CHEM102 Exam II (Jul 31 2009).
$33\frac{1}{3}$ points / problem with maximum of 100 points.

1. $H_2S(g) + \frac{3}{2}O_2(g) \rightleftharpoons SO_2(g) + H_2O(g)$ with at 298 K. (below 1 atm corresponds to 760 torr pressure)

   a) Given the equilibrium partial pressure of H_2O as 99.803 torr, and the initial partial pressures of H_2S and O_2 as 100.00 torr and 200.00 torr, respectively, what are the equilibrium partial pressures of H_2S, O_2, SO_2, and H_2O?

   b) What are the values of K_p and K_c?

   c) If the chemical reaction is written as:
   $2SO_2(g) + 2H_2O(g) \rightleftharpoons 2H_2S(g) + 3O_2(g)$
   What would be the value of K_p?

   d) If 10.000 torr of $SO_2(g)$ is added to the gas mixture, what would be the value of the reaction quotient Q and which way would the equilibrium shift?

   e) Given K_p, what is ΔG°_{rxn}?

2. Citric acid $(H_3C_6H_5O_7)$ is a polyprotic acid, which has three different pK_a values: $pK_{a1} = 3.13$, $pK_{a2} = 4.77$, and $pK_{a3} = 6.40$.

   a) If citric acid acts as an acid, how many protons can it donate?

   b) What are the corresponding equilibrium constants K_a?

   c) What are the corresponding K_b values?

3. Consider a 1.0 M hydrazoic acid solution. pK_a for hydrazoic acid is 4.60.

   a) What is the pH?

   b) What is the pOH?

   c) What are the concentrations $[H^+]$ and $[OH^-]$?