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 $^{\circ}$ C will lead to a saturated solution:

- a) NaNO3
- b) KCl
- c) Na₂SO₄
- d) $Ce_2(SO_4)_3$

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 °C:
a) KNO₃
b) sugar

c) $Ce_2(SO_4)_3$

4) Which of the following in each pair is more likely to be soluble in water?
a) CH₃CH₂CH₂CH₂CH₂OH or CH₃CH₂OH
b) CCl₄ or CaCl₂
c) HCl or CH₃CH₂Cl

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

5a) Calculate the mass percentage (pph) of Na_2SO_4 in a solution containing 14.7 g of Na_2SO_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, CH₃OH, 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, $C_6H_6,$ 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 H_2SO_4 per liter has a density of 1.329 g/cm³. Calculate

- a) the mass percentage
- b) the mole fraction
- c) the molality
- d) the molarity

12a) Which of the following solutions would have the lowest freezing point: 0.10 m CaCl_2 , 0.20 m KBr, 0.30 m NH_3 .

b) Which of the following solutions would have the lowest boiling point: $0.10 \text{ m K}_3\text{PO}_4$, $0.20 \text{ m Na}_2\text{SO}_4$, 0.30 m 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 ($C_{12}H_{22}O_{11}$) 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, $C_3H_8O_2$, that must be added to 0.500 kg of water to reduce the vapor pressure by 4.60 torr at 40 °C.

14) What is the osmotic pressure of a solution formed by dissolving 50.0 mg of aspirin, $C_9H_8O_4$, in 0.250 L of water at 25 °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, C₆H₁₂O₆, in 255 g of water.
c) 18.0 g of C₁₀H₂₂ in 425 g of CHCl₃
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 °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 M K_3 CrO₄ solution. The solubility product of silver chromate is 1.2×10^{-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° F and 745 torr?