7.S: Mixtures and Solutions (Summary)

Learning Objectives

After mastering the material in this chapter, one will be able to

1. Describe the thermodynamics of mixing and calculate \(\Delta H\), \(\Delta S\), and \(\Delta G\) or mixing for an ideal solution.
2. Define chemical potential, and calculate its value as a function of pressure and composition.
3. Derive expressions for the colligative properties and perform calculations using the relationships.
4. Estimate the maximum solubility of a solute in a solvent based on the concept equality of chemical potential at saturation.
5. Define fugacity and activity.
6. Calculate the mean activity coefficients of ions in solution based on the ionic strength of the solution.

Vocabulary and Concepts

- activity
- activity coefficient
- chemical potential
- cryoscopic constant
- ebullioscopic constant
- enthalpy of mixing
- fugacity
- fugacity coefficient
- Gibbs-Duhem equation
- ideal mixture
- ionic strength
- mean activity coefficient
- osmosis
- osmotic pressure
- Raoult's Law
- solute
- solution
- solvent
- the partial molar Gibbs function

References

1. Debye, P., & Hückel, E. (1923). Zur Theorie der Electrolyte. *Physikalische Zeitschrift*, *24*, 185-206.
2. Schubert, F. E. (1983). Depression of Freezing Point and Elevation of Boiling Point. *Journal of Chemical Education*, *60*(1), 88. doi:10.1021/ed060p87.2