Maxwell Relations

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

$$\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$$

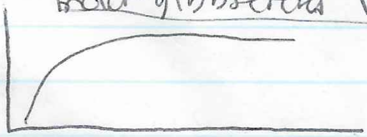
$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V = \frac{\beta}{K}$$

$$-\left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial T}\right)_P = V\beta$$

6.3 The Dependence of the Gibbs and Helmholtz Energies on P, V, and T

- $\left(\frac{\partial A}{\partial T}\right)_V = -S$ and $\left(\frac{\partial A}{\partial V}\right)_T = -P$
  - ~ Helmholtz energy of a pure substnce decrases as either temp or volume increases
- $\left(\frac{\partial G}{\partial T}\right)_P = -S$ and $\left(\frac{\partial G}{\partial P}\right)_T = V$
  - ~ Gibbs energy decreases with increasing temp, increases with increasing pressure

molar gibbs energy vs pressure at 298.15K



- Gibbs-Helmholtz equation

$$\left(\frac{\partial[G/T]}{\partial[1/T]}\right)_P = \left(\frac{\partial[G/T]}{\partial T}\right)_P \left(\frac{dT}{d[1/T]}\right) = -\frac{H}{T^2}(-T^2) = H$$

- check end of book for analogies of equations