}{3} N_A \pi d^3 \quad l = \frac{1}{n\sigma}$$

$$\frac{\bar{N}_i/N}{g_j} = \exp \frac{\mu - \epsilon_i}{k_B T} \quad \Delta N_v = \frac{4N}{\sqrt{\pi}} \left(\frac{m}{2kT}\right)^{3/2} v^2 \exp\left(-\frac{mv^2}{2kT}\right) \Delta v$$

$$H \equiv U + PV \quad F \equiv U - TS \quad G \equiv F + PV$$

$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V \quad \left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$$

$$\left(\frac{\partial S}{\partial V}\right)_P = \left(\frac{\partial P}{\partial T}\right)_S \quad \left(\frac{\partial S}{\partial P}\right)_V = -\left(\frac{\partial V}{\partial T}\right)_S$$

$$\left(\frac{\partial P}{\partial T}\right)_{23} = \frac{L_{23}}{T(v_3 - v_2)} \quad \left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial T}{\partial V}\right)_P \left(\frac{\partial V}{\partial P}\right)_T = -1$$

$$TdS = C_v dT + T \left(\frac{\partial P}{\partial T}\right)_V dV \quad TdS = C_p dT - T \left(\frac{\partial V}{\partial T}\right)_P dP$$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!} x^2 + \dots \quad \int_0^\infty e^{-ax} dx = \frac{1}{a}$$

$$R = 8.31 \cdot 10^3 \text{ J kilomole}^{-1} \text{ K}^{-1} \quad k_B = 1.38 \cdot 10^{-23} \text{ JK}^{-1}$$

$$N_A = 6.02 \cdot 10^{26} \text{ molecules kilomole}^{-1}$$

$$1 \text{ Atmosphere} \equiv 101 \text{ kPa}$$

$$1 \text{ kg mole of an ideal gas occupies } 22.4 \text{ m}^3 \text{ at } 273 \text{ K and } 100 \text{ Pa.}$$