Chem 210 – Exam 3a *Name:* _____
Spring 2008

Chemistry 210 Exam 3

Be sure to put your name on each page. This page can be removed from your exam so that you will have a Periodic Table handy throughout the exam, it does not need to be turned in. Show all your work for problems which require any sort of calculation, no credit will be given for answers without work shown. If you have shown a significant amount of work or multiple drawings for a problem, draw a box around what you consider your final answer.

Avogadro's Number = $6.022 \times 10^{23}\ ^{\text{units}}/_{\text{mol}}$
$32.00^{\circ}F = 0.000^{\circ}C = 273.15K$
Density of Water = $1.000\ ^{g}/_{mL}$
$R = 0.08206\ ^{L \cdot atm}/_{mol \cdot K} = 8.314\ ^{J}/_{mol \cdot K}$
$PV=nRT$
$\Delta T_{fp/bp} = k_{fp/bp} \cdot m \cdot i$
For water, $k_{fp} = -1.86\ ^{\circ C}/_{m}$; $k_{bp} = 0.52\ ^{\circ C}/_{m}$
$P_1 = X_1 P_1^{\circ}$
$P = cRTi$
$C_1V_1 = C_2V_2$
Quadratic formula:

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

Integrated Rate Laws:

$\ln[A]_t = -kt + \ln[A]_o$
$1/[A]_t = kt + 1/[A]_o$
$[A]_t = -kt + [A]_o$

$$k = Ae^{-Ea/RT}$$

$$\ln(k) = \left(\frac{-E_a}{R}\right)\left(\frac{1}{T}\right) + \ln(A)$$

$$\ln\left(\frac{k_1}{k_2}\right) = \frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

$$pH = pK_a + \log\left(\frac{[\text{conjugate base}]}{[\text{conjugate acid}]}\right)$$

1 **H** 1.0079																	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.066	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.88	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.847	27 **Co** 58.933	28 **Ni** 58.69	29 **Cu** 63.546	30 **Zn** 65.39	31 **Ga** 69.723	32 **Ge** 72.61	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.80
37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	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	57 **La** 138.91	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** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.03	89 **Ac** 227.03	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 (269)	111 (272)	112 (277)		114		116		

58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.97	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.94	70 **Yb** 173.04	71 **Lu** 174.97
90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** 237.05	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (258)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Score

1. Complete each row of the following tables for aqueous solutions at 25ºC (4pts per box):

$[H_3O^+]$	$[OH^-]$	pH	pOH	Acidic, Basic or Neutral?
$9.167x10^{-12}$				
		1.642		

Conjugate Acid	K_a @25ºC	Conjugate Base	K_b @25ºC
H_2SO_3			$8.3x10^{-13}$
	$6.2x10^{-8}$	HPO_4^{2-}	

2. Explain why each of the following ***does not*** result in an effective buffer? (15pts)

0.38mol $HClO_4$(aq) + 0.38mol NaOH(aq)

1.28mol H_2CO_3(aq) + 0.64mol HCl(aq)

1.24mol HNO_2(aq) + 0.03mol $NaNO_2$(aq)

3. How much 0.824 M NaOH(aq) must be added to 25.00mL of 0.993 M HCl(aq) to reach the equivalence point? What is the pH of this solution at the equivalence point? (14pts)

Score

4. You have prepared a buffer solution by combining 0.237mols of hypochorous acid (HClO, $K_a = 3.5x10^{-8}$) and 0.186mols of sodium hypochlorite in enough water to make 500.0mL of solution. What is the pH of this buffer solution? (16pts)

5. Sketch the titration curve (pH vs. volume added) for the titration of 1 M hydrosulfuric acid (H_2S, $K_{a1}=1x10^{-7}$) and 1 M KOH(aq). Label all the axes (including approximately accurate numbers) and the major sulfur-based species present in solution at each point in the titration curve. Indicate the equivalence point(s) on the curve. (18pts)

Score

6. What is the K_b of a base if 500.0mL of a solution containing 0.153 mol of the base and 0.191 mol of its conjugate acid has a pH of 6.114? Over what pH range would this conjugate acid/ conjugate base pair make an effective buffer? (18pts)

7. You have titrated 35.00mL of a monoprotic acid ($K_a = 3.4 \times 10^{-6}$) with 0.891 M NaOH(aq). If o-Cresolphthalein (endpoint 8.3-9.8) is used as an indicator, you reach the endpoint when 31.37mL of base is added. Based on this data, what is the concentration of the acid? Would your result change if Bromoeresol Green (endpoint 3.9-5.4) was used as an indicator? If so, how? Which indicator (o-Cresolphthalein or Bromoeresol Green) more correctly indicates the equivalence point in this titration? (Explain your answers!) (21pts)

Score