

## Chapter 15 Study Questions

**CONCENTRATION****Mass percent**

1. What is the mass percentage of  $\text{KMnO}_4$  in a solution containing 1.00 mole of  $\text{KMnO}_4$  and 158 g of water?
2. How many moles of  $\text{KMnO}_4$  are needed to prepare 335 g of a 22.0% solution?

**Molarity**

3. How many moles of  $\text{NaCl}$  are in 275 mL of 0.500 M  $\text{NaCl}$ ?
4. What mass of  $\text{NaCl}$  is needed to prepare 250. mL of a 2.00 M  $\text{NaCl}$  solution?
5. What volume of a 2.00 M  $\text{NaCl}$  solution is needed to make 125 mL of a 0.350 M  $\text{NaCl}$  solution?
6. What is the molarity of a solution made by dissolving 90.0 grams of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ; molar mass = 180. g/mole) in enough water to yield 200. mL of solution?
7. (Optional) What is the molarity of a 24.0% sucrose solution? The density of this solution is  $1.10 \text{ g/cm}^3$ . (The molar mass of sucrose is 342 g/mole.)

**SOLUTION STOICHIOMETRY**

8. When solutions of calcium chloride and silver nitrate are mixed, a silver chloride precipitate forms.
  - a) Write a balanced chemical equation for this reaction (include physical states).
  - b) What volume of 0.250 M calcium chloride is needed to form 1.72 grams of precipitate?
9. What volume of 0.400 M  $\text{KOH}$  is needed to neutralize 16.0 mL of 0.120 M  $\text{HNO}_3$ ?

**COLLIGATIVE PROPERTIES**

10. List three properties of solutions that are colligative properties. List three properties of solutions that are *not* colligative properties.
11. Arrange the following solutions in order of decreasing boiling point:
  - a) pure water
  - b) 1.0 M glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ )
  - c) 1.0 M  $\text{Ca}(\text{NO}_3)_2$
  - d) 1.0 M  $\text{MgSO}_4$
12. Use the following equation to help you solve the problems below:
$$\Delta T_f = 1.86 \text{ }^\circ\text{C} \times \text{moles solute particles/kg water}$$
  - a) What is the freezing point of a solution containing 0.11 moles of  $\text{C}_6\text{H}_{12}\text{O}_6$  in 55 g of  $\text{H}_2\text{O}$ ?
  - b) How many moles of a nonelectrolyte must be added to 200. grams of water to produce a solution with a freezing point of  $-2.79^\circ\text{C}$ ?
  - c) What is the freezing point of a solution containing 27.8 g of  $\text{CaCl}_2$  in 250 g of water? (Is  $\text{CaCl}_2$  an electrolyte or a nonelectrolyte and why is this important?)

## Summary of Chapter 15: Solutions

solution

solute

solvent

molecular and ionic solutes

like dissolves like

nonpolar vs. polar solutes and solvents

Saturated, supersaturated and unsaturated solutions

solubility and temperature

solution composition

mass percent

molarity

dilution:  $V_1 \times M_1 = V_2 \times M_2$

electrolytes and nonelectrolytes

solution stoichiometry

volume  $\times$  molarity = moles

how to prepare a solution from solid solute or by dilution

neutralization reactions

colligative properties

vapor pressure lowering

boiling point elevation

freezing point depression

calculate number of moles, concentration or molar mass from freezing point

$\Delta T_f = 1.86 \times \text{moles solute/kg water}$