

Name:
Class:
Date:

The Alkaline Earth Elements

Background Information

The arrangement of the elements in the periodic table is one of the most important achievements in modern chemistry. The physical and chemical properties of elements change in a regular pattern as you go both across the rows and down the columns of the periodic table. As a result, when elements close to each other in a row or column are compared, they have many of the same properties. However, when elements farther away from each other in a row or column are compared, they have more dissimilar properties.

The elements in Group IIA of the periodic table are known as the alkaline earth elements. Like all members of a group, or family, of elements, they have certain properties that change in a regular pattern within the group. One of these properties is the ability to form a *precipitate*, or solid substance, as a result of a chemical reaction. The precipitate cannot dissolve in water and eventually settles to the bottom of the container.

In this investigation, you will compare the abilities of the alkaline earth elements to form precipitates as a result of a chemical reaction.

Materials (per group)

Safety goggles

Well plates

Sheet of notebook paper

Dropper bottles of:

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	$\text{Ba}(\text{NO}_3)_2$
Sodium carbonate	Na_2CO_3
Sodium sulfate	Na_2SO_4
Sodium chromate	Na_2CrO_4

Procedure:

1. Place the well plate over a sheet of notebook paper.
2. Along the side of the notebook paper write the names of the four alkaline earth elements that are present in each nitrate compound listed in the materials you are using. Write them in the same order in which they are listed. See teacher example.

3. Along the top of the notebook write the names of the three substances that are combined with sodium in the materials you are using. See teacher example.
4. Put on your safety goggles. Place drop of sodium carbonate in each of the four spots under the word "carbonate." Place sodium chromate in each of the four spots under the word "chromate."
5. Take the dropper bottle of magnesium nitrate and place drops in each of the three spots in the row labeled "magnesium." Observe each spot carefully and record the result in the data table. Repeat this procedure using the dropper bottles containing calcium nitrate, strontium nitrate, and barium nitrate. Be very careful not to mix the liquid from one spot with the liquid from another on the transparency.
6. After recording your results, wash your well plate thoroughly with soapy water and dry well.

Observations

Alkaline earth metal	Sodium Carbonate	Sodium Sulfate	Sodium Chromate
Magnesium			
Calcium			
Strontium			
Barium			

Conclusions

1. Was there evidence of a chemical reaction occurring in any of the spots? Explain your answer.
2. Which alkaline earth element formed the smallest number of precipitates?
3. Which alkaline earth element formed the greatest number of precipitates?
4. What is the relationship between the number of precipitates formed and the location of the alkaline earth element on the periodic table?

5. If the ability of an alkaline earth element to form a precipitate is an indication of its ability to chemically react with other substances, which is the most reactive element? The least reactive?
6. List the alkaline earth metals in order of their chemical reactivity, starting with the most reactive.
7. How does the order of the elements you listed in question 6 compare to their order in the periodic table?

Application and Critical Thinking

1. Group IA in the periodic table is known as the alkali metals. Based on your investigation of the Group IIA elements, predict the comparative reactivity of the elements in Group IA of the periodic table.
2. If you had a solution containing a mixture of magnesium, strontium, and barium, how could you separate the three elements?