

I. THE PERIODIC LAW LAB

****Writeup BEFORE the lab: Title, Prelab, Purpose, Summary Procedure of Part A and B, Copy or print the 2 data tables**

II. PreLab

Your prelab assignment will be to begin this lab report complete the following:

1. What is the name of Group IIA elements?
2. Make a list of all the chemicals you are using for this lab, including the name and the chemical formula.
3. What is the purpose of the lab?

Introduction:

When the elements are arranged in order of increasing atomic number, there is a periodic reoccurrence of properties that leads to the grouping of elements in the periodic table. Elements in vertical columns form **groups or families** that are characterized by marked similarities in physical and chemical properties. These similarities are due, in large part, to the fact that all elements within a group have the same outer shell electron configuration, **valence electrons**. Even within a group periodic trends in certain properties can be observed. The properties of chemical reactivity, solubility, and density, for example are known to vary regularly within groups of elements.

Materials List: Assorted glassware, spotplate, ammonium oxalate- $(\text{NH}_4)_2\text{C}_2\text{O}_4$, potassium chromate- K_2CrO_4 , ammonium sulfate, $(\text{NH}_4)_2\text{SO}_4$, ammonium hydroxide- NH_4OH , ammonium carbonate- $(\text{NH}_4)_2\text{CO}_3$, magnesium nitrate- $\text{Mg}(\text{NO}_3)_2$, calcium nitrate- $\text{Ca}(\text{NO}_3)_2$, strontium nitrate – $\text{Sr}(\text{NO}_3)_2$, barium nitrate- $\text{Ba}(\text{NO}_3)_2$

III. Purpose: In Part A, You will determine the density of a metal by water displacement. You will then calculate % error and in Part B, you will be examining the periodic variations of the chemical reactivity and the solubility of compounds within group II elements.

IV. Procedure

Part A: Density: $D = m/v$

$$\% \text{ error} = \frac{|\text{experimental value} - \text{theoretical value}|}{\text{theoretical value}} \times 100$$

1. Obtain a Sn, Pb, and Si from the materials area and measure its mass to the nearest 0.1 g.
2. For each metal, do water displacement by filling a 25 -100 mL graduated cylinder about $\frac{1}{2}$ full of tap water and read the volume to the nearest 0.0 g.
3. Carefully immerse the metal in the water in the water in the cylinder.
4. To cleanup, empty the water into the sink with catch the metal in your gloved hand. Dry it off and return it to the container.
5. Do the other 2 metals the same way.

V. Data:

	Si	Sn	Pb
Mass of metal			
Volume of water			
Volume of water + metal			
Volume of metal			
Density = M/V (experimental value)			
Theoretical value	2.32 g/mL	7.29 g/mL	11.3 g/mL

PART B: Solubility (circle= wells in the spotplate)

1. Place the clean spotplate on the lab bench (station).
2. Place ~ 3 drops of magnesium nitrate solution into circles below it on the chart. Do the same with calcium, strontium, and barium nitrate in subsequent vertical columns.
3. Now ~ 3 drops of ammonium oxalate to the 4 circles in the first horizontal row. Observe the reactions in each well. Record your observations in the data table. **Write observations such as S (soluble) or I (insoluble). Also, write the color and texture of the ppt. (fine, chunky, sinks, etc.)**
4. Add ~ 3 drops of potassium chromate to the 4 circles in the second horizontal row. Observe the reactions and record your observations.
5. Add ~ 3 drops of sulfuric acid to the 4 circles in the third horizontal row. Observe the reactions and record your observations.
6. Add ~ 3 drops of ammonium hydroxide to the 4 circles in the fourth horizontal row. Observe the reactions and record your observations.
7. Add ~ 3 drops of ammonium carbonate to the 4 circles in the fifth horizontal row. Observe the reactions and record your observations.
8. Experiment with your unknown. Make sure to write your unknown number into the data table. You have one of the 4 nitrate solutions.

Data Table Part B:

	Magnesium nitrate	Calcium Nitrate	Strontium Nitrate	Barium Nitrate	Unknown #
ammonium oxalate					
potassium chromate					
Ammonium sulfate					
ammonium hydroxide					
ammonium carbonate					

POST LAB:

VI. Calculations: (Show your work for all)

1. Calculate the density of each metal.
2. Calculate the % error of each metal

VII. Discussion:

1. Based on your observations in this activity, use the periodic table to predict which group II elements would be the most reactive, Mg²⁺, Ca²⁺, Sr²⁺, or Ba²⁺? Why?
2. A color change or the formation of a precipitate is an indication that a reaction has occurred. Which Group II metal (Mg, Ca, Sr, or Ba) showed a reaction with the most compounds?
3. List the four Group II metal in increase order from least reactive to most reactive
4. Compare this order to the position on the periodic table and write a general statement regarding reactivity and position in a group.