

## 2 Explore

Name \_\_\_\_\_

Date \_\_\_\_\_

### Activity 1.

In this activity, you will observe several elements and organize them into logical groups.

Several stations are set up around the classroom. Each contains a sample of a different element. With your group, move to each station and closely observe each element. Describe each element in the space provided. As you observe each element, consider its physical properties, including color, texture, and hardness. **Note:** Your teacher will instruct you on how to proceed from station to station. Be sure to write your notes in the space that corresponds to the element you are describing.

1. Calcium
  
  
  
  
  
  
  
  
  
  
2. Aluminum
  
  
  
  
  
  
  
  
  
  
3. Carbon
  
  
  
  
  
  
  
  
  
  
4. Copper
  
  
  
  
  
  
  
  
  
  
5. Iron

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# Explore

Name \_\_\_\_\_

Date \_\_\_\_\_

Activity 1. (continued)

6. Magnesium

7. Sulfur

8. Silicon

Other elements (optional):



## Explore

Name \_\_\_\_\_

Date \_\_\_\_\_

### Activity 1. (continued)

1. After you have completed your observations, work with your group to devise a logical method of organizing these elements. Use your notes to help you organize the elements into groups. Look at the element samples again if you need more information. Use the space provided to outline your organizational method.
  
2. Discuss your organizational method with your teacher. Address any questions or problems that arise, and then finalize your plan. Describe your final organization scheme in the space provided. Be prepared to share your ideas with other students.
  
3. Now, study the periodic table of elements provided by your teacher. This table is the most widely accepted format for organizing the elements. Compare the way that you organized the elements in your classroom with the way those elements are organized in the periodic table.
  - a. How is your system similar to the periodic table?
  
  - b. How are the two organizational schemes different?

## 2

Date \_\_\_\_\_

## Activity 1. (continued)

4. Based on your observations and any discrepancies between your arrangement and the periodic table, what properties of elements do you think were considered during the creation of the periodic table?
5. In the space below, record at least three questions, comments, or observations that you have while examining the periodic table of elements.



## Explain

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### Activity 2.

In Activity 1, you observed the periodic table of elements and noted the properties of several elements. In this activity, you will research the characteristics and trends of elements arranged on the periodic table.

Designate one member of your group to collect a set of Periodic Table Element Cards. Next, find a large area where your group can spread out your materials.

Begin by using the periodic table provided in Activity 1 to arrange your Periodic Table Element Cards on your workspace in the same order as on the periodic table. The Periodic Table Element Cards should be placed so that the element information side faces upward and the element symbol side faces downward. Keep each group and period aligned, as this will be essential in analyzing the trends in the table. **Note:** These cards represent only the first 54 elements of the periodic table.

When all of the element cards have been laid out according to the periodic table arrangement, work with your group to observe and analyze the properties of the elements. As you read the properties and characteristics of the elements, use the space that follows to record your observations about the organization of the elements. Keep in mind the following questions as you observe the elements in the periodic table.

- What patterns do you find as you study the properties of the elements?
- What do elements in the groups and periods of the table have in common? Is this a random arrangement, or is it based on obvious criteria?
- Do any elements stand out as very different from all of the other elements?
- Are there certain elements that share characteristics?

### MATERIALS

Periodic Table  
Element Cards



## 3 Explain

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Activity 2. (continued)

After you examine the elements, properties, and patterns of the periodic table, describe and explain at least two patterns or trends that you find in the table. If time allows, outline more than two. Use the space below.



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### Activity 2. (continued)

Discuss with your teacher the trends you find. Address any questions or problems with these findings before moving on. When your teacher has approved your trends, and your outline is finalized, graph the patterns.

For each graph, use the following guidelines:

1. Graph each property as a function of atomic number.
2. Title each graph.
3. Place the atomic number on the x-axis, and the property being examined on the y-axis.
4. The trend being graphed can be representative of all elements present in the Periodic Table Element Cards, or of a particular group or period. Indicate which area of the table is being represented in the graph.
5. Label each part of the graph so that someone other than your group members can understand and interpret it.

When each trend has been graphed, share your findings with other groups and participate in a class discussion of periodic trends.

# 3 Explain

Name \_\_\_\_\_

Date \_\_\_\_\_

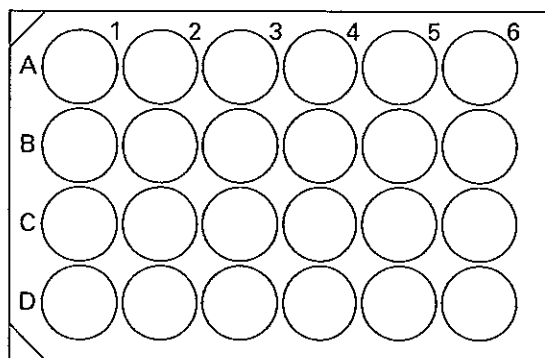
## Activity 3.

In the previous activity, you discovered that many trends are present in the periodic table. This activity provides physical evidence of periodic trends through several microscale laboratory experiments. Remember to use appropriate personal protective equipment when working with chemicals, and adhere to all laboratory safety rules.

### PART 1

Obtain the listed materials from the materials station. When all materials have been gathered for Part 1, follow the instructions below. Perform the experiment and record your observations in Table 1 (at the end of Part 1). If no reaction occurs in a particular well, write NR ("No Reaction") in the appropriate part of the table.

1. Place the microplate on a white piece of paper or other white surface. Use the following diagram to identify each well.



2. Use the pipet to add 20 drops of water to wells A1, A2, and A3 respectively.
3. Use the forceps to drop one piece of calcium into well A1. Record your observations in Table 1.
4. Use the forceps to drop one piece of magnesium ribbon into well A2. Record your observations in Table 1.
5. Roll a piece of the aluminum foil into a loose ball and drop it into well A3. Record your observations in Table 1.
6. Continue observing the wells for 1 or 2 more minutes. Record any additional information in Table 1. Note the rate of any additional reactions.

### MATERIALS

24-well microplate

weighing dish  
containing two  
1-cm strips of  
magnesium  
ribbon (use  
scissors to cut)

weighing dish  
containing two  
2-cm<sup>2</sup> squares of  
aluminum foil

weighing dish  
containing two  
small pieces  
of calcium

pipet

thermometer

white paper or  
surface

beaker of water

bottle of HCl  
(shared by  
two groups)

forceps



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# Explain

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## Activity 3. (continued)

7. Use the shared bottle to add 20 drops of 1 M HCl to wells C1, C2, and C3 respectively. Use a thermometer to measure the initial temperature of each well. Record this data in Table 1.
8. Use the forceps to add one piece of calcium to well C1. Record your observations in Table 1.
9. Use the forceps to add one piece of magnesium ribbon to well C2. Record your observations in Table 1.
10. Roll the remaining piece of aluminum foil into a loose ball and drop it into well C3. Record your observations in Table 1.
11. Use a thermometer to measure the final temperature of each solution. Record this data in Table 1.
12. Continue observing the wells for one or two more minutes. Record any additional information in Table 1. Note the rate of any additional reactions.
13. When each observation is complete and recorded in the table, dispose of the well contents as instructed by your teacher. Clean the microplate thoroughly; you will use it again in Part 2.

**Table 1**

Element	Reaction with Water	Reaction with Acid	Initial Temperature of HCl Well	Final Temperature of HCl Well
Calcium			Well C1:	Well C1:
Magnesium			Well C2:	Well C2:
Aluminum			Well C3:	Well C3:

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## Activity 3. (continued)

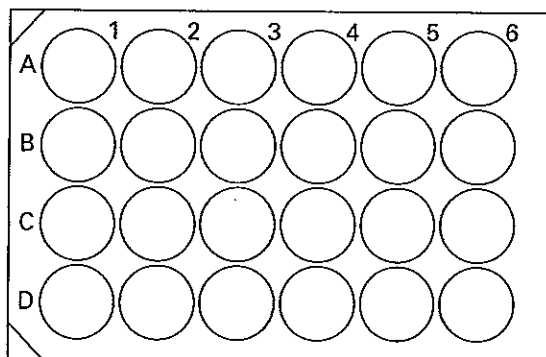
### PART 2

Obtain the listed materials from the materials station. When all materials have been gathered for Part 2, follow the instructions below to prepare the microplate.

### Preparing the Microplate

Set up the 24-well microplate as indicated by the diagram and the instructions that follow.

1. Add 20 drops of magnesium chloride to wells A1, B1, and C1.
2. Add 20 drops of calcium chloride to wells A2, B2, and C2.
3. Add 20 drops of strontium chloride to wells A3, B3, and C3.
4. Add 20 drops of barium chloride to wells A4, B4, and C4.



### Procedure

After the microplate has been prepared, follow the instructions below. Record your observations in Table 2 (at the end of Part 2) as you perform the experiment. If a precipitate (solid) forms in a well, write "PPT" in the corresponding well of Table 2. If no precipitate forms write "NR" in the corresponding well of Table 2.

1. Add 20 drops of sodium carbonate to wells A1, A2, A3, and A4 respectively. Observe the reaction, if any, and record the results in Table 2.

### MATERIALS

24-well microplate

bottle sodium carbonate  
(shared by two groups)

bottle sodium sulfate (shared by two groups)

bottle potassium iodate (shared by two groups)

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Activity 3. (continued)

2. Add 20 drops of sodium sulfate to wells B1, B2, B3, and B4. Observe the reaction, if any, and record the results in Table 2.
3. Add 20 drops of potassium iodate to wells C1, C2, C3, and C4. Observe the reaction, if any, and record the results in Table 2.
4. Dispose of the contents of the microplate as directed by your teacher.

Table 2

Row A	A1	A2	A3	A4	A5	A6
Row B	B1	B2	B3	B4	B5	B6
Row C	C1	C2	C3	C4	C5	C6
Row D	D1	D2	D3	D4	D5	D6

Answer the following questions.

1. In which areas of the periodic table are the elements in Part 1 located?

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## Activity 3. (continued)

Explain your answers to questions 2–5 on the basis of your findings in Part 1.

2. What is the trend in reactivity down a group in the periodic table?
3. What is the trend in reactivity across a period in the periodic table?
4. Arrange the following elements in order of predicted reactivity, from least active to most active: potassium, lithium, sodium.
5. Arrange the following elements in order of predicted reactivity, from most active to least active: magnesium, silicon, sodium.
6. In which area of the periodic table are the elements in Part 2 (i.e., magnesium, calcium, barium, and strontium) located?
7. What do the results of the experiments in Part 2 indicate about the trend in solubility down a group in the periodic table?
8. Based on your experiment in Part 2, how would you expect the solubility of beryllium to compare with that of the other alkaline earth metals?