## Chapter 11 Questions

## Sections 11.1-11.3

1) In each of the following examples, indicate the solvent and possible solutes in the solutions
a) ocean water
b) soda
c) gasoline
d) air
e) steel
2) By referring to figure 11.6 (pg 520), determine whether the addition of 40.0 g of each of the following ionic solids to 100 g of water at $40^{\circ} \mathrm{C}$ will lead to a saturated solution:
a) $\mathrm{NaNO}_{3}$
b) KCl
c) $\mathrm{Na}_{2} \mathrm{SO}_{4}$
d) $\mathrm{Ce}_{2}\left(\mathrm{SO}_{4}\right)_{3}$
3) By referring to figure 11.6 (pg 520), determine the mass of each of the following compounds required to form a saturated solution in 250 g of water at $30^{\circ} \mathrm{C}$ :
a) $\mathrm{KNO}_{3}$
b) sugar
c) $\mathrm{Ce}_{2}\left(\mathrm{SO}_{4}\right)_{3}$
4) Which of the following in each pair is more likely to be soluble in water?
a) $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{OH}$ or $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}$
b) $\mathrm{CCl}_{4}$ or $\mathrm{CaCl}_{2}$
c) HCl or $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{Cl}$

5a) Calculate the mass percentage ( pph ) of $\mathrm{Na}_{2} \mathrm{SO}_{4}$ in a solution containing 14.7 g of $\mathrm{Na}_{2} \mathrm{SO}_{4}$ in 345 g of water.
b) an ore contains 7.35 g of silver per ton (2000
lb) of ore. What is the concentration of silver in ppm?
6) Calculate the mole fraction of methanol, $\mathrm{CH}_{3} \mathrm{OH}$, in the following solutions:
a) 7.5 g of methanol in 245 g of water
b) 55.7 g of methanol in 164 g of carbon tetrachloride
7) Calculate the molarity of the following aqueous solutions
a) 10.5 g of potassium chloride in 250.0 mL of solution.
b) 30.7 g of lithium perchlorate trihydrate in 125 mL of solution.
c) 25.0 mL of 1.50 M nitric acid diluted to 0.500 L
8) Calculate the molality of each of the following solutions:
a) 13.0 g benzene, $\mathrm{C}_{6} \mathrm{H}_{6}$, dissolved in 17.0 g of carbon tetrachloride
b) 4.75 g sodium chloride dissolved in 0.250 L water.
9) An aqueous sulfuric acid solution containing 571.6 g of $\mathrm{H}_{2} \mathrm{SO}_{4}$ per liter has a density of 1.329 $\mathrm{g} / \mathrm{cm}^{3}$. Calculate
a) the mass percentage
b) the mole fraction
c) the molality
d) the molarity

## Section 11.4-11.7

10) How does increasing the concentration on a nonvolatile solute in water affect the following properties:
a) vapor pressure
b) freezing point
c) boiling point
d) osmotic pressure
11) List the factors that affect the changes in
a) melting point
b) vapor pressure
c) osmotic pressure

12a) Which of the following solutions would have the lowest freezing point: $0.10 \mathrm{~m} \mathrm{CaCl}_{2}$, $0.20 \mathrm{~m} \mathrm{KBr}, 0.30 \mathrm{~m} \mathrm{NH}_{3}$.
b) Which of the following solutions would have the lowest boiling point: $0.10 \mathrm{~m} \mathrm{~K}_{3} \mathrm{PO}_{4}, 0.20 \mathrm{~m}$ $\mathrm{Na}_{2} \mathrm{SO}_{4}, 0.30 \mathrm{~m} \mathrm{NH}_{3}$.
c) Which of the solutions in (b) would have the highest boiling point?
d) Explain which of the following conditions has the greatest effect on the osmotic pressure: doubling the molarity, doubling the temperature or doubling the ionization of the substance.

13a) Calculate the vapor pressure of water above a solution prepared by adding 16.2 g of lactose $\left(\mathrm{C}_{12} \mathrm{H}_{22} \mathrm{O}_{11}\right)$ to 105.7 g of water at 338 K . (Vapor pressure data for water are given in Appendix B.)
b) Calculate the mass of propylene glycol, $\mathrm{C}_{3} \mathrm{H}_{8} \mathrm{O}_{2}$, that must be added to 0.500 kg of water to reduce the vapor pressure by 4.60 torr at $40^{\circ} \mathrm{C}$.
14) What is the osmotic pressure of a solution formed by dissolving 50.0 mg of aspirin, $\mathrm{C}_{9} \mathrm{H}_{8} \mathrm{O}_{4}$, in 0.250 L of water at $25^{\circ} \mathrm{C}$ ?
15) Using the data from Table 13.4 (pg 549), calculate the freezing and boiling points of each of the following solutions:
a) 0.35 m glycerol in water
b) 5.13 g KBr and 6.85 g glucose, $\mathrm{C}_{6} \mathrm{H}_{12} \mathrm{O}_{6}$, in 255 g of water.
c) 18.0 g of $\mathrm{C}_{10} \mathrm{H}_{22}$ in 425 g of $\mathrm{CHCl}_{3}$
d) 0.45 mol ethylene glycol and 0.10 mol KBr in 125 g water
16) Seawater contains 3.4 g of salts for every liter of solution. Assuming that the solute consists entirely of sodium chloride, calculate the osmotic pressure of seawater at $20^{\circ} \mathrm{C}$.

## Review

1) 4.0 mL of a 0.00100 M solution of silver nitrate is mixed with 3.0 mL of a $0.00500 \mathrm{M} \mathrm{K}_{3} \mathrm{CrO}_{4}$ solution. The solubility product of silver chromate is $1.2 \times 10^{-12}$. Will a precipitate form?
2) How many grams of calcium carbonate and 3.0 M sulfuric acid to produce 4.0 L of carbon dioxide gas at $72^{\circ} \mathrm{F}$ and 745 torr?
