

## LAB: THE ALKALINE EARTH METALS

Purpose: Investigate some reactions of Group 2 elements and gain some insights into the properties of these alkaline earth elements.

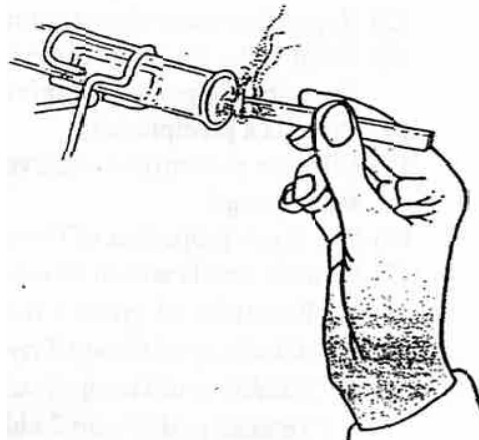
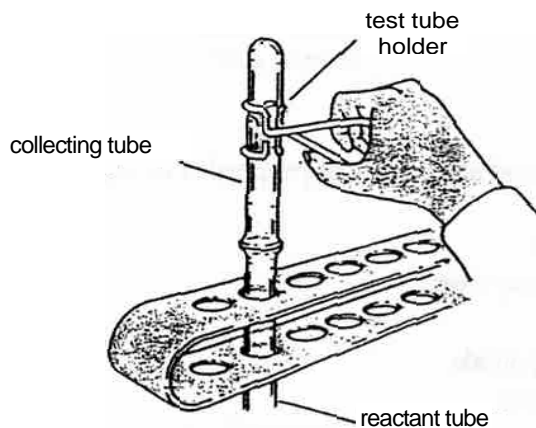
Introduction: The elements in Group 2 of the periodic table are known as the alkaline earth elements. Like the elements in Group 1 (alkali metals), the elements in Group 2 are chemically active and are not found in nature in their elemental states. Because of their similar outer level  $e^-$  configurations, the Group 2 metals share certain common characteristics.

The metallic character (in other words, the tendency to donate electrons) increases when reading down the group. Other trends can be observed:

- tendency to form ions increases
- solubilities of hydroxides ( $\text{OH}^-$ ) decreases
- alkalinity (basicity) of hydroxide solutions increases
- solubilities of sulfates decreases
- all form precipitates when reacted with  $\text{Na}_2\text{CO}_3$

Procedure: **PART A**

- 1) Pour about 5 mL of distilled water into a clean, dry test tube. Add a calcium turning to the water in the tube. Collect the gas being released by holding an inverted test tube over the reactant tube with a test tube holder.
- 2) Test for hydrogen gas by inserting a burning wood splint into the upper part of the inverted test tube.
- 3) Add a few drops of phenolphthalein solution to the reactant tube. Record your observations and discard the contents of the tube.
- 4) Repeat step # 1, using a small piece of Mg ribbon (curl it into a ball) instead of calcium. Observe the reaction taking place. It may be necessary to watch for several minutes to see the reaction. Add a few drops of phenolphthalein solution to the reaction tube and record observations. Discard the contents and clean the test tubes.



**PART B:**

- (1) In separate wells on a spot plate, place a few drops of saturated solutions of
- |                     |                     |
|---------------------|---------------------|
| calcium hydroxide   | Ca(OH) <sub>2</sub> |
| magnesium hydroxide | Mg(OH) <sub>2</sub> |
| barium hydroxide    | Ba(OH) <sub>2</sub> |
- (2) Test each solution with pH paper and record the pH value.

**PART C:**

- (1) Measure out .5 g samples of
- |                   |                   |
|-------------------|-------------------|
| magnesium sulfate | MgSO <sub>4</sub> |
| calcium sulfate   | CaSO <sub>4</sub> |
| barium sulfate    | BaSO <sub>4</sub> |
- (2) Place the samples in 3 separate, labeled test tubes.  
(3) Add 5 mL of distilled water to each tube. Stopper each test tube and shake - getting as much of each solid to dissolve as possible. Rank the solubilities of the three compounds from most soluble to least soluble.

**PART D:**

- (1) Place 1 mL of each of the following solutions into separate, labeled test tubes :
- |                    |                   |
|--------------------|-------------------|
| magnesium chloride | MgCl <sub>2</sub> |
| calcium chloride   | CaCl <sub>2</sub> |
| barium chloride    | BaCl <sub>2</sub> |
- (2) To each of these solutions, add about 10 drops of sodium carbonate solution, Na<sub>2</sub>CO<sub>3</sub>. Record observations.

**QUESTIONS: (Answer in complete sentences. Reference the lab)**

- 1) Which of the metals tested in Part A was most reactive?
- 2) Regarding reactivity, what might you predict about the metal barium?
- 3) What is the common name for the test procedure for hydrogen gas? Describe the procedure briefly.
- 4) What is a precipitate?
- 5) Why are similarities observed in the physical and chemical properties of elements in the same group?
- 6) List some properties of Group 2 elements.
- 7) Identify trends within Group 2 for these properties:
  - Reactivity of group 2 metals
  - Alkalinity of Group 2 hydroxide compounds
  - Solubility of Group 2 sulfate compounds
  - Tendency of Group 2 chloride compounds to form precipitates when reacted with sodium carbonate
- 8) Write balanced equations for part A and D

**Part A**

<b>Metal</b>	<b>H<sub>2</sub> (g)</b>	<b>Phenolphthalein color</b>
Mg		
Ca		

**Part B**

<b>Solution</b>	<b>pH value</b>
Mg(OH) <sub>2</sub>	
Ca(OH) <sub>2</sub>	
Ba(OH) <sub>2</sub>	

**Part C**

<b>Solid</b>	<b>Solubility ranking</b>
MgSO <sub>4</sub>	
CaSO <sub>4</sub>	
BaSO <sub>4</sub>	

**Part D**

<b>Solution</b>	<b>Observations</b> (add 10 drops of Na <sub>2</sub> CO <sub>3</sub> )
MgCl <sub>2</sub>	
CaCl <sub>2</sub>	
BaCl <sub>2</sub>	