

CHEM 1411 Unit 1

Version 1

Spring 2010

Name \_\_\_\_\_

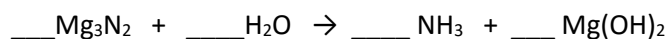
**Part 1: Fill in the blanks with the letter of the appropriate word or phrase from the word list, for 3 points each and a total of 30%. There are extra terms on the list.**

- |                       |   |
|-----------------------|---|
| a) Acid               | 1. A(n) _____ change is one that results in a change of identity for the substance that was tested.   |
| b) Atom               | 2. A(n) _____ is a sample of matter that has only one type of atom; it is as simple as matter can be.   |
| c) Centi-             | 3. Magnesium metal melts at 650.0 °C is an example of a(n) _____ property of matter.  |
| d) Chemical           | 4. The state of matter that has definite volume and definite shape is known as a(n) _____.  |
| e) Coefficients       | 5. _____ is the metric system prefix that indicates 1/1000 <sup>th</sup> of the base unit.  |
| f) Gas                | 6. A(n) _____ is a sample of matter that has two or more substances physically blended together in an arbitrary proportion; each substance retains its own characteristics. |
| g) Element            | 7. When writing the name of a(n) _____, we identify the negative ion name and modify its suffix (ending).   |
| h) Ionic compound     | 8. We can recognize the formula for a(n) _____ because it has a metal or $\text{NH}_4^{+1}$ in its formula.   |
| i) Kilo-              | 9. The _____ are the substances that are present after a chemical change occurs; they are written on the right of a chemical reaction equation.                             |
| j) Liquid             | 10. The _____ are the numbers in a chemical reaction equation that give the number of moles of each reactant and product; we fill these in when we balance the equation.    |
| k) Milli-             |   |
| l) Mixture            |   |
| m) Molecular compound |   |
| n) Nuclear            |   |
| o) Physical           |   |
| p) Products           |   |
| q) Pure substance     |   |
| r) Reactants          |   |
| s) Solid              |   |
| t) Subscript          |   |

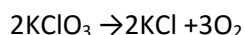
**Part II. Short Answer. Work each of the following problems or answer each question in the space provided. You must show your work and round answers to the correct number of significant figures, unless otherwise specified. 5 points each for a total of 50%.**

- How many significant figures does each number have?
  - $5.712 \times 10^4$  has \_\_\_\_\_ sig figs
  - 2200 has \_\_\_\_\_ sig figs
  - 0.00304 has \_\_\_\_\_ sig figs
- A student is asked to find the density of an unknown metal sample by water displacement. The sample has a mass of 58.18 g. The student pours 27.0 mL of water into a graduated cylinder. She adds the metal sample and notes that the liquid level rises to 33.5 mL. What is the density of her sample?
- Name these compounds:
  - $\text{CuNO}_3$
  - $\text{SeBr}_4$
  - $\text{H}_2\text{SO}_4$
- Write the formulas for these compounds:
  - barium carbonate
  - sulfur dichloride
  - nitric acid
- What is the molar mass of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ ? Round your answer to 4 significant figures.
- What is the mass percent of sodium in sodium sulfate,  $\text{Na}_2\text{SO}_4$ ? Round your answer to 5 significant figures.

- Balance this chemical reaction equation:



- 8.35 g of  $\text{Na}_2\text{SO}_4$  is dissolve in enough water to make 264 mL. What is its molarity?
- 75.0 mL of 3.0 M HCl is diluted to 1.5 L. What is the concentration of the diluted solution?
- How many moles of oxygen diatomic molecules are produced from the decomposition of 5.1 grams of potassium chlorate,  $\text{KClO}_3$ , by the following balanced reaction?



**Big problems choose your best two, and answer on the blank paper provided for 10 points each and a total of 20%:**

1. Compare and contrast the terms 'mixture' and 'compound'. Note that your answer needs more depth than just defining the two terms. Your answer should be about a paragraph in length.
2. An unknown is analyzed and found to be 43.38% Na, 11.33% C, and 45.29% O. What is its empirical formula? It has a molar mass of between 100 and 120 g/mol. What is its molecular formula?
3. How many grams of  $\text{Ca}_3(\text{PO}_4)_2$  could be obtained from 12.5 g of  $\text{CaCO}_3$  and 15.3 g of  $\text{H}_3\text{PO}_4$  according to the equation  $3\text{CaCO}_3 + 2\text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 3\text{CO}_2 + 3\text{H}_2\text{O}$

Answer Key:

**Part I:** d, g, o, s, k, l, a, h, p, e

**Part II:**

1. a) 4; b) 2; c) 3
2. density = 8.950769231 g/mL which rounds to 9.0 (two significant figures due to the subtraction rule)
3. a) copper(I) nitrate; b) selenium tetrabromide; c) sulfuric acid
4. a)  $\text{BaCO}_3$ ; b)  $\text{SCl}_2$ ; c)  $\text{HNO}_3$
5. 244.3 amu
6. 32.370 %
7.  $\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 2\text{NH}_3 + 3\text{Mg}(\text{OH})_2$
8. 0.223 M
9. 0.15 M
10. 0.062 moles

**Part III**

1. Your answer should be written in complete sentences in a paragraph form. It must include definitions for the two terms, two or more similarities, and two or more fundamental differences. Key ideas are 1. a mixture is of variable composition, while a compound has definite composition; 2. properties of a mixture are similar to the properties of its components, while properties of a compound are different from those of its elements; and 3. the formation of a mixture is a physical process, while the formation of a compound is a chemical process. The best answers will use analogy, diagrams, and/or examples to clearly illustrate the key points.
2.  $\text{Na}_2\text{CO}_3$ ;  $\text{Na}_2\text{CO}_3$
3. 12.9 g; this is a limiting reactant problem. For full credit, the student must show why this reactant was chosen.