Matter and Motion Winter 2016
Chemistry Workshop 2

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 a notebook where you keep chemistry class notes. Your workshop solutions will be included in your portfolio.

1. Consider the exothermic reaction CO (g) + H_2O (g) ↔ H_2 (g) + CO_2 (g) at equilibrium.
Discuss with your group how this system will shift in each of the following cases: (a) gaseous carbon dioxide is removed (b) water vapor is added (c) in a rigid container, the pressure is increased by adding helium gas (d) the temperature is increased (e) the pressure is increased by decreasing the volume of the container.

2. Write expressions for K and K_p for the following reactions:
a) $2NH_3$ (g) + CO_2 (g) ↔ N_2CH_4O (s) + H_2O (g)

b) $2NBr_3$ (s) ↔ N_2 (g) + $3Br_2$(g)

c) $2KClO_3$ (s) ↔ 2KCl (s) + $3O_2$ (g)

d) CuO (s) + H_2 (g) ↔ Cu (l) + H_2O (g)

3. Consider the following reaction: 3Fe (s) + $4H_2O$ (g) ↔ Fe_3O_4(s) + $4H_2$(g).
At 1200 Kelvin, it is observed that the equilibrium partial pressure of water vapor is 15.0 torr and the total pressure is 36.3 torr. Calculate K_p for this reaction. Note: 1 atm = 760 torr.

4. The hydrogenation process to make *trans* fats can be described as: *cis* fat (aq) + H_2 (aq) ↔ *trans* fat (aq). A typical value of K for this reaction is about 5.0. If we start with 0.10 mol/L each of *cis* fat and H_2, calculate the equilibrium concentrations.

5. Consider the reaction: $2SO_2$ (g) + O_2 (g) ↔ $2SO_3$ (g).
At 1100 K (temperature!), K_p = 0.25. Calculate the equilibrium partial pressures of all three gasses produced from an initial mixture in which $P_{SO2} = P_{O2}$ = 0.50 atm and P_{SO3}= 0.

6. Consider the dissociation of NO_2 gas: $2NO_2$ (g) ↔ 2NO (g) + O_2 (g).
If 8.0 moles of NO_2 is placed in a 1.0 L container and at equilibrium the concentration of NO (g) is 2.0 M, what is the value of K for this reaction?