THE THERMODYNAMIC WEB

Fundamental Property Relations

$$du = Tds - Pdv \tag{5.6}$$

$$\begin{aligned} dh &= du + d(Pv) \\ &= Tds + vdP \end{aligned} \tag{5.7}$$

$$\begin{aligned} da &= du - d(Ts) \\ &= -sdT - Pdv \end{aligned} \tag{5.8}$$

$$\begin{aligned} dg &= dh - d(Ts) \\ &= -sdT + vdP \end{aligned} \tag{5.9}$$

First Derivatives

$$\left(\frac{\partial u}{\partial s}\right)_v = T \quad \text{and} \quad \left(\frac{\partial u}{\partial v}\right)_s = -P \tag{5.11}$$

$$\left(\frac{\partial h}{\partial s}\right)_P = T \quad \text{and} \quad \left(\frac{\partial h}{\partial P}\right)_s = v \tag{5.12}$$

$$\left(\frac{\partial a}{\partial T}\right)_v = -s \quad \text{and} \quad \left(\frac{\partial a}{\partial v}\right)_T = -P \tag{5.13}$$

$$\left(\frac{\partial g}{\partial T}\right)_P = -s \quad \text{and} \quad \left(\frac{\partial g}{\partial P}\right)_T = v \tag{5.14}$$

Maxwell Relations

$$\left(\frac{\partial T}{\partial v}\right)_s = -\left(\frac{\partial P}{\partial s}\right)_v \tag{5.16}$$

$$\left(\frac{\partial T}{\partial P}\right)_s = \left(\frac{\partial v}{\partial s}\right)_P \tag{5.17}$$

$$\left(\frac{\partial s}{\partial v}\right)_T = \left(\frac{\partial P}{\partial T}\right)_v \tag{5.18}$$

$$-\left(\frac{\partial s}{\partial P}\right)_T = \left(\frac{\partial v}{\partial T}\right)_P \tag{5.19}$$