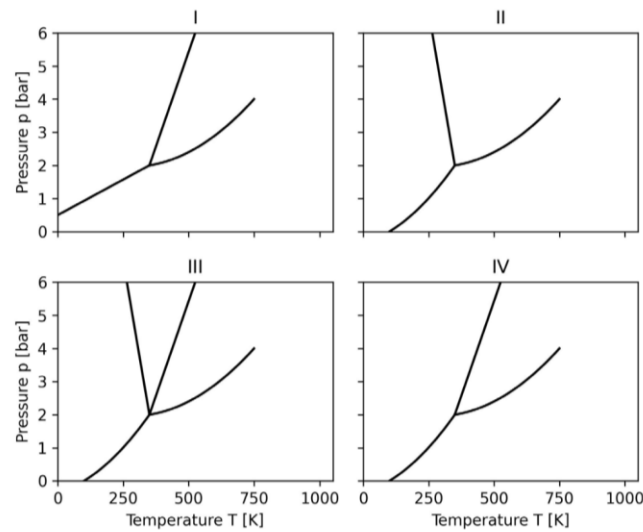


Exercise 1

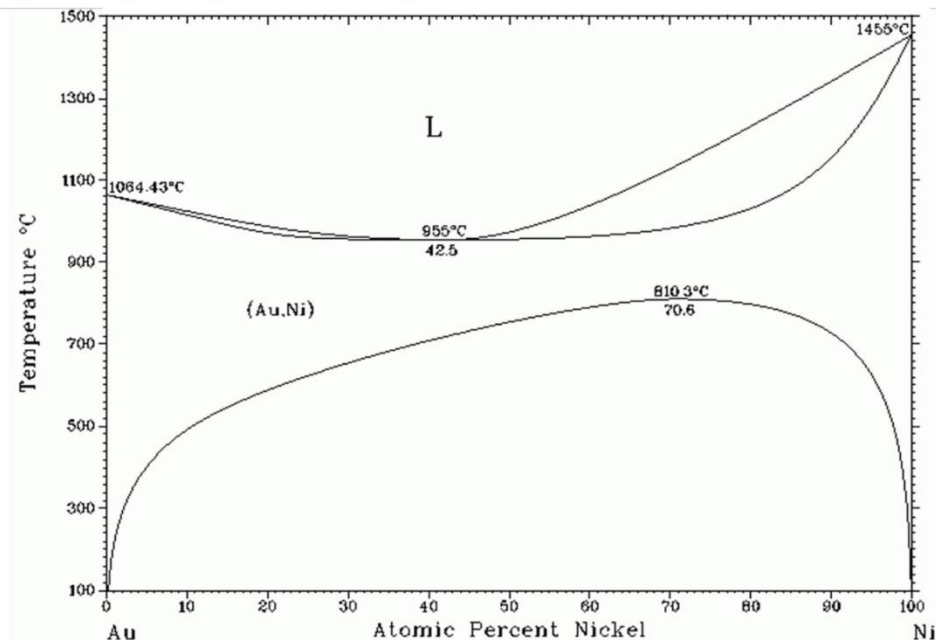
Four hypothetical phase diagrams of different pure substances are shown below. Note that at least one gas, one liquid, and one solid phases are present in the diagrams below.



- Are all of the diagrams possible according to the laws of thermodynamics? For each one, explain whether their form is likely or unlikely to occur. Which phase diagram is the most common?
- For the phase diagram IV shown above, draw the behavior of the chemical potentials as a function of the temperature for all three phases at the constant pressures: $p_1 = 1$ bar, $p_2 = p_{TP} = 2$ bar and $p_3 = p_{CP} = 4$ bar.

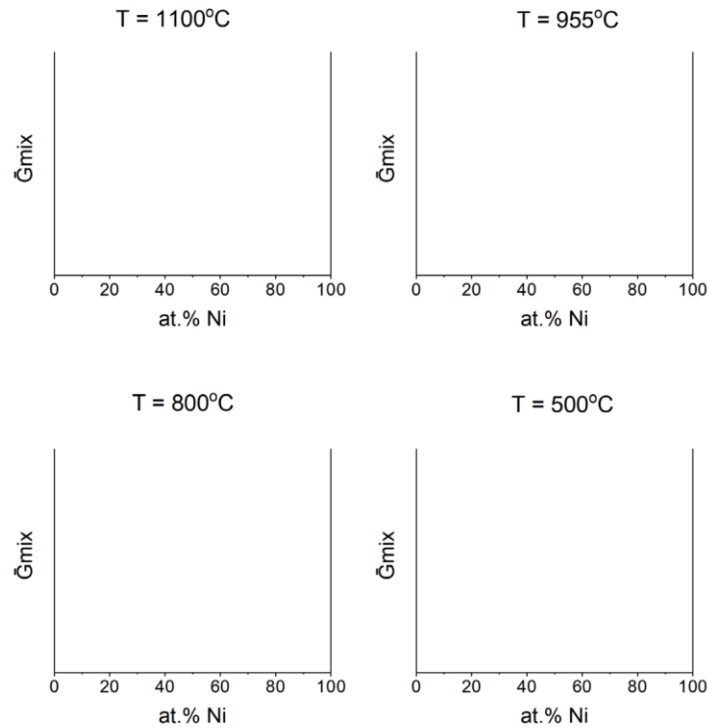
Exercise 2

The phase diagram of gold and nickel at $p = 1$ atm is shown below.



- Label the invariant points on the phase diagram, if they exist, and indicate how you came to this conclusion by appropriately applying the Gibbs phase rule.
- Looking at the characteristic shape of the phase diagram, what can you say about the interaction parameter of the solid and the liquid solution of gold and nickel, Ω^{sol} and Ω^{liq} ?
- Let's suppose we have a solution of 80 at.% Ni at 1100°C . What is the proportion of liquid and solid in the solution?

- d. Using the diagrams below, draw qualitatively the partial molar Gibbs free energy of mixing of all solutions at the temperatures indicated:



- e. On two of these diagrams, you can see coexistence of solid phases. Indicate on both diagram the value of the chemical potential of each component on each phase for a composition of 40 at.% Ni.
- f. Gold-nickel alloys are used in jewelry to obtain the so called “white gold”. Let’s assume this alloy has a composition of 50 at.% of Ni. Starting from a solution with 95 at.% Ni, propose a mechanism to reach the composition of a “white gold” alloy.