

SI CHEMISTRY

Metallic Reactivity Experiment (2 Days)

Purpose: To study the properties of some alkali metals and alkaline earth metals.

Introduction: Group IA, known as the alkali metals, consists of lithium, sodium, potassium, rubidium, cesium, and francium.

Group IIA, known as the alkaline earth metals, consists of beryllium, magnesium, calcium, strontium, barium, and radium.

In this experiment, we will examine the behavior of lithium, sodium, and potassium when they react with water. Then we will predict the behavior of magnesium, calcium, and barium when they react with water. And finally we will test our predictions.

Materials: Solutions - phenolphthalein, 0.1 M NaOH
Solids - lithium, sodium, potassium, magnesium, calcium, and barium

Equipment: large test tubes, test tube racks, forceps, glass plates, wood splints, spatulas, thermometers and small sample vials

Safety Precautions: **Wear safety glasses at all times!** Reactions can be vigorous. Do not handle metals. Metals, their solutions, and NaOH solution are all highly corrosive.

Procedure and Observations: (Day 1)

Part A. Reactions of alkali metals with water

1. Fill three large test tubes with 10.0 ml of de-ionized water and set them in the test tube rack.
2. Bring the glass plate to the front desk and obtain a small piece of freshly cut lithium from your instructor.
3. Using a weighing tray- mass the sample of lithium. Record the mass in your lab notebook.
(Note: masses should range from .03-.06 grams)
4. Measure and record the initial temperature of the water in the test tube.
5. Using a forceps, carefully place the small piece of metal into the first test tube and observe.
6. Before the reaction stops, bring a burning wood splint to the mouth of the test tube.
Record your observations in your notebook.
7. After the reaction is complete -measure and record the final temperature of the water.
8. Repeat this procedure for both sodium and potassium using test tube two for the sodium and test tube three for the potassium.

9. Save three small vials of the solution from one of the test tubes. Make sure you record which metal you saved in your notebook. Label the vials with your name(s) and the metal. Set the vials aside.

10. Add 1 drop of phenolphthalein to the each of the test tubes and record your observations in your lab notebook.

To understand the purpose for adding the phenolphthalein, take two clean test tubes. Fill one of them with 10.0 ml of de-ionized water and the other with 10.0 ml of 0.1 M NaOH. Add a drop of phenolphthalein to each test tube and record your observations.

Homework: Write a brief paragraph in which you predict the behavior of the alkaline earth metals. **Include the rationale for your prediction. You will not be admitted to lab on day 2 without this work.**

Procedure and Observations: (Day 2)

Part B. Reactions of alkaline earth metals with water

1. Rinse out two large test tubes, fill with 10.0 ml of de-ionized water and set them in the test tube rack. **Your instructor will demonstrate the reactions with barium.**
2. Bring the glass plate to the front desk and obtain a small piece of magnesium ribbon from your instructor.
3. Using a weighing tray- mass the sample of magnesium. Record the mass in your lab notebook. **(Note: masses should range from .03-.06 grams)**
4. Measure and record the initial temperature of the water in the test tube.
5. Using a forceps, carefully place the small piece of metal into the first test tube and observe.
6. Before the reaction stops, bring a burning wood splint to the mouth of the test tube. Record your observations in your notebook.
7. After the reaction is complete, measure and record the final temperature of the water. Record the temperature in your lab notebook.
8. Repeat this procedure for calcium using the second test tube.
9. Save three small vials of the solution from one of the test tubes. Make sure you record which metal you saved in your notebook. Label the vials with your name(s) and the metal. Set the vials aside.
10. Add 1 drop of phenolphthalein to the each of the test tubes and record your observations in your lab notebook.

Questions:

1. What observations suggest a chemical reaction has taken place between the metal and water?
2. What gas was produced in these reactions?
3. Rank the three alkali metals you studied in Part A from most reactive with water to least reactive with water. Now consider all alkali metals in Group IA. Which one would you predict to be the most reactive with water? What is the general trend of reactivity with water among elements in this family?
4. Rank the three alkaline earths you studied in Part B from most reactive with water to least reactive with water. Now consider all alkaline earths in Group IIA. Which one would you predict to be the most reactive with water? What is the general trend of reactivity with water among elements in this family?
5. Which family (alkali metals or alkaline earths) tends to be more reactive as a group with water? What is the general trend for reactivity of metals with water as you move across the periodic table from family to family?

Extension Questions:

1. When we think of metals, examples from Group IA, like sodium, typically don't come to mind. Why don't we very often find the element sodium in this state? List a common source of sodium.
2. What does the term alkali mean? Why do you think Groups IA and IIA are called the alkali metals and alkaline earth metals respectively?

Grading Criteria for SI Chemistry
Lab: Metallic Reactivity

Section	Max # points/ section	
Group II A Predictions	2	Predict what will occur with the Group II Metals and give rationale for this prediction
Title and Names	1	
Purpose	1	Why did we perform this lab?
Data Table For all six metals tested	16	(1/2 point each) Name and symbol of metal, reaction in water, combustion reaction, reaction with phenolphthalein, initial and final temperature, reaction of phenolphthalein in water, reaction of phenolphthalein in NaOH
Conclusions	2	Write a paragraph, make connections between what you know about periodic trends and your data
Questions	13	Q#1 – 1, Q#2 – 1, Q#3 – 3, Q#4 – 3, Q#5 – 2, Extension Q#1 – 1, Extension Q#2 – 2
Max # points	35	