

**Matter and Motion Fall 2015**  
**Chemistry Workshop 8**

The workshop is intended to be a low-pressure setting where we get to practice problems, ask any questions, and discuss concepts and problem solving methods. Have fun! Work together on whiteboards or scratch paper and then neatly write your solutions in the notebook where you keep chemistry class notes. Your workshop solutions will be included in your portfolio.

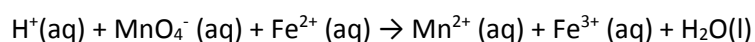
1. Identify the strongest intermolecular force operating in each of the following substances (hydrogen bonds, dipole-dipole forces, or London Dispersion Forces):

- |                    |                                    |
|--------------------|------------------------------------|
| a) HF              | d) CCl <sub>4</sub>                |
| b) CO <sub>2</sub> | e) H <sub>2</sub> O                |
| c) Ar              | f) CH <sub>2</sub> Cl <sub>2</sub> |

2. Which solvent, water or carbon tetrachloride, would you use to dissolve each of the following? Explain.

- |                     |                    |
|---------------------|--------------------|
| a) KrF <sub>2</sub> | c) SO <sub>2</sub> |
| b) SF <sub>2</sub>  | d) CO <sub>2</sub> |

3. Balance the following reaction using the oxidation states method.



4. Benzene and toluene form an ideal solution. Consider a solution of benzene and toluene prepared at 25°C. Assuming the mole fractions of benzene and toluene in the vapor phase are equal, calculate the composition of the solution. At 25°C the vapor pressures of benzene and toluene are 95 and 28 torr, respectively.

5. Consider the following table of vapor pressures for water-propanol mixtures:

$\chi_{\text{H}_2\text{O}}$	Vapor Press. (torr)
0	74.0
0.15	77.3
0.37	80.2
0.54	81.2
0.69	80.6
0.83	78.2
1.00	71.9

- Are the solutions of water and propanol ideal? How do you know?
- Are the intermolecular forces between propanol and water weaker than, stronger than, or equal to the forces in the pure substances? Explain.
- Which solution in the data would have the lowest boiling point? Why?

6. The freezing point of *t*-butanol is 25.50°C and  $K_f = 9.1 \frac{^\circ\text{C}\cdot\text{kg}}{\text{mol}}$ . Usually *t*-butanol absorbs water on exposure to air. If the freezing point of a 10.0 g sample of *t*-butanol is 24.59°C, how many grams of water are present in the sample? Remember this one for lab!

7. Explain how you would prepare 1.0 L of an aqueous solution of sodium chloride in solution having an osmotic pressure of 15 atm at 22°C. Assume sodium exists as  $\text{Na}^+$  and  $\text{Cl}^-$  in solution.
8. You make 20.0 g of a sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) and NaCl mixture and dissolve it in 1.00 kg water. The freezing point of this solution is found to be  $-0.426^\circ\text{C}$ . Assuming ideal behavior, calculate the mass percent composition of the original mixture. Assume the solution has a density of 1.00 g/mL