Solution Equilibria

Name _____ Slayter Box _____

Hour Examination 5 April 2, 2003

General Chemistry (CHEM 122-01)

Solution Equilibria

Dr. Bennett

You will do your choice of:

2 out of 3 of Questions 1, 2, 3

AND

EITHER Question 4 or 5

AND

EITHER Question 6 or 7

Please make your intentions clear as to which questions you want graded for credit!!! If the situation is ambiguous I will grade questions 1 & 2 (of 1, 2, 3), question 4 (of 4 & 5), question 6 (of 6 & 7).

Please do not open until instructed

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Notes:

* This exam consists of answering **4 questions out of 7** (see overview on next page). Please check to make sure that you have a complete copy of the exam.
** Please do not simply give me answers. Give me well-supported answers. Numerical answers that are not backed by supporting calculations will receive minimal credit.*
* Please write clearly; if I can't read your answer, I can't give you credit for your answer.
* Please note that different questions are worth different numbers of points. Plan your time accordingly.
* Remember to include units and significant figures where appropriate.
* No books or notes are to be used on this exam.
* Please do NOT share calculators; if you need a calculator but do not have one, please let me know!

** If you feel that you would be better able to answer **any** question if you had additional information, please do not hesitate to ask for it.* I will happily provide any information that I feel will help you answer the question without compromising the efficacy and fairness of the test.

Question	Possible	Score
1	20	
2	20	
3	20	
4	20	
5	20	
6	10	
7	10	
TOTAL	70	
	percent:	

The Quadratic Equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

OVERVIEW—DO NOT PUT YOUR ANSWERS ON THIS PAGE

Do TWO of the following 3 problems

1. The solubility product of silver sulfate (Ag_2SO_4) is 1.4×10^{-5}.
(a) Calculate the molar solubility of the salt in water.
(b) To increase the molar solubility of Ag_2SO_4, you could add one of the following to the solution: Ag^+, SO_4^{2-}, H^+, NH_3. Which would you add to the solution, and why?

2.
(a) Show with calculations why solid $PbCl_2$ forms when the following two solutions are mixed. ($K_{sp}(PbCl_2) = 1.6 \times 10^{-5}$)

soln A: 500.0 mL 0.060 *M* $Pb(NO_3)_2$

soln B: 500.0 mL 0.12 *M* NaCl

(b) Calculate the concentration of Pb^{2+}*(aq)* that remains in solution after mixing.

3. Hexacyanoferrate(III) ion, $Fe(CN)_6^{3-}$, is a complex ion. The formation constant (K_f) for this ion is 9.1×10^{41}.
(a) Calculate the value of the dissociation constant (K_d) for this ion.
(b) If 5×10^{-5} moles of Fe^{3+} is placed in contact with 1.0 L of 1.0 *M* CN^-, calculate the molarity of Fe^{3+} that remains uncomplexed in solution. (Hint: Use the dissociation constant from part a.)

Do ONE of the following 2 problems

4. A solution is made to contain 0.70 M NH_4Cl and 0.50 M NH_3. The pH is 9.11. This solution will behave as a buffer. (For NH_3, $K_b = 1.8 \times 10^{-5}$).
You take 1.00 L of this solution and add to it 0.150 mol of NaOH*(s)*. Assume that the volume of the solution does not change. What will the new pH of the solution be after this addition of base?

5. Consider the titration of 75.00 mL of 0.235 M nitrous acid (HNO_2) with a 0.600 M KOH solution. ($K_a(HNO_2) = 6.0 \times 10^{-4}$)
(a) Calculate the pH at the equivalence point.
(b) What is the pH at the half-equivalence point? Explain briefly.
(c) At what pH would HNO_2 / NO_2^- make a good buffer? Explain.

Do ONE of the following 2 problems

6. Calculate the pH of a 0.20 M solution of sodium hypochlorite, NaOCl. The K_a for HOCl is 3.0×10^{-8}.

7. A solution is 0.38 *M* in aniline ($PhNH_2$) and has a pH of 9.58. Find K_b.

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