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

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

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

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

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

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

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

$$dS \geq \frac{đQ}{T}$$

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

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

$$\Delta S_m = -R\sum_{i=1}^k n_i\, lnX_i$$

$$A = U - TS \quad G = A + PV \;\; H = U + PV$$

$$\left(\frac{\partial U}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V - P \quad \mu_{JT} = \frac{V(\alpha T - 1)}{c_P}$$

$$\left[\frac{\partial\left(\frac{\Delta A}{T}\right)}{\partial T}\right]_V = -\frac{\Delta U}{T^2} \qquad \left[\frac{\partial\left(\frac{\Delta G}{T}\right)}{\partial T}\right]_P = -\frac{\Delta H}{T^2}$$

$$ln\frac{P_2}{P_1} = -\frac{\Delta\overline{H_{izp}}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right) \quad \frac{dP}{dT} = \frac{\Delta H_{tal}}{T\Delta V_{tal}}$$

$$s = 2 + k - f$$

$$X_A = \frac{P_A}{P_A^0} \quad X_B = \frac{P_B}{K_B}$$