$$\left(P + a\frac{n^2}{V^2}\right)(V - bn) = nRT$$

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

$$T_R = \frac{T}{T_K} \quad P_R = \frac{P}{P_K} \quad z = \frac{PV}{nRT}$$

$$\bar{M} = \sum_i^k X_i\, M_i \quad P_i = X_i P$$

$$dU = đQ + đW \quad W = -\int_{V_1}^{V_2} P_0\, dV \quad \Delta H = \int_{T_1}^{T_2} n\, \overline{c_P} dT \quad \Delta U = \int_{T_1}^{T_2} n\, \overline{c_V} dT$$

$$W = -nRT ln\frac{V_2}{V_1} \quad W = n\overline{c_V}T_1\left[\left(\frac{V_1}{V_2}\right)^{\gamma-1} - 1\right] \; \gamma = \frac{\overline{c_P}}{\overline{c_V}} \quad \overline{c_P} = \overline{c_V} + R$$

$$c_P - c_V = \left[P + \left(\frac{\partial U}{\partial V}\right)_T\right]\left(\frac{\partial V}{\partial T}\right)_P$$

$$dS \geq \frac{đQ}{T}$$

$$\Delta S = n\int_{T_1}^{T_2} \frac{\overline{c_P}}{T} dT \quad \Delta S = \frac{n\Delta\bar{H}(izp)}{T_V}$$

$$dS = n\overline{c_V} dlnT + nRdlnV \qquad dS = n\overline{c_P} dlnT - nRdlnP$$