

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

$$\Delta G^{\circ} = -RT \ln K$$

	ΔH_f° kJ/mol	S° J/K·mol	ΔG_f° kJ/mol
Bromine			
$\text{Br}_2(l)$	0	152.21	0
$\text{Br}_2(g)$	30.91	245.39	3.13
$\text{Br}_2(aq)$	-2.59	130.5	3.93
$\text{Br}^-(aq)$	-121.55	82.4	-103.96

Quadratic Equation

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

Henderson-Hasselbalch

$$\text{pH} = \text{p}K_a + \log \frac{\text{base}}{\text{acid}}$$

K_a Values	$\text{C}_3\text{H}_7\text{CO}_2\text{H}$	1.5×10^{-5}		
	CO_2	(1) 4.5×10^{-7}	(2) 4.7×10^{-11}	
	HClO	3.0×10^{-8}		
	H_3PO_4	(1) 7.1×10^{-3}	(2) 6.3×10^{-8}	(3) 4.5×10^{-13}

K_b Values	NH_3	1.8×10^{-5}
	N_2H_4	1.0×10^{-6}
	$\text{C}_5\text{H}_5\text{N}$	1.7×10^{-9}

K_{sp} Value	PbI_2	9.8×10^{-9}
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K_f Values	$\text{Ag}(\text{S}_2\text{O}_3)^{3-}$	2.9×10^{13}	(1) 6.6×10^8	(2) 4.4×10^4
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PRINT NAME _____

SIGN NAME _____

CIRCLE your recitation section in the list below.

15: M 9:00 DA 103

16: M 10:00 CB 16

17: T 11:00 CB 329

18: W 8:00 CB 16

19: W 12:00 CB 329

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 directly from the assigned homework. These total 30 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.

****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.

- _____ $\text{Br}_2(l)$ is more soluble in water at higher temperature.
- _____ In the industrial production of ammonia, higher temperature gives both a faster reaction and a greater K value.
- _____ Calcium oxide is basic.
- _____ For a basic solution, $\text{pOH} > \text{pH}$.
- _____ The acid dissociation of HF in water is favored by entropy.
- _____ For every weak acid, its conjugate base is weak.
- _____ Barium ion is basic.
- _____ Addition of strong acid to a buffer solution will raise the pH.
- _____ Iron(II) hydroxide is more soluble in a solution at pH 9 than in a solution at pH 5.
- _____ AgCl is more soluble in $\text{NH}_3(aq)$ than in pure water.

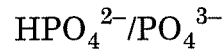
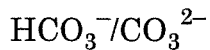
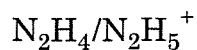
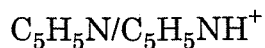
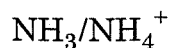
2. (6 pts) Circle the solubility (in M) of lead(II) iodide in a solution of 0.0028 M lead(II) nitrate.

2.7×10^{-6}	5.8×10^{-6}	7.1×10^{-6}	3.9×10^{-5}	7.6×10^{-5}	9.1×10^{-5}
4.5×10^{-4}	8.2×10^{-4}	9.4×10^{-4}	1.6×10^{-3}	4.4×10^{-3}	7.2×10^{-3}

- ** 3. (6 pts) A 500. mL solution is prepared using 0.0198 mol butyric acid, $\text{C}_3\text{H}_7\text{CO}_2\text{H}$. Circle the percent dissociation at equilibrium.

0.23%	0.41%	0.78%	1.3%	1.5%	1.9%
2.2%	2.4%	2.8%	3.0%	3.3%	3.6%

4. (5 pts) Circle all conjugate pairs below which are suitable for a buffer at pH = 9.60.



- ** 5. (6 pts) Consider pure water versus the separate solutions as given below. Circle the one which will give the highest solubility for ZnCO_3 .

pure water

0.01 M Na_2CO_3 0.01 M $\text{Zn}(\text{NO}_3)_2$ 0.01 M $\text{CH}_3\text{CO}_2\text{H}$ 0.01 M HNO_3

- ** 6. (8 pts) A buffer solution is prepared from 0.00519 mol NaH_2PO_4 and 0.00150 mol Na_2HPO_4 in a total volume of 300. mL. Circle the pH of the original solution.

6.62

6.66

6.69

6.72

6.75

6.78

6.80

6.83

6.87

6.91

6.95

6.99

Circle the pH after adding 23.0 mL of 0.0774 M KOH to the buffer.

6.81

6.84

6.87

6.90

6.96

6.98

7.01

7.04

7.08

7.12

7.16

7.18

- ** 7. (5 pts) Give the balanced equation for solubility with base dissociation for $\text{Ag}_2\text{C}_2\text{O}_4$. (You can leave out phases.)

last name: _____

8. (8 pts) Write a balanced equation and the K_b expression for the weak base dissociation of sulfite. (You can leave out phases.)

9. (8 pts) Indicate whether separate solutions of each of the following are acidic (A), basic (B) or neutral (N).

AuCl_3 _____ NH_4HSO_4 _____ Rb_2CO_3 _____ $\text{Ca}(\text{NO}_3)_2$ _____

** 10. (5 pts) A solution contains 0.630 g sodium hydroxide in 500.0 mL. Circle the pH.

10.11 10.43 10.62 10.97 11.23 11.40
11.69 11.84 12.06 12.27 12.50 12.63

11. (5 pts) Ag^+ forms a complex with thiosulfate to give $\text{Ag}(\text{S}_2\text{O}_3)_2^{3-}$. Consider a solution at equilibrium with 0.0018 M $\text{Ag}(\text{S}_2\text{O}_3)_2^{3-}$ and 0.0023 M $\text{S}_2\text{O}_3^{2-}$. Circle the concentration of the intermediate complex, $\text{Ag}(\text{S}_2\text{O}_3)^-$ (in M).

1.2×10^{-9} 5.3×10^{-9} 3.5×10^{-8} 6.0×10^{-8} 4.8×10^{-7} 9.7×10^{-7}
 2.5×10^{-6} 7.1×10^{-6} 1.8×10^{-5} 8.4×10^{-5} 4.0×10^{-4} 9.0×10^{-4}

12. (2 pts) In addition to H_3O^+ , what other cation is present in every acidic solution? _____

(2 pts) Give the formula of one diatomic, strong acid. _____

(2 pts) Of HClO_3 , HIO_3 and HIO_4 , which is the weakest? _____

(2 pts) Give the name of the shape of an ML_2 complex. _____