Chem 1142—Exam 3A
Spring 2011 Name:_____

Multiple Choice. [5 pts. Each]
Circle the best response.

Q1. A Brønsted acid is:
a) a proton acceptor b) a proton donor c) an electron-pair donor
d) an electron-pair acceptor e) a substance that ionizes to produce H_3O^+ ions.

Q2. The pH of 0.20 M $Sr(OH)_2$(aq) is:
a) 0.70 b) 0.40 c) 1.00 d) 13.30 e) 13.60

Q3. A weak acid:
a) Has a high pH b) Has a low pH c) Has a pH close to 7.00
d) Partially ionizes in water e) Is chemically unreactive

Q4. Which of the following has the **greatest** molar solubility?
a) PbF_2 ; $K_{sp} = 4.1 \times 10^{-8}$ b) CaF_2 ; $K_{sp} = 4.0 \times 10^{-11}$
c) BaF_2 ; $K_{sp} = 1.7 \times 10^{-6}$ d) Ag_2SO_4 ; $K_{sp} = 1.4 \times 10^{-5}$

Q5. An aqueous solution of NH_4Br is:
a) Acidic b) Basic c) Neutral d) Not enough information to give an answer

Q6. K_{sp} for $PbCl_2$ is 2.4×10^{-4}. What is the molar solubility of $PbCl_2$?
a) 6.2×10^{-2} M b) 3.9×10^{-2} M c) 2.4×10^{-4} M
d) 7.7×10^{-3} e) 6.0×10^{-5} M

Short Response Questions. Show ALL work to receive credit.

Q7. [10 pts.] Calculate the pH of a 0.10 M aqueous solution of NaF(aq), given K_a (HF) = 7.1×10^{-4}.

Q8. [10 pts.] Identify (and explain how you identified) the Lewis acid and base in the following reaction:

$AlCl_3 + Cl^- \rightarrow AlCl_4^-$

Be sure to write valid Lewis structures as part of your answer.

Q9. [6 pts.] The pK_as of two monoprotic acids, HA and HB, are 5.9 and 8.1 respectively. Which of the two is the stronger acid?

Q10. [10 pts.] Write formulas for the following compounds:

a) lithium phosphate
b) ammonium bicarbonate
c) sulfuric acid
d) calcium sulfate dihydrate
e) trisulfur heptabromide

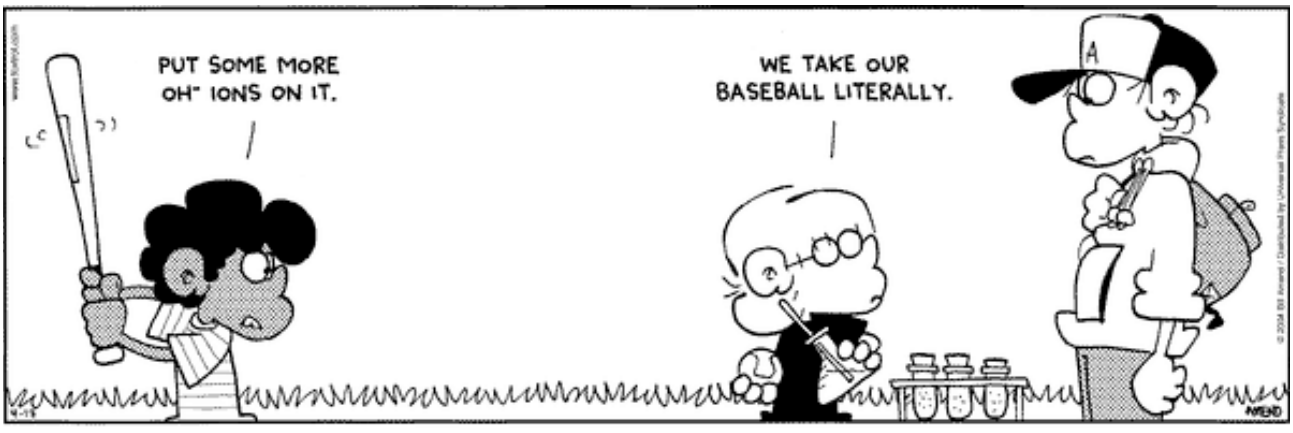
Q11. [15 pts.] Calculate the pH of a buffer with an acetic acid concentration of 0.900 M, and a sodium acetate concentration of 0.500 M. What will the pH of the buffer change to if 5.00 mL of 12.0 M HCl is added to 125 mL of this buffer? K_a ($HC_2H_3O_2$) = 1.8 x 10^{-5}.

Q12. [10 pts.] 15.4 g of H_2(g) is reacted with 18.3 g of N_2(g) and forms 10.9 g of NH_3(g). Calculate the percent yield of this reaction.

Q13. [10 pts.] How many grams of $CaCO_3$ will dissolve in 300. mL of 0.050 M $Ca(NO_3)_2$(aq)?
K_{sp} ($CaCO_3$) = 8.7 x 10^{-9}.

BONUS QUESTION.

H_3PO_4 is a triprotic acid. Write out the chemical reactions corresponding to K_{a1}, K_{a2}, and K_{a3}.



Useful Information

$N_A = 6.022 \times 10^{23}\ \text{mol}^{-1}$

Given: $ax^2 + bx + c = 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14}$ at 25 °C.

$\text{pH} = -\log[H_3O^+]$ $\qquad$ $\text{pH} + \text{pOH} = 14.00$ (at 25 °C)

$K_aK_b = K_w$ $\qquad$ $R = 8.314\ \text{J/mol·K} = 0.08206\ \text{L·atm/mol·K}$

$\text{pH} = \text{p}K_a + \log\dfrac{[\text{Base}]}{[\text{Acid}]}$ $\qquad$ $M_1V_1 = M_2V_2$

Periodic Table of the Elements

IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA
1																	*18*
1 H 1.01	*2*											*13*	*14*	*15*	*16*	*17*	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc [98]	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba* 137.33	71 Lu 174.97	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po [210]	85 At [210]	86 Rn [222]
87 Fr [223]	88 Ra** [226]	103 Lr [262]	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [265]	109 Mt [268]	110 [269]	111 [272]	112 [277]	113	114 [285]	115	116 [289]	117	118 [293]

*	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm [145]	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04
**	89 Ac [227]	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]