Honors Chemistry Hour\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
Dr. Wexler  
Trends within A Group: Chemical Reactivity  
Standard: HS-PS1-2  
Date assigned\_\_\_\_\_

**Brief Background:**   
The periodic table of elements organizes the elements according to their atomic structures. The table is arranged in horizontal rows called periods and vertical columns called groups or families.

Elements in the same group have similar chemical properties. Thus, it is possible to predict many of the properties of an element by examining its position in the table.

The reactivity of a metal depends on its position within its group. When nitrates of alkaline earth metals react with sodium carbonate, they form an insoluble product (precipitate). The amount of precipitate is a measure of the reactivity of the metal.

**Objectives:**Prepare serial dilutions of solutions containing ions of alkaline earth metals.  
Observe precipitates that form when another chemical is added to these solutions.  
Recognize patterns of chemical reactivity for compounds containing alkaline earth metals (Group 2).

**Materials:**0.1M (molar, moles/liter) solutions of:  
 Mg(NO3)2  
 Ca(NO3)2  
 Sr(NO3)2  
 Ba(NO3)2  
 Na2CO3

**Pre-Lab Questions:**1. Most elements within a group have common (chemical) (physical) properties. (Circle the best response)

2. List all the alkaline earth metals in order of atomic number from lowest to highest.

3. What are valence electrons?

4. How many valence electrons are in the group 2 elements?

5. What happens to the distance between the valence electrons and the nucleus as you go down group 2?

6. Draw the Bohr models for Magnesium and Barium to illustrate your answer to question 5.

**Procedure:**

1. Add 1mL dH2O to all 24 wells (4 rows of six wells)

2. Do a two-fold serial dilution of Mg(NO3)2 in **row 1**: A. Add 1mL 0.1M Mg(NO3)2 to **well 1** of row 1 and mix. (1/2 dilution)  
 B. Transfer 1mL from well 1 to well 2 and mix. (1/4 dilution)  
 C. Transfer 1mL from well 2 to well 3 and mix. (1/8 dilution)  
 D. Transfer 1mL from well 3 to well 4 and mix. (1/16 dilution)  
 E. Transfer 1mL from well 4 to well 5 and mix. (1/32 dilution)  
 F. Transfer 1mL from well 5 to well 6 and mix. (1/64 dilution)  
 G. Discard 1mL from well 6. All wells should now contain a 1mL volume of liquid.

3. Repeat this procedure for row 2 with Ca(NO3)2)

4. Repeat this procedure for row 3 with Sr(NO3)2)

5. Repeat this procedure for row 4 with Ba(NO3)2)

6. Add 1mL Na2CO3 to all 24 wells (squirt it into the wells without the pipette touching the liquid in the wells)

7. Examine each well for the presence of a precipitate. Score the intensity of precipitation for each well using a scale of 0-10, where 0 is no precipitation and 10 is the highest degree of precipitation. If it looks too close to call, hold the plate up to the light and look at the wells from below.

Record your results in the data table below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Well 1 (1/2 dil)** | **Well 2 (1/4 dil)** | **Well 3 (1/8 dil)** | **Well 4 (1/16 dil)** | **Well 5 (1/32 dil)** | **Well 6 (1/64 dil)** |
| **Mg(NO3)2** |  |  |  |  |  |  |
| **Ca(NO3)2** |  |  |  |  |  |  |
| **Sr(NO3)2** |  |  |  |  |  |  |
| **Ba(NO3)2** |  |  |  |  |  |  |

**Post-Lab Questions:**

1. Which alkaline earth metal (group 2) had the least tendency to form a precipitate in this experiment?
2. Which alkaline earth metal (group 2) had the greatest tendency to form a precipitate in this experiment?
3. Compounds with higher reactivity form heavier precipitates. As you went down group 2, the elements became (more)(less) reactive. (Choose the best response).
4. What are the names of the two physical property that decrease as you go down group 2? (Hint: see textbook pp. 167-168)

A.  
B.

1. What are the definitions of these two physical properties?

A.

B.

1. Explain why a decrease in the values of these two physical properties increases the reactivity of group 1 and group 2 elements.
2. Water that contains high concentrations of magnesium or calcium ions along with carbonate (CO3-)ions can form deposits that may clog pipes. Based on your observations in this experiment, which metal ion – magnesium or calcium – do you think would contribute more to such deposits if both ions were present in equal concentrations? Explain your reasoning.