

Problem 13.10: Water and normal octane are practically *immiscible* in each other.

a) Calculate the dew temperature at 2 bar of a vapor mixture that contains 65% water and 35% octane (by mol). What is the composition of the first liquid to condense?

b) A mixture that contains 75% water and 25% octane (by mol) is brought to 115 °C, 2 bar. Which phases are present?

c) 100 mol of vapor mixture that contains 75 mol water and ~~25~~ ^{25 mol octane} is cooled at constant $P = 2$ bar until 10 mol of liquid octane have been collected. How many moles of water have condensed at that point?

The saturation pressures of the two components are given by the equations below (P in bar, T in C):

$$P_W = e^{11.6832 - 3816.44/(T+227.02)}, \quad P_O = e^{9.3222 - 3120.29/(T+209.52)}$$

where W stands for water and O stands for octane.

Problem 13.11: Water and normal octane are essentially immiscible in each other.

Consider a solution of the two components that contains 32% water by mol. In all of the following the temperature is 50 °C.

- At what pressure does the liquid begin to boil?
- What is the composition of the first bubble?
- Which phase boils off first?
- What is the pressure when the first liquid phase boils off?
- At what pressure does the second liquid phase disappear?
- What is the composition of the vapor at that point?

Additional data: You may use Antoine equations given in Problem 13.10.

Problem 13.12: Water and normal octane are essentially immiscible in each other.

Consider a solution of water and normal octane two components containing 80% water by mol. In all of the following the pressure is 1 bar.

- At what temperature does the liquid begin to boil?
- What is the composition of the first bubble?
- Which phase boils off first?
- What is the temperature when the first liquid phase boils off?
- At what temperature does the second liquid phase disappear?
- What is the composition of the vapor at that point?

Antoine parameters are given in the Problem 13.10.

Problem 13.13: At 100 °C water (w) and nitrobenzene (n) are only partially miscible. At this temperature, the solubility of nitrobenzene in water is 0.147 mol %, while the solubility of water in nitrobenzene is 8.3 mol %.