Chem 202-02 **EXAM III** **April 4, 2018**

INFORMATION, SCRAP, AND COVER PAGE

This page contains information which may or may not be needed. This page can also be used for scrap paper or for cover paper. THIS PAGE WILL NOT BE COLLECTED. TEAR THIS PAGE OFF THE EXAM. DO NOT TURN IN THIS PAGE.

$$R = 0.08206 \text{ atm} \cdot \text{L}/(\text{mol} \cdot \text{K}) = 8.314 \text{ J}/(\text{mol} \cdot \text{K}) \text{ or J/K}$$

$$T(\text{K}) = T(^\circ\text{C}) + 273$$

Free energy $$\Delta G^\circ = -RT \ln K$$

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

Henderson-Hasselbalch $$\text{pH} = \text{p}K_\text{a} + \log \frac{\text{base}}{\text{acid}}$$

Acid Dissociation constants, K_a

Name	Formula	Alternate	(Step)	K_a
chloroacetic acid	$ClCH_2CO_2H$	$ClCH_2C(O)OH$		1.4×10^{-3}
hydrofluoric acid	HF			6.8×10^{-4}
hypochlorous acid	HClO	ClOH		3.0×10^{-8}
nitrous acid	HNO_2	ONOH		7.1×10^{-4}
oxalic acid	$H_2C_2O_4$	HO(O)CC(O)OH	(1)	5.4×10^{-2}
			(2)	5.4×10^{-5}

Solubility Products, K_{sp}

Name	Formula	K_{sp}	Name	Formula	K_{sp}
barium chromate	$BaCrO_4$	1.2×10^{-10}	lead(II) sulfate	$PbSO_4$	2.5×10^{-8}
calcium sulfate	$CaSO_4$	4.9×10^{-5}	magnesium fluoride	MgF_2	5.2×10^{-11}
iron(II) hydroxide	$Fe(OH)_2$	4.9×10^{-17}	silver chloride	AgCl	1.8×10^{-10}

Complex Formation Constants, K_f

Formula	K_f	Formula	K_f
$Ag(NH_2)_2^+$	1.1×10^7	$HgBr_4^{2-}$	1.0×10^{21}
$Cu(CN)_4^{3-}$	2.0×10^{30}	$Zn(NH_3)_4^{2+}$	2.9×10^9

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PRINT NAME _____

SIGN NAME _____

CIRCLE your recitation section in the list below.

A:	W	8:00	NS 130	B:	F	1:00	HM 210
C:	T	9:00	NS 108	D:	W	9:00	NS 317
E:	Th	9:00	HM 210	F:	F	12:00	NS 128

SCORED GRADE: _____

All answers should be with the correct significant figures.

The Periodic Table and the Information Page will not be collected. They can be used as scratch paper or as cover paper. Do not turn them in.

Be certain your answers are clear. If an answer is not clear, it can be considered wrong.

Problems marked with ** in the margin are derived from the assigned homework. These total 40 points.

Place your name in the space provided at the top of each question page. This helps to identify the pages if they are accidentally separated during grading and processing.

Work promptly. Use your time effectively.

last name: _____

KEEP YOUR WORK AND ANSWERS COVERED.

1. (30 pts) Indicate whether each statement is true (T) or false (F). Be certain T or F is clearly indicated.

_____ Water is amphoteric.

_____ Increasing the acidity of a solution gives an increase in pH.

_____ When HF(*g*) dissolves in water, H_2O molecules can break apart the covalent bonds of HF molecules, at least to some extent.

_____ A solution of pH = 6 is more basic than a solution of pOH = 6.

_____ 0.01 M H_2SO_4 has a higher pH than 0.01 M $H_2C_2O_4$.

_____ The sum of $pK_a + pK_b$ for a conjugate pair is equal to pK_w.

_____ A solution of methylamine is basic.

_____ Sn^{2+} is basic.

_____ The addition of a strong acid to a buffer gives a relatively small increase in pH.

_____ The shape of the complex $Ni(CN)_4^{2-}$ is octahedral.

** 2. (6 pts) A solution contains 0.0047 mol HF and 0.026 mol KF in 700.0 mL volume. Circle the pH.

2.48	2.57	2.63	2.77	2.88	2.96
3.16	3.31	3.46	3.61	3.76	3.91

3. (6 pts) Circle the solubility (in M) of AgCl in a solution of 0.00873 M $AgNO_3$.

1.2×10^{-9}	3.7×10^{-9}	4.9×10^{-9}	8.3×10^{-9}	2.1×10^{-8}	3.1×10^{-8}
5.6×10^{-8}	6.3×10^{-8}	9.0×10^{-8}	1.4×10^{-7}	3.5×10^{-7}	4.1×10^{-7}

last name: _____

** 4. (8 pts) A solution was prepared by dissolving 0.00640 mol sodium hypochlorite in 500. mL solution. Circle the concentration (in M) of HClO.

3.2×10^{-6}	5.7×10^{-6}	7.2×10^{-6}	9.3×10^{-6}	1.9×10^{-5}	4.8×10^{-5}
6.5×10^{-5}	7.5×10^{-5}	2.2×10^{-4}	4.1×10^{-4}	5.8×10^{-4}	8.1×10^{-4}

Circle the pH. Above answer must be correct for credit here.

8.33	8.50	8.76	8.86	8.97	9.20
9.34	9.68	9.81	9.88	10.34	10.61

5. (8 pts) Indicate whether separate solutions of each of the following are acidic (A), basic (B) or neutral (N).

$BeCl_2$ _____ Na_3AsO_4 _____ $CsHC_2O_4$ _____ hydrazinium nitrate _____

6. (6 pts) A solution at equilibrium contains 0.0010 M of the complex, $Zn(NH_3)_4^{2+}$, and 0.0025 M NH_3. Circle the value (in M) for $[Zn^{2+}]$.

0.0015	0.0023	0.0030	0.0036	0.0044	0.0051
0.0059	0.0062	0.0067	0.0078	0.0080	0.0088

** 7. (3 pts) Give the formula of the conjugate base of phosphoric acid. _____

(3 pts) Give the formula of the conjugate base of bicarbonate ion. _____

last name: _____

** 8. (8 pts) 0.0512 mol of chloroacetic acid, $ClCH_2CO_2H$, is dissolved in water to make 800. mL of solution. Circle the concentration (in M) of $ClCH_2CO_2^-$.

0.0032	0.0039	0.0046	0.0053	0.0060	0.0067
0.0074	0.0081	0.0088	0.0095	0.010	0.012

Circle the percent dissociation. Above answer must be correct for credit here.

4.3%	5.6%	6.0%	7.2%	8.3%	9.4%
10.%	11%	12%	14%	16%	18%

** 9. (6 pts) Circle all acids below which are monoprotic.

acetic acid nitric acid oxalic acid chlorous acid carbonic acid

** 10. (6 pts) Write the balanced equation for the base dissociation of cyanide ion

11. (5 pts) Consider pure water and the various solutions below. Circle the one which will give the highest overall solubility for CO_2.

pure water 0.01 M H_2SO_4 0.01 M HCl 0.01 M NH_3 0.01 M KOH

12. (5 pts) The solubility of lead(II) hydroxide in plain water is 1.5×10^{-7} M. Circle the value for K_{sp}. (There are no significant, simultaneous equilibria.)

2.1×10^{-22}	6.3×10^{-22}	8.0×10^{-22}	1.4×10^{-20}	4.3×10^{-20}	6.3×10^{-20}
8.3×10^{-18}	2.6×10^{-18}	3.1×10^{-18}	4.9×10^{-16}	6.5×10^{-16}	7.0×10^{-16}