

Study guide 1 for week 1 (5.1 and part of 5.2)

Reading: pp182-190.

Concepts:

1. Be able to distinguish between single-phase and two- or multi-phase systems.
 - a. A single-phase system can have multiple components. For example, air; metal alloy; alcohol mixture
 - b. Give an example of metal alloy from everyday life
2. Common phase diagrams: P-T diagram for water. Be able to give the degree of freedom.
3. Liquid crystal is a special kind of phase. What are the two class of liquid crystals? Name a common usage of liquid crystals. Is it nematic or smetic and why?
4. What is the thermodynamic quantity that determines the most stable phase and the direction of phase transition at constant pressure? How about at constant volume?
5. Make a schematic diagram of Gibbs energy vs. T for water from 0 K to 400 K at 1 atm. Identify boiling point and melting point. Identify regions for solid, liquid and vapor phases. Now raise the pressure to P' , and redraw the diagram. Identify the new T_b and T_m . Compare them with those at 1 atm.
6. Challenging question: in terms of the G-T curves, which curve (in solid, liquid or vapor phase) has the largest curvature?
7. At liquid-vapor equilibrium, Gibbs energies of both phases are the same.
8. Remember: Partial derivative of G with respect to T at constant P; Partial derivative of G with respect to P at constant V.

Calculation problems

9. Given the molar enthalpy and volume change, Clapeyron equation relates the change in the phase-transition temperature to the change in pressure.
 - a. Work through Example 5.2 and 5.3.
 - b. What is dP/dT at 273.15K and 1 atm?