1. Calculate the freezing point depression of 100 g of alien snot when 8.4 g of salt NaHCO$_3$ is added. Pretend that the freezing point depression constant of alien snot is 1.5 °C·kg/mol. (In case you didn't know alien snot is very runny, not so viscous).
   a. 3.0°C  
   b. 2.0°C  
   c. 1.5°C  
   d. 4.5°C

2. Determine the correct equilibrium expression for the reaction of hydrogen gas with nitrogen gas to produce ammonia.
   a. $K_p = \frac{P(N_2) P^2(H_2)}{P^3(NH_3)}$  
   b. $K_p = P^3(NH_3) / \{P(N_2) P^2(H_2)\}$  
   c. $K_c = \frac{[NH_3]^2}{\{[N_2][H_2]^3\}}$  
   d. $K_c = \frac{\{[N_2][H_2]^2\}}{[NH_3]^3}$

3. In the reaction below the partial pressures are $P_{CO_2} = 2$ atm, $P_{Cl_2} = .20$ atm, $P_{CCl_4} = 10$ atm, $P_{O_2} = 0.5$ atm. Determine the direction of the reaction and why. ($K_p = 6.4 \times 10^{-18}$)
   CO$_2$(g) + 2 Cl$_2$(g) $\rightleftharpoons$ CCl$_4$(g) + O$_2$(g)
   a. Shift right, $Q<K$  
   b. Shift left, $Q=K$  
   c. Shift left, $Q<K$  
   d. Shift right, $Q>K$  
   e. Shift left, $Q>K$  
   f. No shift, $K<Q$

4. Steel rusting is exothermic. It's mostly made of iron, which when reacted with oxygen will form iron oxide (Fe$_2$O$_3$). An increase in which of the following compounds will be seen when the temperature decreases?
   1. Fe  
   2. O$_2$  
   3. Fe$_2$O$_3$
   a. I  
   b. I and II  
   c. I, II and II  
   d. II  
   e. II and III  
   f. III  
   g. I and III

5. Consider the following reaction:
   $6 H_2(g) + N_2(g) \rightleftharpoons 2 NH_3(g)$, $K_{eq} = 2 \times 10^{12}$
   Which combination of concentrations of H$_2$, N$_2$, and NH$_3$ will lead to the most ammonia once equilibrium is reached? Assume 1 L of solvent.
   a. 0 M, 0 M, and 1 M  
   b. 10 M, 10 M, and 1 M  
   c. .1 M, .1 M, and 1 M

6. Complete the following table:
   \[
   \begin{array}{ccc}
   R & 4 NH_3(g) & + 3 O_2(g) = 2 N_2(g) & + 6 H_2O(g) \\
   C & 20 & 11 & 6 & 0 \\
   E & 5
   \end{array}
   \]
What is the value of $K$?
   a. 2  
   b. 1.4  
   c. 234.4  
   d. 115.2

7. Which of the following values for $\Delta G$ will result in the largest positive value for $K$? (No calculations necessary)
   a. -1 kJ/mol  
   b. -100 J/mol  
   c. 100 J/mol  
   d. 1 kJ/mol

8. Which of the following is a true statement?
   a. As temperature increases, the equilibrium of an exothermic reaction will shift right.  
   b. As temperature increases, the equilibrium of an endothermic reaction will shift right.  
   c. The equilibrium of any reaction is independent of temperature.  
   d. When using the Van't Hoff equation, the sign of $\Delta H$ can be ignored