Ideal Gas Model

If compressibility factor, Z, is about 1 then the gas is called Ideal Gas.

Compressibility Factor:

$$Z = \frac{P\,v}{R\,T} = \frac{P\,\bar{v}}{\bar{R}\,T}$$

Ideal Gas

$$P\,v = R\,T \quad \text{or} \quad P\,V\!\!\!/ = mR\,T$$

$$P\,\bar{v} = \bar{R}\,T \quad \text{or} \quad P\,V\!\!\!/ = n\bar{R}\,T$$

It can be shown for an Ideal Gas that

$$h(T) = u(T) + Pv$$

$$c_v = \left(\frac{\partial u}{\partial T}\right)_v \rightarrow du = c_v dT \rightarrow u_2 - u_1 = \int_{T_1}^{T_2} c_v dT$$

$$c_p = \left(\frac{\partial h}{\partial T}\right)_p \rightarrow dh = c_p dT \rightarrow h_2 - h_1 = \int_{T_1}^{T_2} c_p dT$$

$$\frac{h(T)}{dT} = \frac{u(T)}{dT} + R$$

$$c_p - c_v = R$$

$$\bar{c}_p - \bar{c}_v = \bar{R}$$

$$\left.\begin{aligned} k &= \frac{c_p}{c_v} \\ c_p - c_v &= R \end{aligned}\right\} \rightarrow c_p = \frac{kR}{k-1}, c_v = \frac{R}{k-1}$$

If for Cp and Cv a function is given, Table A-21

$$\frac{\overline{c}_p}{\overline{R}} = \alpha + \beta T + \gamma T^2 + \delta T^3 + \varepsilon T^4$$

Then we need to integrate that function and find *u* and/or *h*.