

Chemistry 2290, Winter 2012, G. Schreckenbach

Practice problems –7–

Phases: Phase Rule and Phase Diagrams

Practice problems from Atkins/ de Paula

(Problems adapted from Atkins, de Paula, Physical Chemistry, 8th ed., W. H. Freeman and co.)

- A01. State the number of components in the following systems: (a) NaH_2PO_4 in water at equilibrium with water vapor; (b) AlCl_3 dissolved in water, noting that hydrolysis and precipitation of $\text{Al}(\text{OH})_3$ may occur. (*Atkins 8th ed., E6.6a and b*)
- A02. Blue $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ crystals release their water of hydration when heated. How many phases and components are present in an otherwise empty heated container? (*Atkins 8th ed., E6.7a*)
- A03. Ammonium chloride, NH_4Cl , decomposes when it is heated.
 (a) How many phases and components are present when the salt is heated in an otherwise empty heated container? (b) Now suppose that additional ammonia is also present. How many phases and components are present in this case? (*Atkins 8th ed., 6.7b*)
- A04. A saturated solution of Na_2SO_4 , with excess of the solid, is present in equilibrium with its vapor in a closed vessel. (a) How many phases and components are present? (b) What is the number of thermodynamic degrees of freedom (the variance)? Identify the independent variables. (*Atkins 8th ed., 6.8a*)
- A05. Suppose the solution in problem A04 is *not* saturated. (a) How many phases and components are present? (b) What is the number of thermodynamic degrees of freedom (the variance)? Identify the independent variables. (*Atkins 8th ed., 6.8b*)
- A06. The following figure (*Figure copied from Atkins, de Paula, 8th ed.*) shows the phase

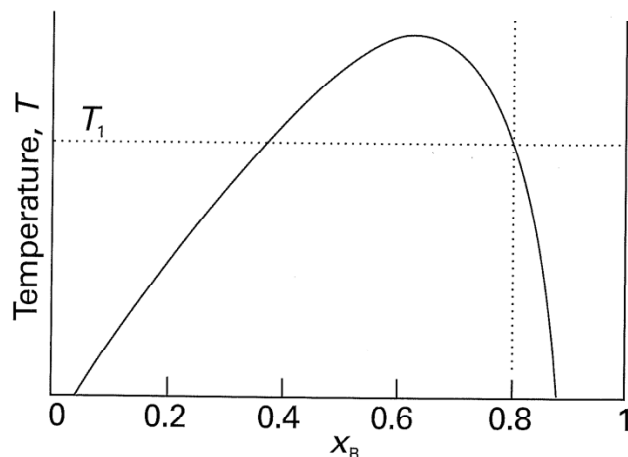


diagram for two partially miscible liquids. It could be the diagram for water (A) and 2-methyl-1-propanol (2). Describe what will be observed when a mixture of composition $x_B = 0.8$ is heated. At each stage, give the number, composition, and relative amounts of the phases present. (*Atkins 8th ed., 6.10a*)