

**Assignment 3**  
**Chapter 12**  
**(Physical Properties of solutions)**

- Which of the following compounds should be soluble in  $\text{CCl}_4$ ?  
A.  $\text{NaCl}$     B.  $\text{H}_2\text{O}$     C.  $\text{NaOH}$     D.  $\text{C}_8\text{H}_{18}$     E. none of these
- Which of the following gives the molarity of a 17.0% by mass solution of sodium acetate,  $\text{CH}_3\text{COONa}$  (molar mass = 82.0 g/mol) in water? The density of the solution is 1.09 g/mL.  
A.  $2.26 \times 10^{-6} \text{ M}$     B. 0.207 M    C. 2.07 M    D. 2.26 M    E. 2.72 M
- What is the percent  $\text{CdSO}_4$  by mass in a 1.0 molal aqueous  $\text{CdSO}_4$  solution?  
A. 0.001 %    B. 0.10 %    C. 17.2 %    D. 20.8 %    E. 24.4 %
- Calculate the percent by mass of potassium nitrate in a solution made from 45.0 g  $\text{KNO}_3$  and 295 mL of water. The density of water is 0.997 g/mL.  
A. 1.51 %    B. 7.57 %    C. 13.3 %    D. 15.2 %    E. none of these
- Calculate the molality of a solution containing 14.3 g of  $\text{NaCl}$  in 42.2 g of water.  
A.  $2.45 \times 10^{-4} \text{ m}$     B.  $5.80 \times 10^{-4} \text{ m}$     C.  $2.45 \times 10^{-1} \text{ m}$     D. 103 m    E. 5.80 m
- The solubility of gases in water usually decreases with  
A. increasing pressure.    B. increasing temperature.    C. decreasing temperature.
- The solubility of nitrogen gas at  $25^\circ\text{C}$  and a nitrogen pressure of 522 mmHg is  $4.7 \times 10^{-4} \text{ mol/L}$ . What is the value of the Henry's Law constant in  $\text{mol/L}\cdot\text{atm}$ ?  
A.  $6.8 \times 10^{-4} \text{ mol/L}\cdot\text{atm}$     B.  $4.7 \times 10^{-4} \text{ mol/L}\cdot\text{atm}$   
C.  $3.2 \times 10^{-4} \text{ mol/L}\cdot\text{atm}$     D.  $9.0 \times 10^{-7} \text{ mol/L}\cdot\text{atm}$     E.  $1.5 \times 10^3 \text{ mol/L}\cdot\text{atm}$
- The solubility of  $\text{CO}_2$  gas in water  
A. increases with increasing temperature.  
B. decreases with decreasing temperature.  
C. decreases with increasing temperature.  
D. is not dependent on temperature.

9. Consider a solution made from a nonvolatile solute and a volatile solvent. Which statement is *true*?
- A. The vapor pressure of the solution is always greater than the vapor pressure of the pure solvent.
  - B. The boiling point of the solution is always greater than the boiling point of the pure solvent.
  - C. The freezing point of the solution is always greater than the freezing point of the pure solvent.
10. Dissolving a solute such as KOH in a solvent such as water results in
- A. an increase in the melting point of the liquid.
  - B. a decrease in the boiling point of the liquid.
  - C. a decrease in the vapor pressure of the liquid.
  - D. no change in the boiling point of the liquid.
11. Which of the following aqueous solutions has the highest boiling point?  $K_b$  for water is  $0.52^\circ\text{C}/\text{m}$ .
- A. 0.2 m KCl      B. 0.2 m  $\text{Na}_2\text{SO}_4$       C. 0.2 m  $\text{Ca}(\text{NO}_3)_2$
  - D. 0.2 m KCl AND 0.2 m  $\text{Na}_2\text{SO}_4$       E. 0.2 m  $\text{Na}_2\text{SO}_4$  AND 0.2 m  $\text{Ca}(\text{NO}_3)_2$
12. Calculate the freezing point of a solution made from 22.0 g of octane ( $\text{C}_8\text{H}_{18}$ ) dissolved in 148.0 g of benzene. Benzene freezes at  $5.50^\circ\text{C}$  and its  $K_f$  value is  $5.12^\circ\text{C}/\text{m}$ .
- A.  $-1.16^\circ\text{C}$     B.  $0.98^\circ\text{C}$       C.  $6.66^\circ\text{C}$       D.  $12.2^\circ\text{C}$       E.  $5.49^\circ\text{C}$
13. What is the molar mass of toluene if 0.85 g of toluene depresses the freezing point of 100. g of benzene by  $0.47^\circ\text{C}$ ?  $K_f$  of benzene is  $5.12^\circ\text{C}/\text{m}$ .
- A. 92.6 g/mol      B. 78.0 g/mol      C. 10.7 g/mol      D. 81.8 g/mol      E. 927 g/mol
14. 0.102 g of an unknown compound dissolved in 100. mL of water has an osmotic pressure of 28.1 mmHg at  $20^\circ\text{C}$ . Calculate the molar mass of the compound.
- A. 663 g/mol    B. 0.872 g/mol    C. 1.15 g/mol    D. 727 g/mol    E.  $1.10 \times 10^2$  g/mol
15. The osmotic pressure of a 0.010 M  $\text{MgSO}_4$  solution at  $25^\circ\text{C}$  is 0.318 atm. Calculate  $i$ , the van't Hoff factor, for this  $\text{MgSO}_4$  solution.
- A. 0.013    B. 1.3    C. 1.5    D. 2.0    E. 76.8