

Chapter 11
Properties of Solutions: Their Concentrations and Colligative Properties
Learning Objectives

To satisfy the minimum requirements for this course, you should be able to:

1. Define the following terms regarding solutions: solute, solvent, volatile/non-volatile, and electrolyte/non-electrolyte.
2. Define the meaning of the vapor pressure of a liquid and qualitatively describe how vapor pressure varies with temperature.
3. Discuss the concept of colligative properties and be able to
 - describe the effects of solute concentration on the osmotic pressure, vapor pressure, boiling point, and freezing point of a solution.
 - explain the magnitude of changes caused by electrolytes compared to those caused by non-electrolytes and be able to use the van't Hoff factor in calculations.
 - calculate the osmotic pressure, boiling point, and freezing point of a solution containing a non-volatile solute in a volatile solvent.
 - determine the concentration and molar mass of a non-volatile solute from the change in boiling point, freezing point or osmotic pressure of solution.
4. Explain how fractional distillation of crude oil separates hydrocarbons based on boiling point.
5. Define molality and be able to interconvert with other concentration units (*e.g.* molarity and ppm).
6. Describe the solubility of gases in liquid solutions
 - how it is affected by temperature
 - calculate solubility using Henry's Law
7. NavApp: Water Treatment
 - describe the following methods used by the Navy and Marines to purify water: distillation (including a solar still), ion exchange, reverse osmosis
 - identify reverse osmosis as the *primary* method used onboard ships and submarines to purify seawater