MIXED REVIEW

35. Given 0.01 *m* aqueous solutions of each of the following, arrange the solutions in order of increasing change in the freezing point of the solution.
a. NaI
b. $CaCl_2$
c. K_3PO_4
d. $C_6H_{12}O_6$ (glucose)

36. What is the molal concentration of an aqueous calcium chloride solution that freezes at –2.43°C?

37. a. Write the balanced formula equation that shows the possible products of a double-displacement reaction between calcium nitrate and sodium chloride.
b. Using **Table 1,** determine whether there is a precipitate.
c. Does this reaction occur?

38. Write a balanced equation to show what occurs when hydrogen bromide dissolves and reacts with water. Include a hydronium ion in the equation.

39. Write the equation for the dissolution of each of the following in water, and then indicate the total number of moles of solute ions formed.
a. 0.275 mol of potassium sulfide
b. 0.15 mol of aluminum sulfate

40. Calculate the expected change in the boiling point of water in a solution made up of 131.2 g of silver nitrate, $AgNO_3$, in 2.00 kg of water.

41. Nitrous acid, HNO_2, is a weak electrolyte. Nitric acid, HNO_3, is a strong electrolyte. Write equations to represent the ionization of each in water. Include the hydronium ion, and show the appropriate kind of arrow in each equation.

42. Find the boiling point of an aqueous solution containing a nonelectrolyte that freezes at –6.51°C.

43. Write a balanced equation for the dissolution of sodium carbonate, Na_2CO_3, in water. Find the number of moles of each ion produced when 0.20 mol of sodium carbonate dissolves. Then, find the total number of moles of ions.

44. Given the reaction below and the information in **Table 1,** write the net ionic equation for the reaction.
potassium phosphate (*aq*) + lead (II) nitrate (*aq*)

45. Find the expected freezing point of a water solution that contains 268 g of aluminum nitrate, $Al(NO_3)_3$, in 8.50 kg of water.

CRITICAL THINKING

46. Applying Models
a. You are conducting a freezing-point determination in the laboratory by using an aqueous solution of KNO_3. The observed freezing point of the solution is –1.15°C. Using a pure water sample, you recorded the freezing point of the pure solvent on the same thermometer as 0.25°C. Determine the molal concentration of KNO_3. Assume that there are no forces of attraction between ions.
b. You are not satisfied with the result in part (a) because you suspect that you should not ignore the effect of ion interaction. You take a 10.00 mL sample of the solution. After carefully evaporating the water from the solution, you obtain 0.415 g KNO_3. Determine the actual molal concentration of KNO_3 and the percentage difference between the concentration observed in the freezing-point determination and the actual concentration of KNO_3. Assume that the solution's density is 1.00 g/mL.

47. Analyzing Information The observed freezing-point depression for electrolyte solutions is sometimes less than the calculated value. Why does this occur? Is the difference greater for concentrated solutions or dilute solutions?

48. Analyzing Information The osmotic pressure of a dilute solution can be calculated as follows:

$\pi = MRT$
π = osmotic pressure
M = concentration in moles per liter
R = ideal gas constant
T = absolute temperature of the solution

How does the osmotic-pressure equation compare with the ideal gas law?