EXERCISE FOR THE IDLE MIND

for Lecture Notes No. 10

1. Calculate the at.% Zn in brass of 70 wt.% Cu – 30 wt.% Zn.

2. One of the phases of Cu-Sn alloys contains 38.2 wt.% Sn. What is the copper-tin atom ratio in this phase?

3. Construct the phase diagram (T,c) for Ag-Cu given the following data. (Assume all phase lines to be straight.)
   T_M Ag: 960°C
   T_M Cu: 1080°C
   T_E (Eutectic) 780°C: α [9 wt.% Cu]; β [92 wt.% Cu]; Eutectic comp. 28 wt.% Cu
   400°C: α [1 wt.% Cu]; β [100 wt.% Cu]

4. Determine the liquidus temperature for a 60 wt.%Ag – 40 wt.% Cu alloy.

5. Determine which other Ag-Cu alloy composition has the same liquidus temperature as the one determined in (4).

6. 26 g of sterling silver (92.5 wt.% Ag – 7.5 wt.% Cu) are melted together with 376 g of pure copper (Cu). Given the phase diagram for Ag-Cu, determine:
   (a) the liquidus temperature for the alloy formed;
   (b) the solidus temperature for this alloy;
   (c) the composition of the alloy formed.

7. Given 100 g of a eutectic alloy of Ag-Cu, determine the fraction of copper (g Cu) in the Ag-rich phase at 600°C.

8. Determine the phases present at each 100°C interval during cooling of a 20 Ag – 80 Cu alloy (starting at 900°C).

9. A Ag-Cu eutectic (80 g) is solidified. Determine the amounts of α and β phases formed (in g).

10. Given is an alloy (A,B) with 50 wt.% B, exhibiting complete liquid and solid solubility. The temperature of 2 kg of such an alloy, all in the molten state, is lowered until the molten phase assumes a composition of 18 wt.% B and the solid solution phase (which is in equilibrium with the molten phase) has a composition of 66 wt.% B. Determine the amount (in kg) of liquid phase and of solid phase present at that temperature.

11. At 200°C, a PbSn solder alloy (of 50 wt.% Sn) exists in two phases, a lead-rich solid phase and a tin-rich liquid phase. Determine the degrees of freedom (F) for the alloy under these conditions and comment on the practical significance of the alloy behavior.