

1. Complete the following tables. If a square is darkened, you do not have to determine that value.

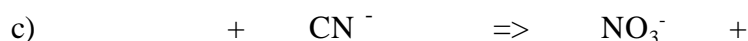
Note: The data in the tables below **will not agree** with the K_{sp} table which has been provided.

Therefore, **do not use any of that data on this problem.** (8 pts)

Compound	K_{sp}	molar sol(s)	gram sol	[cation]	[anion]
barium permanganate					0.00040

Compound	K_{sp}	gram sol	molar sol(s)	[cation]	[anion]
iron(II) carbonate			5.6×10^{-6}		

2. Complete the following proton transfer reactions(6 pts)



3. What would the solubility be of iron(II) hydroxide in a 0.0010M solution of potassium hydroxide?(6 pts)

4. A solution of phosphoric acid has $[\text{H}^+] = 5.3 \times 10^{-3}$. Determine the concentrations of all **three conjugate bases** this solution will contain.(6 pts). Be certain to give the chemical formula of each of the conjugate bases.

5. If equal volumes of 0.002 M barium nitrate and 0.003M potassium fluoride are combined, will a precipitate form? Explain your answer(6 pts)

6. A student reports that the reaction of fluoride ion with $\text{C}_2\text{H}_5\text{NH}_3^+$ results in complete conversion of the fluoride ion into HF. Is this the expected result? Explain your answer.(6 points)

7. In an acid-base titration, it is found that 23.4mL of 0.100M NaOH are required to titrate 0.384g of the weak acid. What is the acid's equivalent weight?(6 points)

8. For the following solutions, provide complete treatments, with the following exception: **if the solution is neutral, just write "neutral"**. For weak acids and bases, it is **not acceptable** to go directly to the quadratic solution.(16 pts)

a) 0.025M HNO_3

b) 0.15M potassium perchlorate

c) 0.015M $\text{CH}_2\text{ClCO}_2\text{H}$

d) 0.10M NaHCO_2

9. You wish to prepare a buffer with a pH of 4.20

a) Identify a suitable conjugate acid/base pair and give the chemical formulas of each.(2 points)

b) For the acid you chose, what concentrations of acid and base would give the desired pH? **Provide concentrations, not just the ratio.** Recall that the $[\text{HA}]$ can be set to 1.00M(4 points)

c) If 50.0mL of distilled water were added to 50.0mL of your buffer from b), what would the resultant pH be?(2 points)

c) If 20mL of 0.30M HCl is added to 75.0 mL of the buffer from b), what would the resultant pH be?(4 points)

10. If carbonate ion is added to a solution which is 0.0050M in both Cu^{2+} and Ag^+ , which cation will precipitate first and at what concentration of carbonate?(6 points)

11. You have a mixture which contains the following cations: Ba^{2+} , Ca^{2+} , and Mn^{2+} . Describe how you could separate them using anions to form ppts. Identify the anion you would use for each cation and the order in which you would add the anions to the mixture.(6 pts)

12. Briefly, describe a LeChatelier effect in acid/base chemistry.(4 points)

13. Using the table of K_{sp} s provided, identify two species whose solubilities should increase with

decreasing pH (addition of acid) and two whose solubilities should not change with decreasing pH. Briefly explain the reasoning behind your choices.(6 points)

14. In the space below, sketch and label completely the titration curve that would result from the titration of a weak monoprotic acid with 0.10M NaOH.(6 pts)

Exam 2

5/20/04

1. For each of the following descriptions, **circle the correct description** of the relation between temperature and spontaneity.(3 points each)

a) $\Delta H < 0$ and $\Delta S < 0$

always spontaneous at lower temperatures at higher temperatures never spontaneous

b) $\Delta H < 0$ and $\Delta S > 0$

always spontaneous at lower temperatures at higher temperatures never spontaneous

2. A reaction has an equilibrium constant of 5.30×10^3 at 86°C . What is ΔG° in KJ?(5 pts)

3. What is the equilibrium constant for a process with $\Delta G^\circ = 23.1 \text{ KJ}$?(5 pts)

4. The enthalpy of vaporization of carbon dioxide is 16.1 KJ/mole at -60°C . What is its entropy of vaporization?(5 pts)

5. Calculate E° , K and ΔG° for the following:(6 pts each)

a) The oxidation of iron(II) by Au^{3+}

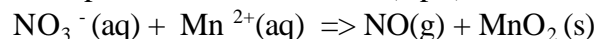
b) The reduction of I_2 by Hg(l) going to Hg_2^{2+}

6. Balance the following redox equations(6 pts each)

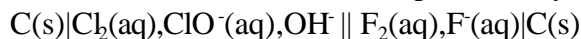
a) $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{Fe}(\text{s}) \Rightarrow \text{Fe}^{2+}(\text{aq}) + \text{Cr}^{3+}(\text{aq})$ (acidic)

b) $\text{SO}_3^{2-}(\text{aq}) + \text{ClO}_2(\text{g}) \Rightarrow \text{S}(\text{s}) + \text{ClO}_3^-(\text{aq})$ (basic)

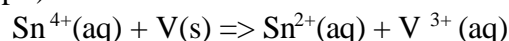
7. When the reaction below is driven electrolytically what would be the mass **produced at the cathode** if a current of 3.20amps flowed for 2.90hours?(8 pts)



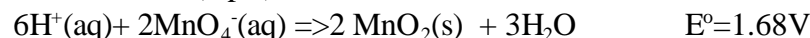
8. Give the **unbalanced** redox reaction represented by the following cell presentation.(5 pts)



9. Using standard cell notation (as shown in problem 7), present the reaction shown below as an electrochemical cell.(5 pts)



10. Using the **balanced redox equation**, given below, and the other information provided, calculate E for the reaction below at 25°C .(8 pts)



$[\text{H}^+] = 0.50\text{M}$; $[\text{MnO}_4^-] = .20\text{M}$

11. For each of the following, write an unbalanced redox reaction and, **using only the positional relationships in the electrochemical series** explain whether or not the reaction would be spontaneous under standard conditions(3 pts each)

a) F_2 oxidizing $\text{Fe}(\text{s})$?

b) The oxidation of Br^- by cobalt(II)

c) The reduction of Fe^{2+} by $\text{Ni}(\text{s})$

d) $\text{Cd}(\text{s})$ acting as a reducing agent toward $\text{S}(\text{s})$

e) (No equation required) Identify a compound which will be reduced by $\text{Sn}(\text{s})$, but not by $\text{Fe}^{2+}(\text{aq})$

12. Answer **any two** of the following, but **do only 2!**(6 pts each)

a) Why is the balanced redox equation not needed in solving a Faraday's Law problem?

b) To provide the needed protection, chrome plating must be intact while a zinc coating(galvanization) need not be?

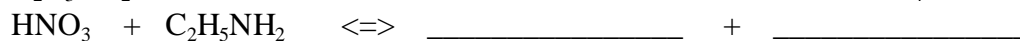
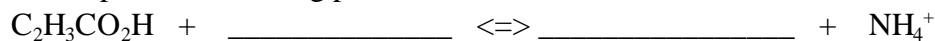
c) Explain why the use of permanganate as an oxidizing agent requires solutions of very low pH

d) What can be stated about a process whose direction of spontaneity is temperature dependent?

Quiz 1-Freebie

Quiz 2

1. Complete the following proton transfer reactions:



2. Complete the following table:

[H+]	[OH-]	pH	pOH
0.0067			
			5.41

Quiz 3

1. For each of the following, calculate either the [H+] or [OH-], depending on whether the material is an acid or base, using the weak approx and determine whether the approx is valid or not. Stop at that point.

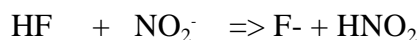
a) 0.030M HCO₂H

b) 0.010M C₃H₁₁N

Quiz 4

1. Identify an acid which would be appropriate for the preparation of a pH=2.54 buffer and calculate its pKa.

2. What is K for the following proton transfer reaction? Is your result consistent with the reaction running downhill?



Quiz 5

1. Complete the following tables for compounds shown

nickel(II) carbonate

Ksp	Gram solubility	[cation]	[anion]
	4.4*10 ⁻⁴		

Tl(OH)₃

Ksp	Gram solubility	[cation]	[anion]
6.3*10 ⁻⁴⁶			

Quiz 6-Freebie

Quiz 7

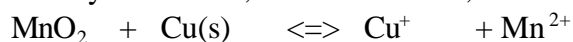
1. Assign oxidation numbers to all of the elements in the following compounds. If a single element appears more than once, you may assume it has the same oxidation number.

a) K₂C₂O₄

b) BCl₃

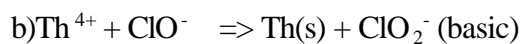
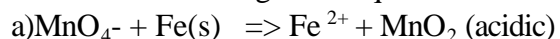
c) NO₂⁻

2. Fully breakdown, as shown in class, the following redox reaction:



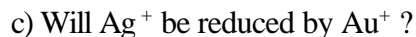
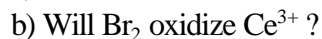
Quiz 8

Balance the following redox equations

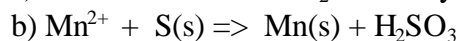


Quiz 9

1. Answer each of the following with a brief explanation **based solely upon relative position in the EC Series.**



2. Calculate E° for the following:



Quiz 10

1. Calculate K and ΔG for the reaction shown below



2. $\text{Cl}_2(\text{g})$ is produced by the electrolysis of molten NaCl ($2\text{Cl}^- \Rightarrow \text{Cl}_2$).

a) Would the chlorine be produced at the anode or cathode?

b) How many **grams** of chlorine would be produced by a current of 23.1 amps flowing for 2.7 hours?

Quiz 11-Freebie

Quiz 12

1. Name the following



2. Give structural formulas (as in Prob 1, above) including proper positioning of the functioning groups, for the following



3. Complete **one** of the following reactions (**only 1!**)

