Compressibility Factor

$$Z = \frac{Pv}{RT} = \frac{v_{actual}}{v_{ideal}}$$

$$T_R = \frac{T}{T_{cr}}$$

$$P_R = \frac{P}{P_{cr}}$$

$$v_R = \frac{v_{actual}}{RT_{cr} / P_{cr}}$$

Other Equations of State

Van der Waal's :

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

Beattie-Bridgeman :

$$P=\frac{R_uT}{\bar{v}^2}\left(1-\frac{c}{\bar{v}T^3}\right)(\bar{v}+B)-\frac{A}{\bar{v}^2}$$

Benedict-Webb-Rubin :

$$P=\frac{R_uT}{\bar{v}}+\left(B_0R_uT-A_0-\frac{C_0}{T^2}\right)\frac{1}{\bar{v}^2}+\frac{bR_uT-a}{\bar{v}^3}+\frac{a\alpha}{\bar{v}^6}+\frac{c}{\bar{v}^3T^2}\left(1+\frac{1}{\bar{v}^2}\right)e^{-\left(\gamma/\bar{v}^2\right)}$$