

Exam 2 Chm 203 (Dr Mattson) 30 September 2013

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

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.

1. (3 pts) Write the balanced equation for the combustion of propane, C₃H₈.

2. (3 pts) Balance the following reaction with the smallest whole-number coefficients.



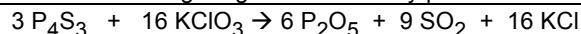
Questions 3 – 10 refer to the following balanced equation (which we discussed in class along with a demo):



3. (3 pts) How many moles of KClO₃ would be required to react stoichiometrically with 7.10 mol P₄S₃?

Answer with units: _____

4. (4 pts) Suppose 0.538 g P₄S₃ (MM = 220.1 g/mol) and 0.821 g KClO₃ (MM = 122.6 g/mol) were reacted together. What is the limiting reagent, and how many moles of the limiting reagent were initially present?



Limiting reagent _____ Moles of LR: _____

5. (3 pts) Suppose 30.0 g P₄S₃ were reacted with excess KClO₃ and 34.3 g P₂O₅ (MM = 141.9 g/mol) were obtained. What is the percent yield in this reaction?

Answer with units: _____

6. (3 pts) What is the percent by mass of phosphorus in P₄S₃?

Answer with units: _____

7. (4 pts) The formula P₂O₅ is an empirical formula. Suppose we found out that the actual MM was about 284 g/mol. What is the actual molecular formula?

Answer with: _____

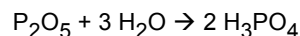
8. (4 pts) Another sulfide of phosphorus is known to exist that consists of 27.87 % P. What is the empirical formula for this compound?

Answer: _____

9. (1 pt) The formula you obtained in Question 8 and the formula P₄S₃ are examples of which law?

- A. Law of conservation of mass
- B. Law of definite proportions
- C. Law of multiple proportions
- D. Law of combining volumes

10. (3 pts) One of the products obtained, P₂O₅, reacts readily with water as shown here:



Suppose 0.442 mol of P₂O₅ were reacted with excess water and diluted to 1.000 L. What is the molar concentration of H₃PO₄?

Answer with units: _____

11. (5 pts) True/False about the solubility rules:

- T F All nitrates are soluble.
 T F All carbonates are soluble, except for Ag^+ , Pb^{2+} , and Hg_2^{2+} .
 T F All Group I salts are soluble.
 T F Sulfides are generally insoluble except for Group I and NH_4^+ .
 T F All chlorides are soluble.

12. (5 pts) What sort of solution results when each of the following compounds is placed in a beaker of water? Will the solution be a strong, weak or non-electrolyte?

- A. $\text{Ba}(\text{NO}_3)_2$ strong weak non-electrolyte
 B. FeCO_3 strong weak non-electrolyte
 C. $\text{HC}_2\text{H}_3\text{O}_2$ strong weak non-electrolyte
 D. HBr strong weak non-electrolyte
 E. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ strong weak non-electrolyte

13. (6 pts) Which of these compounds are considered soluble in water? There is more than one!

- A. NH_4Br B. PbCl_2 C. CuSO_4
 D. BaSO_4 E. $\text{KC}_2\text{H}_3\text{O}_2$ F. MgS

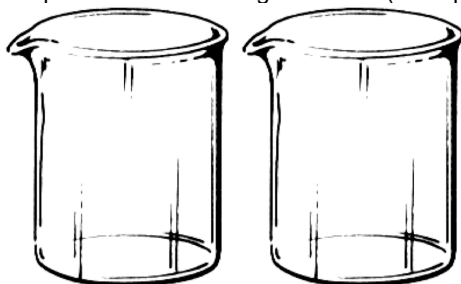
14. (4 pts) Match these reactions (all aqueous) with their type

- ___ Acid-base A. $\text{HF} + \text{KOH} \rightarrow \text{H}_2\text{O} + \text{KF}$
 ___ Precipitation B. $2 \text{Mg} + \text{O}_2 \rightarrow 2 \text{MgO}$
 ___ Redox C. $2 \text{NaBr} + \text{CuSO}_4 \rightarrow \text{CuBr}_2 + \text{Na}_2\text{SO}_4$
 ___ No reaction D. $\text{Na}_2\text{CO}_3 + \text{CaCl}_2 \rightarrow \text{CaCO}_3 + 2 \text{NaCl}$

15. (4 pts) Will a precipitate form if these two solutions are mixed? If so, identify the precipitate in the box at right.

$\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{K}_2\text{SO}_4(\text{aq}) \rightarrow$	Yes	No	
$(\text{NH}_4)_2\text{S}(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow$	Yes	No	

16. (4 pts) Sketch a representation of $\text{HCl}(\text{aq})$ in the beaker at on the left and $\text{HF}(\text{aq})$ in the beaker on the right. The sketches must correctly portray what ions, if any, are present. Show charges on ions (example, Na^+)



17. (2 pts) Write the net ionic reaction that takes place between any strong acid with any strong base?

18. 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 $\text{Al}^{3+}(\text{aq})$.

18a. (3 pts) Write and balance the net ionic reaction that took place.

18b. (2 pt) Circle the oxidizing agent and draw a box around the reducing agent.

19. (4 pts) Assign oxidation numbers to the sulfur atom in each of these compounds.

S_8	H_2S
H_2SO_3	SO_3

Note: If you are Nomenclature Certified you may stop.

20. (5 pts) Name these substances.

HNO_3
CoCO_3
HClO_2
KClO_3
N_2O_4

21. (5 pts) Circle the correct formula for each of these.

A. vanadium(V) phosphate

- $\text{V}_3(\text{PO}_4)_5$ VPO_4 $\text{V}_3(\text{PO}_3)_5$
 V_5PO_4 VPO_3 $\text{V}_5(\text{PO})_4$

B. potassium bromite

- PBrO_3 KBrO_4 K_2BrO_3
 K_2BrO_2 KBrO_2 KBrO

C. acetic acid

- $\text{H}_2\text{C}_2\text{H}_3\text{O}_2$ $\text{HC}_2\text{H}_2\text{O}_3$ $\text{H}_2\text{C}_2\text{H}_2\text{O}_3$
 $\text{H}_2\text{C}_2\text{H}_2\text{O}_2$ $\text{HC}_2\text{H}_3\text{O}_3$ $\text{HC}_2\text{H}_3\text{O}_2$

D. tetraphosphorus trisulfide

- $\text{P}_4(\text{SO}_3)_3$ $\text{P}_4(\text{SO}_4)_3$ P_5S_3
 P_4S_3 $(\text{PO}_4)_3\text{S}_3$ P_3S_4

E. nitrous acid

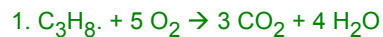
- HNO_2 HNO_3 HNO_4
 H_2NO_2 H_2NO_3 H_2NO_4

Subtotal from exam: _____

Folder work: (20 max) _____

Total: _____

Answers



3. 37.9 mol $KClO_3$

4. 0.00670 mol $KClO_3$

5. 88.6%

6. 56.3 % P

7. P_4O_{10}

8. P_2S_5

9. C

10. 0.884 M H_3PO_4

11. T F T T F

12.

A. $Ba(NO_3)_2$ strong electrolyte

B. $FeCO_3$ non-electrolyte

C. $HC_2H_3O_2$ weak electrolyte

D. HBr strong electrolyte

E. $C_{12}H_{22}O_{11}$ non-electrolyte

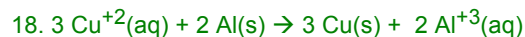
13. A C E

14. A D B C

15.

$Ba(NO_3)_2(aq) + K_2SO_4(aq) \rightarrow$	Yes	$BaSO_4(aq)$
$(NH_4)_2S(aq) + Na_2CO_3(aq) \rightarrow$	No	

16. Your sketch of $HCl(aq)$ should show 100% dissociated into H^+ (or H_3O^+) and Cl^- . $HF(aq)$ is a weak acid and the drawing should show mostly associated HF molecules and one dissociated H^+ (or H_3O^+) and F^- .



18b. The oxidizing agent is $Cu^{+2}(aq)$; the reducing agent is $Al(s)$.

19.

S_8 ox number = 0	H_2S ox number = -2
H_2SO_3 ox number = +4	SO_3 ox number = +6

20. (5 pts) Name these substances.

Nitric acid
Cobalt(II) carbonate
Chlorous acid
Potassium chlorate
Dinitrogen tetroxide

21. (5 pts) Circle the correct formula for each of these.

