Chem 1114 Exam 2. April 1. 2009
Name_____

By submitting this assignment, you affirm that you did not give or receive any unauthorized help on this exam.

Useful Information: , $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, pH $=-\log[H_3O^+]$, $K_a \bullet K_b = K_w$, pH + pOH = 14.00,

PV=nRT, R=0.0821 L•atm/mol•K, 8.314 J/mol•K K_w= 1.00 x 10^{-14}, (n/V)•RT = P,

$$\ln\frac{k_2}{k_1} = \frac{-E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right) \quad \ln\frac{[A]_t}{[A]_0} = -kt$$

(1)(3 points) Give the Acid-Base definition that matches the following description

(a) a proton donor

(b) and electron-pair acceptor

(c) forms OH⁻ when placed in water

(2)(4 points) Write the conjugate base of each of the following acids

(a) NH_4^+

(b) H_2CO_3

(c) $H_2PO_4^-$

(d) H_2O

(3) (6 points) Calculate the pH for the following solutions

(a) 0.250 M NH_3

(b) 0.290 M $HClO_4$

(4)(4 points) Calculate the pH of a solution formed by mixing 15.00 mL of 0.100 M HOCl and 10.00 mL of 0.100 NaOH.

(5) (6 points) Buffer Problem:

(a) What is the pH of a solution that contains 0.100 M HOCl and 0.200 M NaOCl?

(b) If 50.00 ml of 0.100 M HCl is added to 1.00 L of the above buffer, what is the new pH?

(6)(4 points) Which way will the reaction shift under the following conditions (left, right, no change)?

$$AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$$

(a) AgCl is added to the system

(b) $AgNO_3$ is added

(c) H_2O is added

(d) NaCl is added

(7)(4 points) For the following reaction, the initial and final concentrations are shown

	$SO_2(g) +$	$H_2O(g) \rightleftharpoons$	$H_2SO_3(g)$
initial	0.030 M	0.020 M	0 M
final	0.030-x	0.020-x	0.016 M
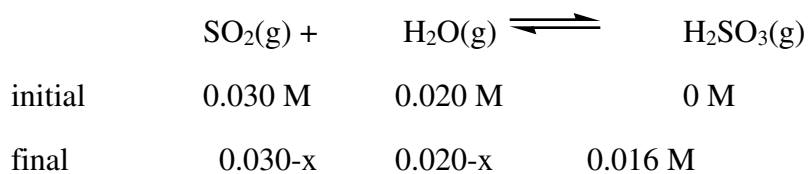
(a) What is the final concentration of SO_2?

(b) What is the value of K?

(8)(4 points) For the reaction below, $K_c = 25$, If $[Fe(SCN)_2] = 0.20$ M and $[SCN^-] = 0.95$ M at equilibrium, what is $[Fe^{2+}]$?

$$Fe^{2+}_{(aq)} + 2\ SCN^-_{(aq)} \rightleftharpoons Fe(SCN)_{2(aq)}$$
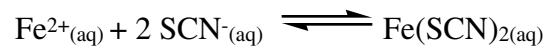
(9)(4 points) $BaSO_{4(s)}$ is often suspended in water and given to patients to help visualize their digestive tract. The heavy Ba^{2+} ions absorb most of the X-rays, making the digestive tract stand out under a CT scan. The minimal risk level of $BaSO_4$ is about 1×10^{-6} M Ba^{2+}. What is the concentration of Ba^{2+} in saturated $BaSO_4$? (ref: http://www.atsdr.cdc.gov/toxprofiles/tp24-c2.pdf, CDC Toxicity Profiles).

(10) (6 points) Find the $[Pb^{2+}]$ in the following solutions.

(a) A saturated solution of $PbCO_3$

(b) A saturated solution of $PbCO_3$ that contains 0.100 M Na_2CO_3

(11)(4 points) If a buffer of pH = 10.00 needs to be prepared, would a NH_3/NH_4^+ or a $OCl^-/$HOCl buffer be better? Why

(12)(4 points) Are the following salts acidic, basic, or neutral?
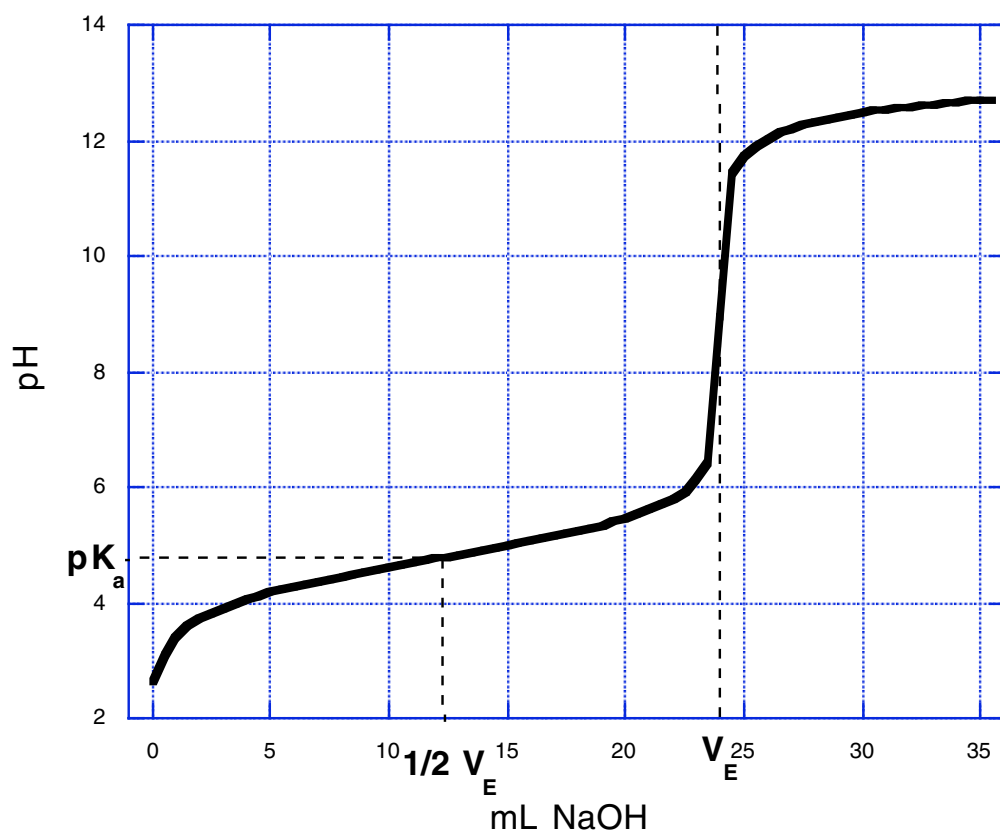
(a) NaCl

(b) NaClO

(c) NaCN

(d) $Ca(NO_2)_2$

Extra Credit Question: (4 points) A sample of acid (25.00 mL) was titrated with a 0.100 M NaOH solution.   From the titration curve below, what was the concentration of the acid (to 2 sig figs)?

Extra Special Extra Credit Question: (4 points). Buffers are often made by partially neutralizing the weak acid or base. If 0.100 M NH_3 was reacted with HCl (a small amount that doesn't change the total volume much) until the pH of the resulting buffer was 9.50. What are the final concentrations of NH_3 and NH_4^+?