

Homework 9

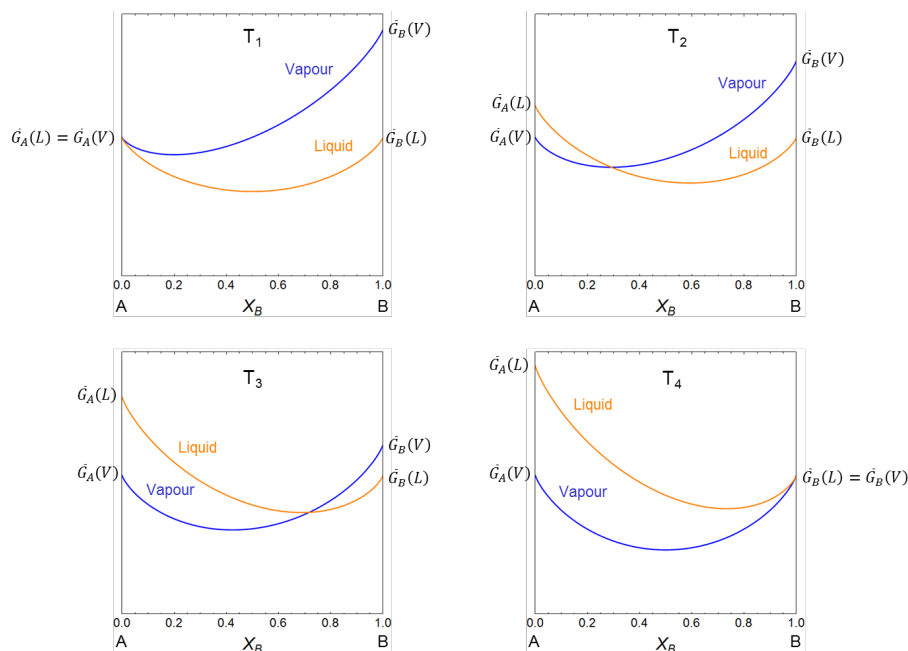
Exercise 1

Gold (15g) and Silver (25g) are mixed to form a single-phase ideal solid solution. The molar masses of gold and silver are 197 g/mol and 108 g/mol, respectively. $R=8.314 \text{ J/mol K}$ and Avogadro's number $N_A=6.02 \times 10^{23} \text{ mol}^{-1}$.

- How many moles of solution are there?
- What are the mole fractions of Gold and Silver?
- What is the molar entropy of mixing?
- What is the total entropy of mixing?
- What is the molar free energy change at 500°C ?
- What are the chemical potentials of Gold and Silver at 500°C , assuming free energies of pure Gold and Silver are zero?
- How much will the free energy of the solution change at 500°C if one Gold atom is added?

Exercise 2

Imagine an ideal binary mixture at different temperatures (T_1, T_2, T_3 and T_4 of an increasing order). The respective molar Gibbs free energy G vs. X_B diagrams for liquid (L) and vapor (V) phases are given as:



- Given the information, predict the fusion temperatures of the two components A and B
- For each plot, make a rectangular box along X_B and draw which phase(s) are present for all compositions.
- For temperature T_3 and composition $X_B=0.7$, annotate on the plot the chemical potential of each component at each phase associated with these conditions. For the same conditions apply the lever rule to find the fractions of the liquid and solid phases.