

Ch.11 Continued

CALVIN

Name:

Date:

Hour:

1) Which of the following concentration measures will change in value as the temperature of a solution changes?

- A) mass percent
- B) mole fraction
- C) molality
- D) molarity**
- E) all of these

2) How many milliliters of 15.7 M H<sub>2</sub>SO<sub>4</sub> are needed to prepare 600.0 mL of 0.10 M H<sub>2</sub>SO<sub>4</sub>?

- A) 0.26 mL
- B) 94 mL
- C) 3.8 mL**
- D) 1.9 mL
- E) 4.8 mL

$$M_1 V_1 = M_2 V_2$$

$$V_1 = \frac{M_2 V_2}{M_1} = \frac{(0.10 M)(.600.0 L)}{(15.7 M)} = 3.8 \text{ mL}$$

3) What volume of a 0.771 M solution of CaCl<sub>2</sub> contains 1.28 g of solute?

- A) 66.8 mL
- B) 15.0 mL**
- C) 1.66 mL
- D) 8.89 mL
- E) 85.0 mL

$$\frac{1.28 \text{ g CaCl}_2}{110.98 \text{ g CaCl}_2} \times \frac{1 \text{ mol CaCl}_2}{1} = 0.0115 \text{ mol}$$

$$M = \frac{n}{L} \Rightarrow L = \frac{n}{M} = \frac{(0.0115 \text{ mol})}{(0.771 \text{ mol/L})} = 15.0 \text{ mL}$$

4) Determine the molarity of a solution containing 6.76 g BaCl<sub>2</sub> in 750.0 mL of solution.

- A) 3.25 × 10<sup>-2</sup> M
- B) 2.44 × 10<sup>-2</sup> M
- C) 9.01 × 10<sup>-3</sup> M
- D) 4.33 × 10<sup>-2</sup> M**
- E) 9.01 M

$$\frac{6.76 \text{ g BaCl}_2}{208.23 \text{ g BaCl}_2} \times \frac{1 \text{ mol BaCl}_2}{1} = 0.0325 \text{ mol}$$

$$\frac{0.0325 \text{ mol}}{(0.750 \text{ L})} = 4.33 \times 10^{-2} \text{ M}$$

5) What is the molality of a solution of 30.1 g of propanol (CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>OH) in 152 mL water, if the density of water is 1.00 g/mL?

- A) 3.29 m**
- B) 0.00330 m
- C) 0.303 m
- D) 0.501 m
- E) 5.01 m

$$\frac{30.1 \text{ g Prop}}{60.1 \text{ g Prop}} \times \frac{1 \text{ mol Prop}}{1} = 0.501 \text{ mol}$$

$$\frac{0.501 \text{ mol}}{(0.152 \text{ kg})} = 3.29 \text{ molal}$$

6) How many molecules of sucrose (table sugar), C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>, dissolved in 450.0 g of water are needed to make a 1.81 m solution?

- A) 4.90 × 10<sup>23</sup> molecules
- B) 8.15 × 10<sup>23</sup> molecules
- C) 2.42 × 10<sup>24</sup> molecules
- D) 2.72 × 10<sup>25</sup> molecules
- E) 1.50 × 10<sup>23</sup> molecules

$$\text{molal} = \frac{n}{\text{kg}}$$

$$n = \text{molal} \cdot \text{kg} = (1.81 \frac{\text{mol}}{\text{kg}})(.450 \text{ kg}) = 0.815 \text{ mol}$$

$$\frac{0.815 \text{ mol Sucrose}}{1 \text{ mol Sucrose}} \times 6.02 \times 10^{23} \text{ molecules} = 4.91 \times 10^{23} \text{ molecules}$$

7) A 20.0-g sample of methyl alcohol ( $\text{CH}_3\text{OH}$ , molar mass = 32.04 g/mol) was dissolved in 43.3 g of water. The mole fraction of  $\text{CH}_3\text{OH}$  is:

- A) 0.260
- B) 0.624
- C) 0.316
- D) 4.85
- E) 0.206

$$\frac{20.0 \text{ g CH}_3\text{OH}}{32.04 \text{ g CH}_3\text{OH}} \times 1 \text{ mol CH}_3\text{OH} = 0.624 \text{ mol}$$

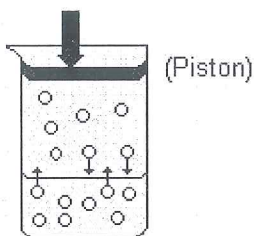
$$\frac{43.3 \text{ g H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \times 1 \text{ mol H}_2\text{O} = 2.40 \text{ mol}$$

$$\frac{(0.624 \text{ mol})}{(0.624 + 2.40 \text{ mol})} = 0.206$$

8) Which of the following chemical or physical changes is an endothermic process?

- A) the evaporation of water
- B) the combustion of gasoline
- C) the mixing of sulfuric acid and water
- D) the freezing of water
- E) none of these

9) Use the following drawing of a gaseous solute in equilibrium with a solution to help answer the question below.



Which of the following statements are true when the piston is pushed in (downward)?

- A) This will cause the pressure of the gas to increase and the concentration of the dissolved gas to go down.
- B) This will cause the pressure of the gas to decrease and the concentration of the dissolved gas to go down.
- C) This will cause the pressure of the gas to increase and the concentration of the dissolved gas to go up.
- D) This will cause the volume of the gas to decrease and the concentration of the dissolved gas to go down.
- E) This will cause the volume of the gas to increase and the concentration of the dissolved gas to go up.

10) A salt solution sits in an open beaker. Assuming constant temperature and pressure, the vapor pressure of the solution

- A) increases over time
- B) decreases over time
- C) stays the same over time
- D) need to know which salt is in the solution to answer this
- E) need to know the temperature and pressure to answer this

11) A 6.06-gram sample of a compound is dissolved in 250. grams of benzene. The freezing point of this solution is 1.02°C below that of pure benzene. What is the molar mass of this compound? (Note:  $K_f$  for benzene = 5.12°C/m.) Ignore significant figures for this problem.

- A) 30.4 g/mol
- B) 122 g/mol
- C) 243 g/mol
- D) 4.83 g/mol
- E) 60.8 g/mol

$$\Delta T_f = K_f \cdot (\text{molal})$$

$$(\text{molal}) = \frac{\Delta T_f}{K_f} = \frac{(1.02^\circ\text{C})}{(5.12^\circ\text{C/molal})} = 0.199 \text{ molal} = \frac{n}{.250 \text{ kg}} = \frac{6.06 \text{ g}}{122 \text{ g/mol}}$$

12) What is the boiling point change for a solution containing 0.736 moles of naphthalene (a nonvolatile, nonionizing compound) in 250. g of liquid benzene? ( $K_b$  = 2.53°C/m for benzene)

- A) 7.45 °C
- B) 0.859 °C
- C) 3.44 °C
- D) 1.86 °C
- E) 0.466 °C

$$\Delta T_b = (2.53^\circ\text{C/molal})(2.94 \text{ molal}) = 7.44^\circ\text{C}$$

$$(\text{molal}) = \frac{(0.736 \text{ mol})}{(0.250 \text{ kg})} = 2.94 \text{ molal.}$$

13) A solute added to a solvent raises the boiling point of the solution because:

- A) The temperature to cause boiling must be great enough to boil not only the solvent but also the solute.
- B) The solute particles lower the solvent's vapor pressure, thus requiring a higher temperature to cause boiling.
- C) The solute particles raise the solvent's vapor pressure, thus requiring a higher temperature to cause boiling.
- D) The solute increases the volume of the solution, and an increase in volume requires an increase in the temperature to reach the boiling point (derived from  $PV = nRT$ ).
- E) Two of the above are correct.

14) Consider pure water separated from an aqueous sugar solution by a semipermeable membrane, which allows water to pass freely but not sugar. After some time has passed, the concentration of sugar solution:

- A) will have increased
- B) will have decreased
- C) will not have changed
- D) might have increased or decreased depending on other factors
- E) will be the same on both sides of the membrane

15) What is reverse osmosis?

- A) the application, to a concentrated solution, of a pressure that is greater than the osmotic pressure, such that solvent flows from the concentrated solution to the dilute solution
- B) the application, to a dilute solution, of a pressure that is greater than the osmotic pressure, such that solvent flows from the concentrated solution to the dilute solution
- C) the application, to a concentrated solution, of a pressure that is greater than the osmotic pressure, such that solute flows from the concentrated solution to the dilute solution
- D) the application, to a dilute solution, of a pressure that is greater than the osmotic pressure, such that solute flows from the concentrated solution to the dilute solution
- E) the application, to a concentrated solution, of a pressure that is greater than the osmotic pressure, such that solvent flows from the dilute solution to the concentrated solution

16) Which of the following solutions would have the highest osmotic pressure?

- A) 0.2 M KBr, potassium bromide  $i = 2.0 \approx 0.4$   
 B) 0.2 M MgBr<sub>2</sub>, magnesium bromide  $i = 3.0 \approx 0.6$   
 C) 0.3 M CH<sub>3</sub>COOH, acetic acid  $i = 1.0 \approx 0.3$   
 D) 0.3 M C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, glucose  $i = 1.0 \approx 0.3$   
 E) 0.3 M C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>, sucrose  $i = 1.0 \approx 0.3$

17) Which of the following solutions has the lowest boiling point?

- A) 0.15 M NaCl  $i = 2.0 \approx 0.30$   
 B) 0.10 M MgBr<sub>2</sub>  $i = 3.0 \approx 0.36$   
 C) 0.15 M Ba(NO<sub>3</sub>)<sub>2</sub>  $i = 3.0 \approx 0.45$   
 D) 0.20 M C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>  $i = 1.0 \approx 0.20$   
 E) 0.10 M Fe(NO<sub>3</sub>)<sub>3</sub>  $i = 4.0 \approx 0.40$

18) What is the expected boiling point of a solution prepared by dissolving 7.27 g of sodium iodide (NaI) in 68.6 g of water (H<sub>2</sub>O)? For water,  $T_b = 100.00^\circ\text{C}$  and  $K_b = 0.512^\circ\text{C m}^{-1}$ .

- A) 0.72°C  
 B) 100.36°C  
 C) 103.72°C  
 D) 100.72°C  
 E) 0.36°C

$$\frac{7.27 \text{ g NaI}}{149.89 \text{ g NaI}} \cdot \frac{1 \text{ mol NaI}}{149.89 \text{ g NaI}} = \frac{0.0485 \text{ mol}}{0.0686 \text{ kg}} = 0.707 \text{ molal}$$

$$\Delta T_b = i \cdot K_b \cdot \text{molal} = (2.0)(0.512^\circ\text{C/molal})(0.707 \text{ molal}) = 0.724^\circ\text{C}$$

19) What type of colloid is formed when a liquid is dispersed in a gas?

- A) foam  
 B) aerosol  
 C) emulsion  
 D) sol  
 E) gel

$$T_b = 100.724^\circ\text{C}$$

20) Shaving cream is an example of which colloid type?

- A) aerosol  
 B) foam  
 C) emulsion  
 D) sol  
 E) coagulate

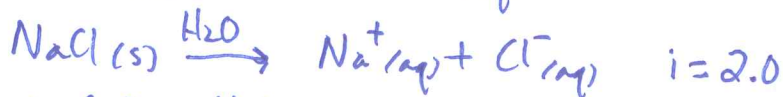
21) Write dissolution equations for examples compounds that have a Van't Hoff factor of:

Ex //

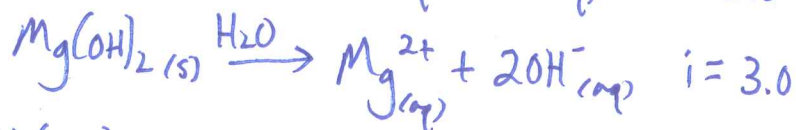
a) One



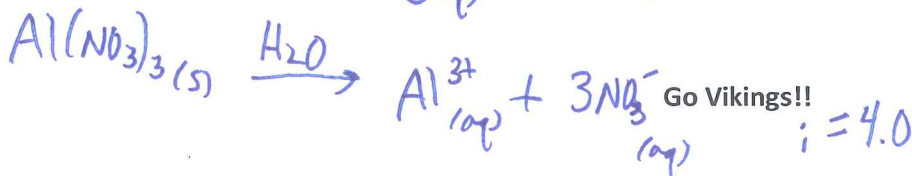
b) Two



c) Three



d) Four



Go Vikings!!