

Example: given that superheated steam at 250°C and 1 kPa , what will be the fugacity and fugacity coefficient for that steam at 3000 kPa and 250°C

Solution: at 250°C and 1 kPa , the steam is superheated.

residual \rightarrow

$$G^R = H^R - TS^R \quad \text{and} \quad G^R = RT \ln \phi_i$$

$$\therefore \phi_i = \frac{f_i}{p^*} = \text{Exp} \left[\frac{H_i - H_i^*}{RT} - \frac{S_i - S_i^*}{R} \right] \text{ in general}$$

it is known that the properties at (*) should be at ideal condition, however, having these properties at $p = 1\text{ kPa}$ & $T = 250^{\circ}\text{C}$ will be closed to ideal conditions

(a) $T = 250^{\circ}\text{C}$, $p = 1\text{ kPa}$

$$H_i^* = 2977.7 \text{ J/g}$$

$$S_i^* = 10.1641 \text{ J/g}\cdot\text{K}$$

$$p_i^* = 1\text{ kPa}$$

The above values are in J/g and should be in J/mol therefore, they should multiply by 18 g/mol for water

$$\therefore H_i = 2977.7 \times 18 = 53598.6 \text{ J/mol}$$

$$S_i = 10.1641 \times 18 = 182.95 \text{ J/mol}\cdot\text{K}$$