Exam 2 Chm 203 (Dr Mattson) 6 October 2014

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:

Circle your Folder group:

H He Li Be B C N O F Ne Na Mg Al Si P

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 and purses must be closed and stored on the floor under the table. Cell phones must be OFF and placed in your backpack/purse – not in your pocket. When you re done, hand in your exam and periodic table and you are free to go. May you do well!

Questions 1 – 6 refer to the reaction:

$$P_4S_6 + 11\ KClO_2 \rightarrow 2\ P_2O_5 + 6\ SO_2 + 11\ KCl$$

1. (3 pts) How many moles of P_4S_6 would be required to react stoichiometrically with 0.830 mol $KClO_2$?

Answer with units:_____

2. (4 pts) Suppose 77.4 g P_4S_6 (MM = 316.24 g/mol) and 269 g $KClO_2$ (MM = 106.55 g/mol) were reacted together. What is the limiting reagent, and how many moles of the limiting reagent were initially present?

$P_4S_6 + 11\ KClO_2 \rightarrow 2\ P_2O_5 + 6\ SO_2 + 11\ KCl$

Limiting reagent_____ Moles of LR with units:_____

3. (4 pts) What **mass** of the excess reagent remains after the reaction is complete?

Answer with units:_____

4. (3 pts) What is the percent by mass of **sulfur** in P_4S_6?

Answer as %:_____ %

5. (3 pts) Another sulfide of phosphorus (besides P_4S_6) is known to exist. It consists of 56.29 % P. What is the empirical formula for this compound?

Answer:_____

6. (4 pts) One of the products obtained, P_2O_5, reacts readily with aqueous KOH as shown here:

$$P_2O_5(s) + 6\ KOH(aq) \rightarrow 2\ K_3PO_4 + 3\ H_2O$$

What volume of 0.944 M KOH(aq) is required to react completely with 2.682 g P_2O_5 (MM = 141.94 g/ mol)?

Answer with units:_____

7a. (4 pts) Suppose a 15.244 g sample of potassium sulfate was dissolved in water and diluted to a volume of 500.0 mL. What is the molar concentration of potassium ion to the correct number of sig figs?

Answer with units:_____

7b. (3 pts) Next, suppose 50.00 mL of the previous solution were diluted to 1.000 L. What is the new molar concentration of potassium sulfate to the correct number of sig figs?

Answer with units:_____

8. (4 pts) In a combustion analysis of an organic substance, known to contain only C, H, and O, a 8.5848 mg sample yields 18.861 mg CO_2 and 10.295 mg H_2O. What is the empirical formula for this substance?

Answer: _____

9. (6 pts) Which of these compounds, all water-soluble, are strong electrolytes? (More than one!)

KNO_3 $FeSO_4$ $HC_2H_3O_2$ HBr $CO(NH_2)_2$ Na_2CO_3

10. (6 pts) Which of these compounds are soluble in water? (More than one!)

$CuCO_3$ $(NH_4)_2SO_4$ $PbBr_2$ $BaSO_4$ Ag_2SO_4 $MgSO_4$

11. (6 pts) Which of these acids are also strong electrolytes? (More than one!)

$HClO_2$ HNO_3 HCN HF HI H_2SO_4

12. (4 pts) Which of these pairs of compounds, all in aqueous solution, would produce a precipitate when mixed? (More than one!)

A. $BaCl_2 + CuSO_4 \rightarrow$ B. $NaCl + Ag_2SO_4 \rightarrow$

C. $Na_2S + FeCl_2 \rightarrow$ D. $MgBr_2 + NaNO_3 \rightarrow$

13. Aqueous potassium phosphate and aqueous calcium chloride form a precipitate when mixed.

13a. (2 pts) Write the balanced chemical reaction, including phases, (s), (l), (g), (aq).

13b. (2 pts) Write the net ionic chemical reaction, including phases, (s), (l), (g), (aq).

14. (4 pts) Assign oxidation numbers to the phosphorus atom in each of these compounds.

P_4	H_3PO_4	PH_3	P_2O_3

15. (4 pts) Which of these are oxidation-reduction reactions? (More than one!)

A. $HF(aq) + KOH(aq) \rightarrow H_2O(l) + KF(aq)$

B. $2\ Na(s) + Cl_2(g) \rightarrow 2\ NaCl(s)$

C. $2\ Na_2S(s) + SO_2(g) \rightarrow 3\ S(s) + 2\ Na_2O(s)$

D. $Na_2CO_3(aq) + CaCl_2(aq) \rightarrow CaCO_3(s) + 2\ NaCl(aq)$

16. In class we saw the reaction between metallic aluminum and aqueous copper(II) chloride. We saw that solid metallic copper was formed and the other product was colorless $Al^{+3}(aq)$.

16a. (2 pts) Write and balance the **net ionic** reaction that took place.

16b. (2 pt) **Circle** the oxidizing agent and **draw a box** around the reducing agent.

Note: If you are Nomenclature Certified you may stop.

17. (5 pts) Name these substances.

H_2SO_3
$MnCO_3$
$HClO_3$
$KBrO_4$
P_2S_6

17. (5 pts) Circle the correct formula for each of these.

A. chromium(VI) phosphate

$Cr_6(PO_4)_2$ $CrPO_4$ $Cr(PO_3)_2$
Cr_6PO_4 $CrPO_3$ $Cr(PO_4)_2$

B. potassium chlorate

$PClO_2$ $KClO_4$ K_2ClO_3
K_2ClO_2 $KClO_3$ KClO

C. acetic acid

$H_2C_2H_3O_2$ $HC_2H_2O_3$ $H_2C_2H_2O_3$
$H_2C_2H_2O_2$ $HC_2H_3O_3$ $HC_2H_3O_2$

D. nitrogen trioxide

NO_2 NO_3 NO_2^- NO_3^- N_2O_3

E. ammonium sulfide

NH_3S NH_4S_2 $(NH_4)_2S$
$(NH_3)_2S_2$ $(NH_4)_2S_2$ $(NH_4)_2SO_4$

Subtotal from exam: _____

Folder work: (20 max) _____

Total: _____

Answers

1. 0.075 mol P_4S_6

2. 2.53 mol $KClO_2$

3. 4.82 g

4. 60.8%

5. P_4S_3

6. 0.120 L

7a. 0.350 M K^+

7b. 0.00875 M K_2SO_4

8. $C_3H_8O_1$

9. KNO_3 $FeSO_4$ HBr Na_2CO_3

10. $(NH_4)_2SO_4$ Ag_2SO_4 $MgSO_4$

11. HNO_3 HI H_2SO_4

12. A, B, and C

13a. $2\ K_3PO_4(aq) + 3\ CaCl_2(aq) \rightarrow Ca_3(PO_4)_2(s) + 6\ KCl(aq)$

13b. $2\ PO_4^{3-}(aq) + 3\ Ca^{2+}(aq) \rightarrow Ca_3(PO_4)_2(s)$

14. 0, +5, -3, +3

15. B and C

16a. $2\ Al(s) + 3\ Cu^{2+}(aq) \rightarrow 2\ Al^{3+}(aq) + 3\ Cu(s)$

16b. Oxidizing agent Cu^{2+} and the reducing agent is Al.

17. (5 pts) Name these substances.

H_2SO_3	sulfurous acid
$MnCO_3$	manganese(II) carbonate
$HClO_3$	chloric acid
$KBrO_4$	potassium perbromate
P_2S_6	diphosphorus hexasulfide

17.

A. $Cr(PO_4)_2$

B. $KClO_3$

C. $HC_2H_3O_2$

D. NO_3

E. $(NH_4)_2S$