Unit 8 Practice Problems (with answers at end)

The dissolving process

1. What types of forces are responsible for the solution of a non-polar solute in a non-polar solvent?

2. How will increasing the pressure affect the solubility of a gas in a liquid?

Molality and mole fraction

3. Calculate the molality of a solution with 3.00 mol of sulfuric acid dissolved in 1255 g of water.

4. Determine the mass of ethylene glycol (a type of anti-freeze), $C_2H_4(OH)_2$, which must be dissolved in 2.5×10^3 g of water to make a 4.0 m solution.

5. Calculate the mole fraction of each component in a solution consisting of 54.3 g of $C_{10}H_8$ and 600 g (to the nearest 1 g) of $C_4H_{10}O$.

Colligative properties

6. Find the freezing and boiling points for a solution of 100 g (to the nearest 1 g) of biphenyl ($C_{12}H_{10}$) in 202 g of benzene, C_6H_6.
($K_f = 5.12$, fp $= 5.5^oC$, $K_b = 2.53$, bp $= 80.1^oC$)

7. Find the freezing and boiling points for a solution of 47.7 g of $C_{15}H_9NO_4$ in 110 g (to the nearest 1 g) of nitrobenzene, $C_6H_5NO_2$.
($K_f = 7.00$, fp $= 5.7^oC$, $K_b = 5.24$, bp $= 210.8^oC$)

Molar mass determination

8. What is the molar mass of glucose if 22.5 g gives a freezing point of -0.930^oC when dissolved in 250 g (to the nearest 1 g) of water? ($K_f = 1.86$)

9. If 23.0 g of ethanol are dissolved in 1.000×10^3 g of water, the freezing point is -0.930^oC. What is the molar mass of ethanol? ($K_f = 1.86$)

Answers:

1. dispersion forces
2. the solubility will increase--Henry's Law
3. 2.39 m
4. 620 g
5. 0.0497 $C_{10}H_8$, 0.951 $C_4H_{10}O$
6. fp = -11.0^{o}C, bp = 88.2^{o}C
7. fp = -5.7^{o}C, bp = 219.3^{o}C
8. 180 g/mol
9. 46.0 g/mol