Chapter 13: 26, 28, 31, 32, 40, 44a, 46, 50, 52a, 54, 58, 64a, 68a, 70a, 74, 76, 78 and A and B, below.

26. a) solution  
b) solution  
c) not a solution  
d) solution  

28. a) solvent: water, solute: ethyl alcohol  
b) solvent: water, solute: oxygen  
c) solvent: water, solute: ethylene glycol

31. The dissolved particles are the cations and anions that make up the ionic solute. This solution is referred to as a strong electrolyte.

32. The dissolved particles are the intact molecules. This solution is referred to as a nonelectrolyte.

40. The solubility of gases decreases as temperature increases. When water is boiled, the dissolved oxygen is completely removed, which is what fish need to breathe.

44. a) mass \(\% = \frac{9.55 \text{ g } C_2H_6O}{(9.55 + 69.1) \text{ g solution}} \times 100\% = 12.1\%\)

46. mass \(\% = \frac{35 \text{ mg sodium } \times 1 \text{ g}}{1000 \text{ mg } (35 \text{ mg } \times 1 \text{ g } + 315) \text{ g solution}} \times 100\% = 0.011\%\)

50. \(\frac{1.1 \text{ g NaCl}}{100 \text{ g solution}} \times 87.2 \text{ g solution} = 0.96 \text{ g NaCl}\)

52. a) \(\frac{1.08 \text{ g KCl}}{100 \text{ g solution}} \times 19.7 \text{ g solution} = 0.213 \text{ g KCl}\)

54. a) \(12 \text{ g sucrose } \times \frac{100 \text{ g solution}}{4.1 \text{ g sucrose}} = 2.9 \times 10^2 \text{ g solution}\)

b) \(12 \text{ g sucrose } \times \frac{100 \text{ g solution}}{3.2 \text{ g sucrose}} = 3.8 \times 10^2 \text{ g solution}\)

c) \(12 \text{ g sucrose } \times \frac{100 \text{ g solution}}{12.5 \text{ g sucrose}} = 96 \text{ g solution}\)

58. \(1.2 \text{ g Ca } \times \frac{100 \text{ g solution}}{0.0085 \text{ g NaCl}} = 1.4 \times 10^4 \text{ g solution}\)

64. a) moles: \(33.2 \text{ g KCl } \times \frac{1 \text{ mol KCl}}{74.55 \text{ g}} = 0.445 \text{ mol KCl}\)

\(M = \frac{0.445 \text{ mol KCl}}{0.895 \text{ L}} = 0.497 \text{ M KCl}\)

68. \(\frac{0.100 \text{ mol } C_{12}H_{22}O_{11}}{3.4 \text{ L}} = 0.34 \text{ mol } C_{12}H_{22}O_{11}\)
A. Predict whether each of the following will be more soluble in water or in hexane (CH₃CH₂CH₂CH₂CH₂CH₃). Explain your answer briefly.

1. gasoline (mainly composed of octane, CH₃CH₂CH₂CH₂CH₂CH₂CH₂CH₃)
   This should be more soluble in HEXANE, because both the solute and solvent are nonpolar. (Remember that all compounds containing only C and H – hydrocarbons – are nonpolar molecules and you don’t need Lewis structures to determine polarity.

2. oxygen difluoride
   OF₂ is a polar molecule (you should establish this by looking at a Lewis dot structure and the overall shape of the molecule.) Therefore, you can predict that it’s more soluble in water, which is a polar solvent.

3. ammonia (NH₃)
   This is also a polar molecule (you should establish this by looking at a Lewis dot structure and the overall shape of the molecule.) Therefore, you can predict that it’s more soluble in water, which is a polar solvent.

4. hydrocyanic acid (HCN)
   This is also a polar molecule (you should establish this by looking at a Lewis dot structure and the overall shape of the molecule.) Therefore, you can predict that it’s more soluble in water, which is a polar solvent.

B. Remember the “conductivity test” demonstrated in lecture. For each of the test solutions described below, predict whether or not it would cause the light bulb to light up and give a brief explanation.

1. CaCl₂ (aq) Yes, bulb will light (because the solution is an electrolyte, with dissolved ions present in the solution.)
2. ethanol (CH₃CH₂OH) in water No light (nonelectrolyte solution, because the solute is covalent.)
3. sucrose (C₁₂H₂₂O₁₁) in water No light (nonelectrolyte solution, because the solute is covalent.)
4. NH₄Cl (aq) Yes, bulb will light (because the solution is an electrolyte, with dissolved ions present in the solution.)