

## Exam 2 Chm 203 (Dr Mattson) 26 September 2018

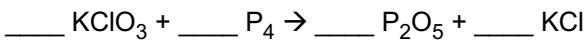
**Academic Integrity Pledge:** In keeping with Creighton University's ideals and with the Academic Integrity Code, I pledge that this work is my own and that I have neither given nor received inappropriate assistance in preparing it.

**Signature:**

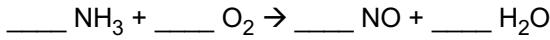
**Instructions:** Show all work whenever a calculation box is provided! Write legibly. Include units whenever appropriate. You will receive credit for how you worked each problem as well as for the correct answer. If you need more space, you may use the back of the data sheet provided — Write: "See data sheet" in the answer box — then write your name on the data sheet. On your desk you are allowed only pencils (but no pencil pouch), an eraser, and a non-programmable calculator without a slipcover. Backpacks, bags, and purse-like items must be stored on the tables in the back of the room. Cell phones must be silent and placed in your backpack/bag/purse — not in your pocket.

1. (3 pts each) Balance these equations with the smallest whole-number coefficients:

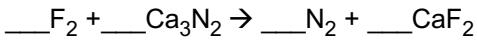
Answer with smallest whole-number coefficients.



Answer with smallest whole-number coefficients.



Answer with smallest whole-number coefficients.



2. (3 pts) Balance the reaction for the combustion of ethane,  $\text{C}_2\text{H}_6$  with the smallest whole-number coefficients.

Answer with smallest whole-number coefficients.

3. (3 pts) Aqueous ammonium chloride reacts with aqueous lead(II) nitrate to produce aqueous ammonium chloride and solid lead(II) chloride. Balance the reaction.

Answer with smallest whole-number coefficients.

- 4a. (4 pts) What is the molar mass of ammonium dichromate? Report answer to the hundredths place.

Show your work for full credit.

Answer to the hundredths place with units: \_\_\_\_\_

- 4b. (4 pts) How many moles of ammonium chloride are in a 150 g sample?

Show your work for full credit.

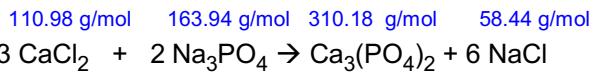
Answer with units: \_\_\_\_\_

Name:

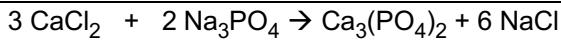
**Chemistry Student Number:** \_\_\_\_\_

(1 point bonus for completing 1. signature, 2. printed name and 3. your correct chemistry student number)

- 5a – 5e pertain to the equation below. Molar masses are given in blue above each compound formula.

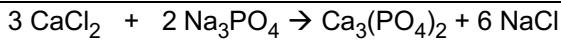


- 5a. (3 pts) How many moles of sodium phosphate are required to react stoichiometrically with 41.5 mmol of calcium chloride? Show your work for full credit.



Answer with units: \_\_\_\_\_

- 5b. (4 pts) Suppose 5.33 g  $\text{CaCl}_2$  and 7.16 g  $\text{Na}_3\text{PO}_4$  were reacted to produce the products as shown. Which is the limiting reagent? Show your work for full credit.



The limiting reagent is: \_\_\_\_\_

- 5c. (4 pts) Using your answer to 5b, what is the theoretical yield in grams of calcium phosphate?

Show your work for full credit.

Answer with units: \_\_\_\_\_

- 5d. (4 pts) What mass of the excess reagent is left over?

Show your work for full credit.

Answer with units: \_\_\_\_\_

- 5e. (3 pts) Suppose the actual yield of calcium phosphate is 4.82 g. What is the percent yield?

Show your work for full credit.

Answer: \_\_\_\_\_

6. (5 pts) Penicillin contains C, H, N, O and S. It is 57.45% C, 5.43% H, 8.38% N, 9.59% S and the rest is oxygen. What is the formula for penicillin?

Show your work for full credit.

Answer: \_\_\_\_\_

7. (5 pts) A sample of a hydrocarbon (a compound of C and H only) is combusted to yield 15.13 mg CO<sub>2</sub> and 7.744 mg H<sub>2</sub>O. What is the simplest formula? Given its molar mass is approximately 58 g/mol, what is the molecular formula of the compound?

Show your work for full credit.

Simplest formula: \_\_\_\_\_ Molecular formula: \_\_\_\_\_

- 8a. (4 pts) What is the molarity of a solution prepared by 14.7 g sodium acetate, MM = 82.03 g/mol in enough water to make 100.00 mL?

Show your work for full credit.

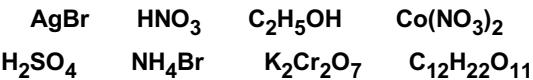
Answer with units: \_\_\_\_\_

- 8b. (4 pts) What volume in mL of the previous solution is needed to make 500.00 mL of a 7.50 × 10<sup>-2</sup> M solution?

Show your work for full credit.

Answer with units: \_\_\_\_\_

9. (8 pts) Circle all of the following compounds that are strong electrolytes when placed in distilled water? (Hint: Some do not dissolve.)



- 10a. (3 pts) Solutions of AgNO<sub>3</sub>(aq) and KI(aq) form a precipitate when mixed. Write the balanced overall equation for this reaction. **Include states of matter.**

\_\_\_\_\_

- 10b. (3 pts) Write the balanced net ionic equation for this reaction. **Include states of matter.**

\_\_\_\_\_

11. (8 pts) Which of these solutions, when mixed, are expected to form a precipitate? **Circle Yes** for a precipitate or **No** if no precipitate is expected. If a precipitate is expected, write its formula in the right-hand column; otherwise leave it blank.

| Will a precipitate form if we mix...                                                   | Precipitate is: |
|----------------------------------------------------------------------------------------|-----------------|
| Yes or No FeCl <sub>2</sub> (aq) + K <sub>2</sub> S(aq)                                | _____           |
| Yes or No Na <sub>2</sub> CO <sub>3</sub> (aq) + KCl(aq)                               | _____           |
| Yes or No K <sub>2</sub> SO <sub>4</sub> (aq) + Ba(NO <sub>3</sub> ) <sub>2</sub> (aq) | _____           |
| Yes or No CrCl <sub>3</sub> (aq) + KOH(aq)                                             | _____           |

12. (3 pts) Strong acids such as HBr(aq) dissociate 100% into ions. Specifically, HBr(aq) takes up with a water molecule to produce aqueous hydronium ion and aqueous bromide ion. Write the chemical equation for this dissociation. **Include states of matter.**

\_\_\_\_\_

- 13a. (3 pts) Aqueous perchloric acid undergoes a neutralization reaction with aqueous potassium hydroxide. Write the balanced overall equation for this reaction. **Include states of matter.**

\_\_\_\_\_

- 13b. (3 pts) Write the balanced net ionic equation for this reaction. **Include states of matter.**

\_\_\_\_\_

14. (10 pts) Nomenclature. Complete each of these. **Skip this question if you are nomenclature certified.**

|                           |                                |
|---------------------------|--------------------------------|
| nitrous acid              | _____                          |
| sodium hydrogen carbonate | _____                          |
| cobalt(III) nitrate       | _____                          |
| phosphorus triiodide      | _____                          |
| disulfur dichloride       | _____                          |
|                           | CrO <sub>3</sub>               |
|                           | HClO <sub>2</sub> (aq)         |
|                           | B <sub>3</sub> N <sub>3</sub>  |
|                           | K <sub>2</sub> SO <sub>3</sub> |
|                           | N <sub>2</sub> O <sub>5</sub>  |

Total score (out of 100): \_\_\_\_\_

A+ ≥ 95% A ≥ 90% B+ ≥ 85% B ≥ 80% C+ ≥ 75% C ≥ 70% D ≥ 60%

## Answers

1.  $10 \text{ KClO}_3 + 3 \text{ P}_4 \rightarrow 6 \text{ P}_2\text{O}_5 + 10 \text{ KCl}$   
 $4 \text{ NH}_3 + 5 \text{ O}_2 \rightarrow 4 \text{ NO} + 6 \text{ H}_2\text{O}$   
 $3 \text{ F}_2 + \text{Ca}_3\text{N}_2 \rightarrow \text{N}_2 + 3 \text{ CaF}_2$
2.  $2 \text{ C}_2\text{H}_6 + 7 \text{ O}_2 \rightarrow 4 \text{ CO}_2 + 6 \text{ H}_2\text{O}$
3.  $2 \text{ NH}_4\text{Cl} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbCl}_2(\text{s}) + 2 \text{ NH}_4\text{NO}_3$
- 4a. 252.08 g/mol
- 4b. 1.478 mol
- 5a. 0.0277 mol
- 5b.  $\text{CaCl}_2$
- 5c. 4.96 g
- 5d. 1.91 g
- 5e. 97%
6.  $\text{C}_{16}\text{H}_{18}\text{N}_2\text{SO}_4$
7.  $\text{C}_2\text{H}_5$  and  $\text{C}_4\text{H}_{10}$
- 8a. 1.79 mol/L
- 8b. 20.93 mL
9.  $\text{HNO}_3$      $\text{Co}(\text{NO}_3)_2$      $\text{H}_2\text{SO}_4$      $\text{NH}_4\text{Br}$      $\text{K}_2\text{Cr}_2\text{O}_7$
- 10a.  $\text{AgNO}_3(\text{aq}) + \text{KI}(\text{aq}) \rightarrow \text{Agl}(\text{s}) + \text{NaNO}_3(\text{aq})$
- 10b.  $\text{Ag}^+(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{Agl}(\text{s})$
11. Yes  $\text{FeS}(\text{s})$   
No  
Yes  $\text{BaSO}_4(\text{s})$   
Yes  $\text{Cr(OH)}_3(\text{s})$
12.  $\text{HBr}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{Br}^-(\text{aq})$
- 13a.  $\text{HClO}_4(\text{aq}) + \text{KOH}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{KClO}_4(\text{aq})$
- 13b.  $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow 2 \text{ H}_2\text{O}(\text{l})$
14.

|                           |                            |
|---------------------------|----------------------------|
| nitrous acid              | $\text{HNO}_2(\text{aq})$  |
| sodium hydrogen carbonate | $\text{NaHCO}_3$           |
| cobalt(III) nitrate       | $\text{Co}(\text{NO}_3)_3$ |
| phosphorus triiodide      | $\text{PI}_3$              |
| disulfur dichloride       | $\text{S}_2\text{Cl}_2$    |
| chromium(VI) oxide        | $\text{CrO}_3$             |
| chlorous acid             | $\text{HClO}_2(\text{aq})$ |
| triboron trinitride       | $\text{B}_3\text{N}_3$     |
| potassium sulfite         | $\text{K}_2\text{SO}_3$    |
| Dinitrogen pentoxide      | $\text{N}_2\text{O}_5$     |