

## Water Chemistry Homework 2.

**Remember: NEAT and orderly.**

*Organize problems so they are presented in the same order as the problem numbers. Do not rewrite the problems, but do number the answers (use the a's and b's too!). Show work as appropriate.*

1. Complete the following table. Do not show work. Use this page.

[H <sup>+</sup> ] (M)	[OH <sup>-</sup> ] (M)	pH	pOH
3.6 x 10 <sup>-9</sup>			
	0.0582		
		2.12	
			7.28

2. Write the answers for question 2 on this page.

At 50°C,  $K_w = 1.85 \times 10^{-13}$ .

a. What is the pH of pure water at 50°C? (Show formulas used!)

b. Fill in the table below for water at 50°C.

[H <sup>+</sup> ] (M)	[OH <sup>-</sup> ] (M)	pH	pOH
	9.6 x 10 <sup>-9</sup>		
			7.86

3. Fill in the blank with "increase", "decrease" or "stay the same".

a. When pH is increased, the concentration of most metal ions will \_\_\_\_\_.

b. When pH is increased, the solubility of hydrogen sulfide will \_\_\_\_\_.

c. When pH is increased, the toxicity of cyanide will \_\_\_\_\_.

d. When pH is increased, the concentration of carbonate ion will \_\_\_\_\_.

e. When pH is increased, the volatility of ammonia will \_\_\_\_\_.

f. When pH is increased, the total phosphate concentration will \_\_\_\_\_.

4. Classify the following as "oxidizing agent", "reducing agent" or "neither"

Bromine (Br<sub>2</sub>)

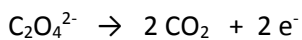
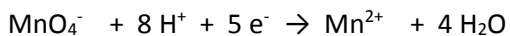
Sodium hypochlorite (NaOCl)

Oxygen gas (O<sub>2</sub>)

Zinc metal (Zn)

Carbon dioxide (CO<sub>2</sub>)

5. Classify the following reactions as "oxidation" or "reduction"



Converting nitrogen into ammonia

Converting ammonia into nitrate

Converting organic matter into CO<sub>2</sub> and water

6. Use the Deffeyes diagrams (Figs 3.3 and 3.4) in your text to answer the following questions:
- At a pH = 7.0 and total carbonate = 2 mmol/L, what is the alkalinity?
  - At pH = 8.0 and alkalinity = 3 meq/L, what is the total carbonate concentration?
  - If the alkalinity is 1.5 meq/L and total carbonate is 2.5 meq/L, what is the pH?
  - If 1 meq of NaOH was added to the solution in "a" what is the new pH?
  - If the solution was diluted so that the alkalinity of solution "b" became 2 meq/L, what is the new pH?
  - If sodium carbonate was added to the solution in "c" so that the total carbonate was 3.5 mmol/L, what is the new pH?

7. What is the most dominant species
- of carbonate at pH 7.0?
  - of sulfur under highly oxidizing conditions?
  - of nitrogen under highly reducing conditions?
  - of phosphate at pH 3.0?
  - of hydrogen sulfide at pH = 9.0?

**Answer the following questions on a separate sheet of paper. Do not rewrite questions, but do number them. Show work as required.**

8. Explain the difference between DO, BOD and COD.
9. My mom lives across the street from a dairy farm and gets her water from a well. She has to purify her drinking water because of the high nitrate concentration. Explain how her water got so contaminated.
10. A solution has a total carbonate concentration of 2.50 mmol/L and a pH of 9.5. What is the concentration of carbonate and of bicarbonate in the sample?
11. What is the ratio of ammonia to ammonium ion in a sample with a pH = 9.0?
12. If 37.1 mg of organic material in a 1.50 L water sample and 15% of that matter is biodegradable, what is the biological oxygen demand in the sample? (make usual/reasonable assumptions). Is water at 25°C likely to be able to support that demand?
13. Why are you more likely to get water with a nasty odor in the bayou?
14. Under what pH conditions is phosphate most likely to be soluble? Why?
15. Define eutrophication, whether is it good or bad, and detail what contaminants contribute to it and why.