Exam 3 Chm 203 (Dr Mattson) 9 October 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: _____

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 stored in the rear section of the room. Cell phones must be silent and placed in your backpack/bag/purse – not in your pocket.

1a. (4 pts) What is the molarity of a solution prepared by dissolving 10.07 g potassium phosphate in enough water to make 100.00 mL solution? (MM = 212.27 g/mol)

Show work for credit whenever a calculation box is provided!

Answer with units: _____

1b. (4 pts) What is the molarity of each ion?

Show work for credit!

Box your answers with units

2. (3 pts) How many moles of ammonium bromide are in 65 mL of 0.155 M solution?

Show work for credit!

Answer with units: _____

3. (3 pts) What volume of the 0.155 M ammonium bromide solution is needed to produce 0.0500 mol ammonium bromide? Express your answer in mL.

Show work for credit!

Answer with units: _____

4. (3 pts) Suppose 25.00 mL of 0.0987 M $Fe(NO_3)_2(aq)$ was diluted to 500.00 mL. What is the concentration of the resulting $Fe(NO_3)_2(aq)$ solution?

Answer with units: _____

5. (3 pts) Suppose 50.00 mL 0.30 M sodium chloride and 75.00 mL 0.40 M nickel(II) chloride were mixed. What is $[Cl^-]$ of the solution? The volumes are additive.

Answer with units: _____

6. (12 pts) Which of the following substances are predicted to be insoluble according to the solubility rules?

NH_4ClO_4	MnS	$MgCO_3$
$PbCl_2$	$FeSO_4$	$Ni(OH)_2$
$Ca_3(PO_4)_2$	NH_4ClO_2	Rb_2SO_4
Hg_2Cl_2	$AgC_2H_3O_2$	$BaSO_4$

7. (6 pts) A precipitate occurs when solutions of $Na_2CO_3(aq)$ and $AgNO_3(aq)$ are mixed. Write a balanced overall equation, ionic equation and net ionic equation for this reaction.

balanced overall equation

ionic equation

balanced net ionic equation

8a. (9 pts) Which of the following are strong acids?

$HClO_4$	H_2O	H_3PO_4
$HC_2H_3O_2$	HBr	HF
$HClO_2$	HNO_2	H_2SO_4

8b. (2 pts) From those listed above, write the formula for one example of a non-electrolyte.

9a. (5 pts) Classify each of the following as a precipitation reaction (**P**), acid-base reaction (**AB**), or no reaction (**NR**)? (Hint: Only one is no reaction)

P AB NR $HC_2H_3O_2(aq) + NaOH(aq) \rightarrow$

P AB NR $HCl(aq) + AgNO_3(aq) \rightarrow$

P AB NR $Na_2SO_4(aq) + NaBr(aq) \rightarrow$

P AB NR $K_2S(aq) + ZnBr_2(aq) \rightarrow$

P AB NR $HBr(aq) + KOH(aq) \rightarrow$

9b. (4 pts) Predict the products and balance the four reactions that actually take place. Do not complete and balance the one you determined to be No Reaction because there was no reaction.

$HC_2H_3O_2(aq) + NaOH(aq) \rightarrow$

$HCl(aq) + AgNO_3(aq) \rightarrow$

$Na_2SO_4(aq) + NaBr(aq) \rightarrow$

$K_2S(aq) + ZnBr_2(aq) \rightarrow$

$HBr(aq) + KOH(aq) \rightarrow$

10. (3 pts) Sketch the particles produced (the products) in solution when the following reaction is done with stoichiometric amounts of reagents. Do not include water molecules in your sketch.

$HClO_4(aq) + KOH(aq) \rightarrow$ (products)

11. (4 pts) How many moles of $HClO_4(aq)$ are required to react completely with 35.42 mL of 0.2277 M KOH(aq)?

Answer with units: _____

12. (5 pts) What volume of 0.100 M KOH(aq) is required to titrate 20.00 mL of 0.111 M $H_3PO_4(aq)$ as per the following reaction? Express your answer in mL.

$H_3PO_4(aq) + 3\ KOH(aq) \rightarrow K_3PO_4(aq) + 3\ H_2O(l)$

Answer with units: _____

13. (10 pts) Assign oxidation numbers to the sulfur atom in each of these:

SO_3^{2-}	K_2SO_4	SO_3	SO_2
$(NH_4)_2S$	S_2Cl_2	S_8	H_2SO_3

14a. (5 pts) Consider this reaction:

$I_2(aq) + SO_3^{2-}(aq) + 3\ H_2O(aq) \rightarrow$

$2\ I^-(aq) + SO_4^{2-}(aq) + 2\ H_3O^+(aq)$

What was oxidized? What was reduced?

What is the oxidizing agent?

What is the reducing agent?

Is this reaction (a) overall, (b) ionic, or (c) net ionic?

14b. (5 pts) What volume of 0.2104 M $K_2SO_3(aq)$ is required to react completely with 0.4117 g molecular iodine? Express your answer in mL.

Answer with units: _____

15. (10 pts) Nomenclature. Complete the following table. (If your are nomenclature certified, skip this question.)

chlorous acid	
hydroiodic acid	
potassium periodate	
sodium permanganate	
manganese(II) chlorate	
	$HBrO_2$
	$Ca(IO_3)_2$
	HBr
	$Fe(OH)_3$
	AgI

Total score (out of 100): _____

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

Answers

1a. 0.474 M

1b. 0.474 M PO_4^{3-} and 1.423 M K^+

2. 0.0101 mol

3. 323 mL

4. 0.00494 M $Fe(NO_3)_2(aq)$

5. $[Cl^-]$ = 0.60 M

6. MnS $MgCO_3$ $PbCl_2$ $Ni(OH)_2$ $Ca_3(PO_4)_2$ Hg_2Cl_2 $BaSO_4$

7. $Na_2CO_3(aq) + 2\ AgNO_3(aq) \rightarrow 2\ NaNO_3(aq) + Ag_2CO_3(s)$

$2\ Na^+(aq) + CO_3^{2-}(aq) + 2\ Ag^+(aq) + 2\ NO_3^-(aq) \rightarrow 2\ Na^+(aq) + 2\ NO_3^-(aq) + Ag_2CO_3(s)$

$CO_3^{2-}(aq) + 2\ Ag^+(aq) \rightarrow Ag_2CO_3(s)$

8a. $HClO_4$ HBr H_2SO_4

8b. H_2O

9a. **AB P NR P AB**

9b. $HC_2H_3O_2(aq) + NaOH(aq) \rightarrow H_2O(l) + NaC_2H_3O_2(aq)$

$HCl(aq) + AgNO_3(aq) \rightarrow HNO_3(aq) + AgCl(s)$

$K_2S(aq) + ZnBr_2(aq) \rightarrow ZnS(s) + 2\ KBr(aq)$

$HBr(aq) + KOH(aq) \rightarrow H_2O(l) + KBr(aq)$

10. The beaker should feature K^+ and ClO_4^- ions

11. 0.00807 mol

12. 66.6 mL

13.

SO_3^{2-} +4	K_2SO_4 +6	SO_3 +6	SO_2 +4
$(NH_4)_2S$ -2	S_2Cl_2 +1	S_8 0	H_2SO_3 +4

14a. The sulfur atom in SO_3^{2-} was oxidized; I_2 was reduced

I_2 was the oxidizing agent; SO_3^{2-} was the reducing agent; (c) net ionic?

14b. 7.71 mL

15.

chlorous acid	$HClO_2$
hydroiodic acid	HI
potassium periodate	KIO_4
sodium permanganate	$NaMnO_4$
manganese(II) chlorate	$Mn(ClO_3)_2$
bromous acid	$HBrO_2$
calcium iodate	$Ca(IO_3)_2$
hydrobromic acid	HBr
iron(III) hydroxide	$Fe(OH)_3$
silver iodide	AgI