MT 202 Metallurgical Thermodynamics

Fall 2004

Home Assignment 2 (Due 14.9.04)

1. Lupis: 1.9
2. Lupis: 1.10
3. Lupis: 1.12
4. Lupis: 1.13
5. Lupis: 1.14
6. Lupis: 1.17
7. Lupis: 1.18
8. Lupis: 1.19
9. Lupis: 1.20
10. Lupis: 1.21
11. Callen: 9.3-2
    A long vertical column is closed at the bottom and open at the top; it is partially filled with a particular liquid, and cooled to 268 K. At this temperature, the fluid solidifies below a particular level, remaining liquid above this level. If the temperature is further lowered to 267.8 K, the solid-liquid interface moves upward by 0.4 m. The latent heat (per unit mass) is 2 calories per gram, and the density of the liquid phase is 1 g cm^{-3}. Find the density of the solid phase. Neglect thermal expansion of all the materials. [Hint: Note that the pressure at the original position of the interface remains constant].
12. Derive expressions for ΔE, ΔH, ΔS for a system containing 1 mol of an ideal gas during the following processes: (a) expansion at constant pressure P from V_1 to V_2, (b) pressure change from P_1 to P_2 at constant volume V, (c) isothermal expansion at a temperature of T from (P_1, V_1) to (P_2, V_2) and (d) adiabatic expansion from (P_1, V_1, T_1) to (P_2, V_2, T_2).
13. Show that the entropy change is zero for a system containing a certain amount of ideal gas when it is taken through a full cycle in a Carnot's engine.