

Midterm 1 Review Sheet

- First, second, & third law of thermodynamics
- Energy minimization, entropy maximization
- Intensive vs. extensive variables
- Definitions: closed system, subsystem, adiabatic, reversible
- Legendre transforms
- Gibbs-Duhem equation
- Euler's equation
- Maxwell relations
- How to take partial derivatives to obtain quantities of interest
- Conditions for single and multiphase equilibrium (thermal/mechanical/chemical equilibrium)
- Definitions of κ_T , κ_S , c_V , c_P
- Stability criteria
- Maxwell construction
- Interpreting phase diagrams
- Gibbs phase rule
- Equilibrium and Gibbs surfaces (including first- and second-order phase transitions)
- Clausius-Clapeyron equation
- The van der Waals equation of state
- P vs. V diagram for VDW (coexistence, metastable, spinodal region)
- Interfaces, surface tension
- Gibbs adsorption isotherm

Practice Problems for the Review Session:

Exercise 1.4 from Chandler. (EOS, thermal equilibrium, adiabatic)

The heat capacity and pressure of an isothermal, fixed volume system containing n moles are given by:

$$C_V = 2bnT \qquad P = \frac{an^2T}{V^2}$$

where a and b are known constants. Identify the thermodynamic potential (Z) you would use to describe this system. Using the equations above and neglecting chemical potential determine Z as a function of a , b , T , V , and n . (Choice of thermodynamic function, EOS)

Exercise 2.10 from Chandler (Multiphase equilibrium, Clausius-Clapeyron equation)