Exam 2 Chm 203 (Dr Mattson) 28 September 2015

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:

Name:

Chemistry Student Number:
(the number you write on your folder activity sheets)

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 periodic table provided — Write: "See PT" in the answer box and then hand the periodic table in with your exam. 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 closed and stored on the floor under the table. Cell phones must be OFF and placed in your backpack/bag/purse – not in your pocket.

1. (16 pts) Write and balance the chemical equations for each of the following. Balance with the smallest whole number coefficients.

1a The reaction for the combustion of methane, CH_4.

1b. The reaction of PCl_5 and P_2O_5 to produce $POCl_3$.

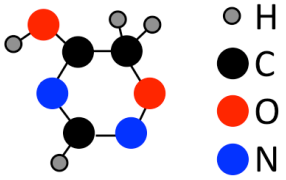
1c. The reaction between iron(III) oxide and carbon monoxide to produce elemental iron and carbon dioxide.

1d. The reaction $NH_3 + O_2 \rightarrow N_2 + H_2O$.

2. (10 pts) Circle those of the first ten elements that exist as diatomic substances under standard conditions?

H He Li Be B C N O F Ne

3. Hydantoin has the structure shown here. Refer to it to answer the Questions, 3a – 3d.



3a. (3 pts) What is the formula of hydantoin using the accepted format of listing C first, H second and then the remaining elements in alphabetical order?

3b. (4 pts) What is the molar mass of hydantoin, reported to the hundredths place?

Answer with units: _____

3c. (4 pts) How many moles of hydantoin are in a sample with mass 50.25 g?

Answer with units: _____

3d. (4 pts) What is the mass in g of 3.11×10^{-3} mol hydantoin?

Answer with units: _____

4. Stibnite is a sulfide ore of antimony with formula Sb_2S_3. It can be "roasted" with oxygen to produce antimony:

$$Sb_2S_3(s) + 3\ O_2(g) \rightarrow 2\ Sb(s) + 3\ SO_2(g)$$

4a. (4 pts) How many moles of oxygen are required to react with 0.730 mol stibnite?

Answer with units: _____

4b. (4 pts) What is the theoretical yield of Sb in moles when 0.730 mol stibnite is reacted with excess oxygen?

Answer with units: _____

4c. (4 pts) Suppose 0.432 mol of Sb_2S_3 and 1.11 mol O_2 were reacted. What is the limiting reagent? Show work!

Answer: _____

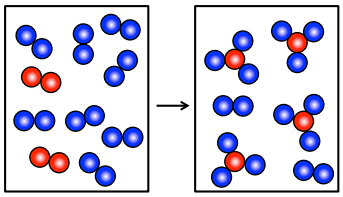
4d. (4 pts) Based on the quantities given in Question 4c, how many moles of the excess reagent are left over?

Answer with units: _____

4e. (4 pts) Based on the information given in Question 4c, what is the theoretical yield of sulfur dioxide (in moles)?

Answer with units: _____

5. Consider the figure to answer Question 5a and 5b. **The red atoms are A** and **the blue atoms are B.**



5a. (3 pts) Write and balance the chemical equation.

5b. (2 pts) What is the limiting reagent.

6. Consider the reaction:

$$V_2O_5 + 6\ HCl \rightarrow 2\ VOCl_3 + 3\ H_2O$$

6a. (4 pts) Given the molar masses, what is the theoretical yield in grams of $VOCl_3$ from 20.07 g V_2O_5 and excess HCl?

	Molar Mass
V_2O_5	181.88 g/mol
HCl	36.46 g/mol
$VOCl_3$	173.29 g/mol
H_2O	18.02 g/mol

Answer with units: _____

6b. (4 pts) Suppose 25.0 g HCl were used with 20.07 g V_2O_5. What mass of HCl is in excess?

Answer with units: _____

6c. (4 pts) Suppose the theoretical yield for $VOCl_3$ was 0.0213 mole. If the actual yield turned out to be 2.90 g, what is the percent yield?

Answer: _____

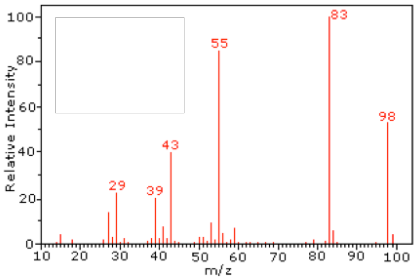
7. (4 pts) Acanthite is a mineral containing only silver and sulfur. Acanthite is 87.06% silver by mass. What is the formula for acanthite?

Answer: _____

8a. (4 pts) 4-methyl-3-pentene-2-one contains C, H and O. It is 73.43% C, 10.27% H, and the rest oxygen. Determine its empirical formula.

Answer: _____

8b. (4 pts) Based on the mass spectrum of 4-methyl-3-pentene-2-one shown here, what is the molecular formula of the compound?



9. (10 pts) Nomenclature. Complete the following table. (If your are nomenclature certified, skip this question.)

Name	Formula
calcium hypochlorite	
potassium cyanide	
sulfur hexafluoride	
nitrogen tribromide	
cobalt(II) nitrate	
	$LiHSO_4$
	$NH_4C_2H_3O_2$
	$KClO_2$
	FeS
	$NaClO_4$

Total score (out of 100): _____

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

Answers

1a. $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(g)$

1a. $3\ PCl_5(s) + P_2O_5(g) \rightarrow 5\ POCl_3(g)$

1a. $Fe_2O_3(s) + 3\ CO(g) \rightarrow 2\ Fe(s) + 3\ CO_2(g)$

1a. $4\ NH_3(g) + 3\ O_2(g) \rightarrow 2\ N_2(g) + 6\ H_2O(g)$

2. H_2 N_2 O_2 F_2

3a. $C_3H_4N_2O_2$

3b. 100.08 g/mol

3c. 0.502 mol

3d. 0.311 g

4a. 2.19 mol

4b. 1.46 mol

4c. O_2

4d. 0.062 mol Sb_2S_3 left over

4e. Theoretical Yield = 1.11 mol SO_2

5a. $A_2 + 3\ B_2 \rightarrow 2\ AB_3$

5b. A_2

6a. 38.23 g $VOCl_3$

6b. 0.87 g HCl in excess

6c. 78.6%

7. Ag_2S

8a. $C_6H_{10}O$

8b. $C_6H_{10}O$

9. (10 pts) Nomenclature. Complete the following table. (If your are nomenclature certified, skip this question.)

Name	Formula
calcium hypochlorite	$Ca(ClO)_2$
potassium cyanide	KCN
sulfur hexafluoride	SF_6
nitrogen tribromide	NBr_3
cobalt(II) nitrate	$Co(NO_3)_2$
lithium bisulfate or lithium hydrogen sulfate	$LiHSO_4$
ammonium acetate	$NH_4C_2H_3O_2$
potassium chlorite	$KClO_2$
iron(II) sulfide	FeS
sodium perchlorate	$NaClO_4$