PRACTICE PROBLEMS:

1. The total mass of a solution is 153.4 g. The solvent mass is 125.2 g. What is the percent of the solute?

solute mass = 153.4g - 125.2g = 28.2g

$$\%\ \text{solute} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100$$

$$\%\ \text{solute} = \frac{28.2\ g}{153.4\ g} \times 100 = 18.38\%$$

2. An oven-cleaning solution is 40% (by mass) NaOH. If one jar of this product contains 454 g. of solution, how much NaOH does it contain?

40% of 454 g = ?

.40 * 454 g = ?

181.6 ≈ 182g = ?

3. A nitric acid solution containing 71% HNO_3 (by mass) has a density of 1.42 g/mL. How many moles of HNO_3 are present in 1.00L of this solution?

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$1.42\ g/mL = \frac{\text{mass}}{1000\ mL}$$

1,420g = mass of HNO_3

71% of 1,420 = 1,008.2 g

periodic mass of HNO_3 = ?

1 + (14) + (3 × 16) = ?

63 g = ?

$$\#\ \text{of moles} = \frac{g}{\text{periodic } g}$$

$$\#\ \text{of moles} = \frac{1,008.2}{63}$$

# of moles = 16.0 moles

4. Commercial concentrated aqueous ammonia is 28% NH_3 by weight has a density of 0.90 g/mL. What is the molality and Molarity of this solution?

10 mL = .001 L

$\text{density} = \frac{\text{mass}}{\text{volume}}$

$.90 = \frac{9}{10}$

$.28 \times 9 = \frac{2.529}{17.01g} = .1481 \text{ moles}$

$NH_3 = 14.01 + (1 \times 3) = 17.01 g$

$\text{Molality} = \frac{\text{moles}}{\text{kg}} = \frac{\text{solute}}{\text{solvent}}$

$\text{Molality} = \frac{.1481 \text{ moles}}{.00648 \text{ kg}} = 22.9 \frac{\text{moles}}{\text{kg}}$

$\text{Molarity} = \frac{\text{moles}}{\text{liter}}$

$\text{Molarity} = \frac{.1481}{.001} = 148.1 \frac{\text{moles}}{\text{liter}}$

5. Lauryl alcohol is obtained from coconut oil and is used to [illegible] detergents. A solution of 5.00g. of lauryl alcohol in 100.0 [illegible]benzene freezes at 4.10°C/m and its normal freezing point [illegible] C, determine the molar mass of the lauryl alcohol.

$K_f m$

1. [illegible].13) m

.273 = m

$.273 = \frac{\text{moles of solute}}{.1 \text{ kg}}$

.0273 = moles of solute

$.0273 = \frac{5.}{mm}$

183.2g = molar mass of lauryl acid

see last page for solution

6. A solution is made by dissolving 2 moles of A in 7 moles of B. What is the mole fraction of A?

$\frac{\#\text{ moles of A}}{\#\text{ moles of total solution}} = \frac{2}{9} = .22$

Ch 13 – Solution Practice Problems

1. The total mass of a solution is 153.4 g. The solvent mass is 125.2 g. What is the percent mass of the solute?

2. An oven cleaning solution is 40% (by mass) NaOH. If one jar of this product contains 454 g of solution, how much NaOH does it contain?

3. A nitric acid solution is 71% HNO_3 (by mass) and has a density of 1.42 g/mL. How many moles of HNO_3 are present in 1.00 L of this solution?

4. Commercial concentrated aqueous ammonia is 28% NH_3 by weight and has a density of 0.90 g/mL. What is the molality and Molarity of this solution?

5. Lauryl alcohol (MW = 186.38 g/mol) is obtained from coconut oil and is used to make detergents. A solution of 5.00 g of lauryl alcohol in 100.0 g of benzene freezes at 4.10°C/m and its normal freezing point is 5.5°C. Determine the freezing point of the solution of lauryl alcohol.

$m = \frac{\text{mol solute}}{\text{kg solv.}} = \frac{.0268\text{mol}}{.1\text{ kg benzene}} = .268m$

$5\text{g lauryl alcohol} \left| \frac{1\text{ mol}}{186.38\text{g}} \right. = .0268\text{mol solute}$

$\Delta T_f = k_f m$

$\Delta T_f = (4.10°C/m)(.268m) = 1.10°C$

$5.5°C - 1.10°C = \boxed{4.4°C}$

6. A solution is made by dissolving 2 moles of A in 7 moles of B. What is the mole fraction of A?

7. What is the osmotic pressure (in atm) of a 0.884 M urea solution at 16°C?

$\pi = MRT = (.884M)(.0821 \frac{L\cdot atm}{mol\cdot K})(289K) = \boxed{20.9\text{ atm}}$

8. A solution of 0.850 g of an organic compound in 100.0 g of benzene has a change in f.p. of 5.16°C. What are the molality of the solution and molar mass of the solute (K_f = 5.12 °C/m)?

.850g solute
.1kg solvent
$\Delta T_f = 5.16°C$

$k_f = 5.12°C/m$
$m = ?$
$MM = ?$

$\Delta T_f = k_f m$

$m = \frac{\Delta T_f}{k_f} = \boxed{1.008m}$

$\frac{1.008\text{mol solute}}{1\text{ kg solv}} \times .1\text{ kg solv} = .1008\text{ mol solute}$

$.850\text{g} / .1008\text{ mol} = \boxed{8.43\text{ g/mol}}$

9. Calculate the change in b.p. and f.p. of a solution containing 478 g of ethylene glycol (MW = 62.08 g/mol) in 3203 g of water (K_f = 1.86 °C/m, K_b = 0.52 °C/m).

$478\text{g} \left| \frac{1\text{ mol}}{62.08\text{g}} \right. = 7.70\text{mol solute}$

3.203 kg solv.

$m = \frac{7.7}{3.203} = 2.40m$

$\Delta T_f = (1.86°C/m)(2.40m)$

$\boxed{\Delta T_f = 4.46°C}$

$\Delta T = km$

$\Delta T_b = (0.52°C/m)(2.40m)$

$\boxed{\Delta T_b = 1.25°C}$