Exercise 9-2

woensdag 20 mei 2020 20:45

$$S = S(T, V)$$

$$ds = \left(\frac{\partial s}{\partial T}\right)_v dT + \left(\frac{\partial s}{\partial v}\right)_T dv = \frac{C_v}{T} dT + \left(\frac{\partial p}{\partial T}\right)_v dv$$

$p = \frac{RT}{v} \Rightarrow \left(\frac{\partial p}{\partial T}\right)_v = \frac{R}{v}$

$$\mu = \frac{G}{n} = u - Ts + vp$$

$$= C_v T + u_0 - Ts_0 - C_v T \ln(T) - RT \ln(v) + RT + \text{constant}$$

$$= C_p T - C_v T \ln(T) - RT \ln(v) - s_0 T + \text{constant}$$

$$ds = \left(\frac{\partial s}{\partial T}\right)_p dT + \left(\frac{\partial s}{\partial p}\right)_T dp$$

$$= \frac{C_p}{T} dT - \left(\frac{\partial v}{\partial T}\right)_p dp$$

$$= \frac{C_p}{T} dT - \frac{R}{p} dp$$

$$\Downarrow$$

$$s - s_0 = C_p \ln T - R \ln p$$

$$\mu = \frac{G}{n} = u - Ts + vp$$

$$u - u_0 = C_v T$$

$$pv = RT$$

$$\mu = C_v T + u_0 - C_p T \ln T - RT \ln p + s_0 T + RT$$

at constant T, $C_v T + u_0 - C_p T \ln T + RT + s_0 T = \text{constant}$

$$\mu_0 = \text{Constant} + RT \ln p_0$$

then $\mu = \mu_0 + RT \ln\left(\frac{p}{p_0}\right)$