

## 14 • Solutions and Their Properties

### Review Topic 1: CONCENTRATION FORMULAS

A solution is made by dissolving 30.0 g NaOH (0.750 moles NaOH) into 745 mL H<sub>2</sub>O (41.3 moles H<sub>2</sub>O). The solution has a density of 1.03 g/mL. Determine the following concentrations:

Molarity	Molality	Weight Percent	Mole Fraction

## 14 • Solutions and Their Properties

### Review Topic 2: DISSECTING CONCENTRATIONS

When you are given a concentration, you should “dissect” the number into two or more useful values.

**Ex: 0.15 m NaOH:            0.15 mole NaOH   and   1000 g H<sub>2</sub>O**

- (a) 3.00 % H<sub>2</sub>O<sub>2</sub>:
- (b) 0.25 m CH<sub>3</sub>OH:
- (c)  $\underline{X}$  = 0.44 C<sub>6</sub>H<sub>6</sub>:
- (d) 1.50 M HCl (density = 1.03 g/mL):

## 14 • Solutions and Their Properties

### Review Topic 3: TERMS

Given the following information:

Solubility of  $\text{AgNO}_3$  is 970 g/100g  $\text{H}_2\text{O}$  and the solubility of  $\text{AgCl}$  is 0.00127 g/100g  $\text{H}_2\text{O}$ , classify the following four solutions:

- (a) 900 g  $\text{AgNO}_3$  in 100 g  $\text{H}_2\text{O}$                       (c) 0.100 g  $\text{AgCl}$  in 100 g  $\text{H}_2\text{O}$   
(b) 1000 g  $\text{AgNO}_3$  in 100 g  $\text{H}_2\text{O}$                       (d) 0.00100 g  $\text{AgCl}$  in 100 g  $\text{H}_2\text{O}$

	Unsaturated	Saturated
Dilute		
Concentrated		

For each of these combinations, state whether we should call them:

soluble                      insoluble                      miscible                      immiscible

- (a) oil and water                      \_\_\_\_\_  
(b) silver bromide and water                      \_\_\_\_\_  
(c) alcohol and water                      \_\_\_\_\_  
(d) sodium acetate and water                      \_\_\_\_\_

## 14 • Solutions and Their Properties

### Review Topic 4: HENRY'S LAW

The value of Henry's law constant  $k_H$  for oxygen in water at  $24^\circ\text{C}$  is  $1.66 \times 10^{-6} \text{ M/torr}$ .

- (a) Calculate the solubility of oxygen in water at  $25^\circ\text{C}$  when the total external pressure is 1 atm and the mole fraction of oxygen in the air is 0.20.
- (b) Calculate the solubility at the same temperature with the same atmospheric composition but at an increased pressure of 2 atm.
- (c) What would happen to the solubility of the oxygen gas if the temperature was increased?

## 14 • Solutions and Their Properties

---

### Review Topic 5: RAOULT'S LAW

- (a) A solution is prepared by dissolving 3.000 grams of hexane,  $C_6H_{14}$ , in 25.00 grams of benzene,  $C_6H_6$ . Calculate the mole fraction of benzene in the solution described above.
- (b) The vapor pressure of pure benzene at  $35^\circ C$  is 150. mmHg. Calculate the vapor pressure of benzene over the solution described above at  $35^\circ C$ .

## 14 • Solutions and Their Properties

---

### Review Topic 6: VAN'T HOFF FACTOR, $i$

Determine the value of the van't Hoff factor for each of the following substances:

\_\_\_ LiOH

\_\_\_  $CH_3OH$

\_\_\_  $Ca(OH)_2$

\_\_\_ NaCl

\_\_\_  $Li_2S$

\_\_\_  $Fe_3(PO_4)_2$

\_\_\_  $FeCl_3$

\_\_\_ HCl

\_\_\_  $C_{12}H_{22}O_{11}$

\_\_\_ NaCl

\_\_\_  $CaBr_2$

\_\_\_ HF

## 14 • Solutions and Their Properties

---

### Review Topic 7: CONVERTING UNITS

A solution is prepared by dissolving 2.53 grams of p-dichlorobenzene (molar mass 147.0) in 25.86 grams of naphthalene (molecular weight 128.2). Calculate the molality of the p-dichlorobenzene solution.

Calculate the molality of a 20.0 percent by weight aqueous solution of  $\text{NH}_4\text{Cl}$ . (molar mass:  $\text{NH}_4\text{Cl} = 53.5$ )

## 14 • Solutions and Their Properties

---

### Review Topic 8: RAST

An unknown substance has the empirical formula of  $\text{C}_3\text{H}_2\text{Cl}$ .

A solution that is prepared by dissolving 3.150 grams of the substance in 25.00 grams of benzene,  $\text{C}_6\text{H}_6$ , has a freezing point of  $1.12^\circ\text{C}$ . (The normal freezing point of benzene is  $5.50^\circ\text{C}$  and the molal freezing-point depression constant,  $K_f$ , for benzene is  $5.12^\circ\text{C}/\text{molal}$ .)

(a) Using the data gathered from the freezing-point depression method, calculate the molar mass of the unknown substance.

(b) What is the molecular formula of the unknown substance?

## 14 • Solutions and Their Properties

---

### Review Topic 9: OSMOTIC PRESSURE

What is the formula for osmotic pressure,  $\Pi$ ?

What value of R do you use? \_\_\_\_\_

What is the osmotic pressure of a 1.00 M solution of sucrose at 25.0°C?

What is the osmotic pressure (at 25.0°C) of seawater? It contains approximately 27.0 grams of NaCl per Liter. (Seawater contains other stuff, but we'll ignore it.)

## 14 • Solutions and Their Properties

---

### Review Topic 9: OSMOTIC PRESSURE

What is the formula for osmotic pressure,  $\Pi$ ?

What value of R do you use? \_\_\_\_\_

What is the osmotic pressure of a 1.00 M solution of sucrose at 25.0°C?

What is the osmotic pressure (at 25.0°C) of seawater? It contains approximately 27.0 grams of NaCl per Liter. (Seawater contains other stuff, but we'll ignore it.)