

**EXAM TWO**  
**CHM 203 (Dr. Mattson)**  
**30 SEPTEMBER 2009**

**Academic Integrity Pledge:**

*In keeping with Creighton University's ideals and with the Academic Integrity Code adopted by the College of Arts and Sciences, I pledge that this work is my own and that I have neither given nor received inappropriate assistance in preparing it.*

*Signature:*

**Instructions:** Show all work whenever a calculation is required! You will receive credit for how you worked each problem as well as for the correct answer. If you need more space, you may use the back of your periodic table — Write: "See PT" in box and then attach the periodic table. **BOX YOUR ANSWERS!** Write legibly.

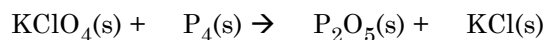
1. (4 pts) From what we learned about naming acids of the formula  $\text{HClO}_n$ , we can name similar acids of the other halogens by analogy. Circle the proper formula for each of these acids:

Hypofluorous acid	HFO	HFO <sub>2</sub>	HFO <sub>3</sub>	HFO <sub>4</sub>
Bromic acid	HBrO	HBrO <sub>2</sub>	HBrO <sub>3</sub>	HBrO <sub>4</sub>
Iodous acid	HIO	HIO <sub>2</sub>	HIO <sub>3</sub>	HIO <sub>4</sub>
Perastatinic acid	HAtO	HAtO <sub>2</sub>	HAtO <sub>3</sub>	HAtO <sub>4</sub>

2. (4 pts) Again, by analogy to the ions of the type  $\text{ClO}_n^-$ , write the formula for each of these salts:

sodium iodate
potassium perchlorate
calcium hypochlorite
cobalt(III) bromite

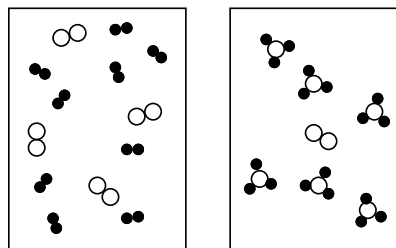
3. (4 pts) Balance the following equation using smallest whole numbers:



4. (3 pts) What is the formula and molar mass of ammonium sulfate?

5. (4 pts) How many moles of sodium carbonate are in a 25.0 g sample of the substance?

6. The drawing at left represents the reactants in a chemical reaction and the figure at the right is the product(s). The filled in small circles are atoms of "A" and the larger open circles are "B" atoms.



- 6a. (2 pts) What are the two reagents?

A   A<sub>2</sub>   B   B<sub>2</sub>   AB   AB<sub>3</sub>   BA<sub>3</sub>

- 6b. (2 pts) What is/are the products?

A   A<sub>2</sub>   B   B<sub>2</sub>   AB   AB<sub>3</sub>   BA<sub>3</sub>

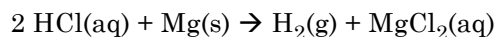
- 6c. (2 pts) What is the limiting reagent?

A   A<sub>2</sub>   B   B<sub>2</sub>   AB   AB<sub>3</sub>   BA<sub>3</sub>

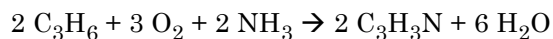
- 6d. (3 pts) Write a balanced equation for the reaction.

7. (4 pts) How many moles of calcium bromide are present in a 222 mL sample of 1.52 M solution?

8. (5 pts) What volume of 1.77 M HCl(aq) is needed to react completely with 10.70 g Mg?



9. Answer the following four questions (9a – 9d) regarding the production of acrylonitrile,  $C_3H_3N$ , the starting material for carpet fibers and fabrics. [Molar masses (g/mol):  $C_3H_6 = 42$ ;  $O_2 = 32$ ;  $NH_3 = 17$ ;  $C_3H_3N = 53$ ;  $H_2O = 18$ ]



9a. (5 pts) How many moles of oxygen,  $O_2$ , would be required to produce 40.0 moles of  $C_3H_3N$ ?

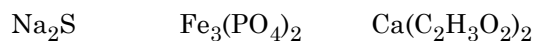
9b. (5 pts) What mass of  $C_3H_3N$  would be expected from 870 g  $C_3H_6$  and excess  $O_2$  and  $NH_3$ ?

9c. (5 pts) If 90.0 g  $C_3H_6$ , 60.0 g  $O_2$  and 40.0 g  $NH_3$  are reacted, which of these three is the limiting reagent?

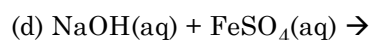
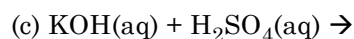
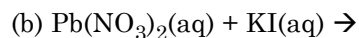
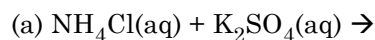
9d. (5 pts) Suppose that it was determined that the theoretical yield of  $C_3H_3N = 5.00$  mol, but during a particular synthesis, the actual yield turned out to be 225 g. What is the percent yield?

10. (5 pts) Molybdenum forms a sulfide that is 66.61% Mo by mass. What is its simplest formula?

11. (9 pts) Which of the following salts are soluble in water? Circle all that are.



12. (8 pts) Which of the following solutions, when mixed together, form a precipitate? Circle all that do.



13. (6 pts) Which of the following substances will form strongly electrolytic aqueous solutions? Circle all that do.

(a) ammonium nitrate     (b) perchloric acid

(c) hydrogen sulfide     (d) barium sulfate

(e) chromium(III) acetate     (f)  $C_{12}H_{22}O_{11}$

14. (2 pts) Which one of the following substances would form a weakly electrolytic aqueous solution?

(a) silver sulfide     (b) nitric acid

(c) ammonium acetate     (d) acetic acid

15. (4 pts) When aqueous solutions of calcium chloride and silver nitrate are mixed together, a precipitate forms. Write the net ionic equation.

16. (6 pts) Metallic aluminum is added to a solution of  $Cu^{+2}(aq)$ . The solution, originally blue turns colorless after several hours. Some aluminum metal remains, but most has been converted into  $Al^{+3}(aq)$ .

16a. What has been oxidized? Al  $Al^{+3}$  Cu  $Cu^{+2}$

16b. What has been reduced? Al  $Al^{+3}$  Cu  $Cu^{+2}$

16c. The limiting reagent is: Al  $Al^{+3}$  Cu  $Cu^{+2}$

(2 pt) Print your name here and sign Academic Integrity Statement on other side. (1 pt each)

## Answers.

1. HFO, HBrO<sub>3</sub>, HIO<sub>2</sub>, and HAtO<sub>4</sub>
2. NaIO<sub>3</sub>, KClO<sub>4</sub>, Ca(ClO)<sub>2</sub>, and Co(BrO<sub>2</sub>)<sub>3</sub>
3.  $5 \text{ KClO}_4(\text{s}) + 2 \text{ P}_4(\text{s}) \rightarrow 4 \text{ P}_2\text{O}_5(\text{s}) + 5 \text{ KCl}(\text{s})$
4. (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, MM = 132.1 g/mol
5. 0.236 mol Na<sub>2</sub>CO<sub>3</sub>
6.
  - 6a. A<sub>2</sub> and B<sub>2</sub>
  - 6b. BA<sub>3</sub>
  - 6c. A<sub>2</sub>
  - 6d.  $3 \text{ A}_2 + \text{B}_2 \rightarrow 2 \text{ BA}_3$
7. 0.337 mol CaBr<sub>2</sub>
8. 0.497 L
- 9a. 60 mol O<sub>2</sub>
- 9b. 1098 g C<sub>3</sub>H<sub>3</sub>N
- 9c. O<sub>2</sub> is the limiting reagent
- 9d. 85%
10. Mo<sub>2</sub>S<sub>3</sub>
11. Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>, NH<sub>4</sub>NO<sub>3</sub>, Na<sub>2</sub>S, and Ca(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub>
12. (b) and (d)
13. (a), (b) and (e)
14. (d)
15.  $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
- 16a. Al
- 16b. Cu<sup>+2</sup>
- 16c. Cu<sup>+2</sup>