

Homework 9

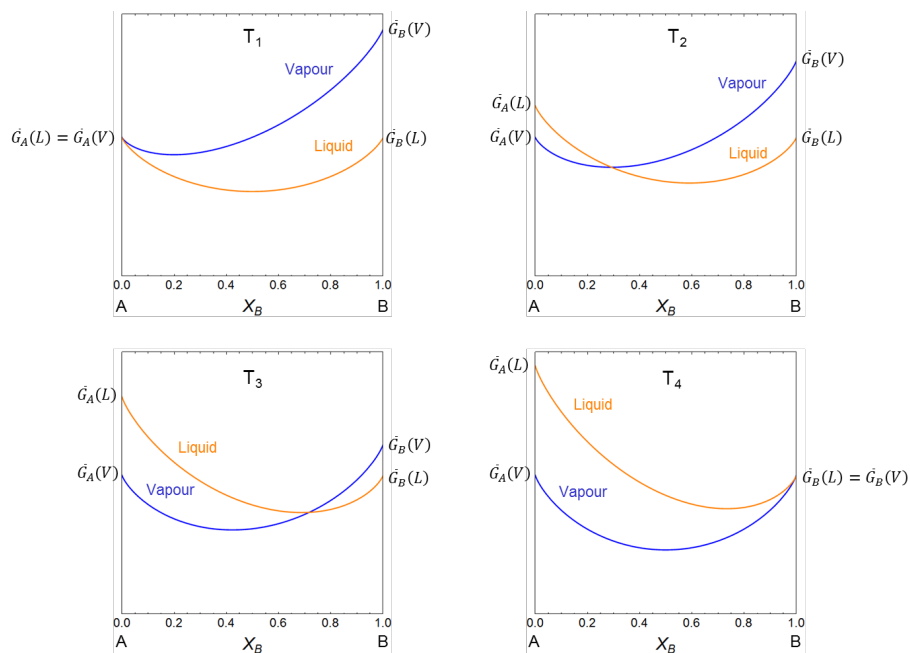
Exercise 1

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, draw a phase diagram (T vs X_B) and label all temperature and composition points (You can use next page's sketch to draw your phase diagram)
- Apply the phase rule for the diagram you draw in (a) to find the degrees of freedom for each phase.
- Imagine you have a liquid mixture with a composition of $X_B = 0.7$. Practically, how would you obtain a liquid mixture with a composition $X_B < 0.1$? That is, explain one route to decrease the composition of B in the mixture.

