Nuts and Bolts of Periodicity
Investigating Periodicity

Although humans have known about elements such as gold, silver, tin, copper, lead, and mercury for many centuries, the first scientific discovery of an element (phosphorous) took place in 1649. By 1869, a total of 63 elements had been discovered and chemists had learned many facts about them. They recognized patterns in their properties and began to develop ways to classify the elements using their similarities and differences.

A Russian chemist, Dimitri Mendeleev, used the periodic patterns to produce a chart for his students that summarized the properties of all the known elements. This chart became known as the Periodic Table of the Elements.

During this activity, you will use the physical properties of nuts and bolts to organize them in a way that will allow you to discover patterns. You will find that your organization of nuts and bolts is similar to the organization of elements on the periodic table.

Questions
1. What "periodic" patterns exist among the items used in this activity?
2. How can you use these patterns to make predictions about the placement of new items?

Text Reference
Physical Science (Holt), pp.336-342.

Prediction
Examine the items in your "nuts and bolts" kit that will be used to represent elements. If you were to arrange these "elements" in a logical order, what patterns (if any) might you observe?

Key Terms
periodicity
period

Materials
Nuts and Bolts Kit
graph paper (2)
newsprint (1)
triple beam balance
metric ruler
Periodic Table of the Elements

Directions

Step 1 Using the newsprint provided by your teacher, create a 5 x 4 grid (5 vertical columns and 4 horizontal rows) to be used as your "periodic table."
Note: Use a ruler and make sure the 5 x 4 grid covers most of the sheet.

Step 2 Place the 5 x 4 "periodic table" and the Nuts and Bolts Kit on your desk.

Step 3 Number the grid from left to right 1-20 with #1 in the box in the upper left corner and #20 in the box in the lower right corner.

Step 4 Place the shortest, thinnest screw in box #1 and place the largest wing nut in box #20.

Step 5 Construct a "periodic table" of nuts and bolts with the remaining materials in the kit by arranging the "elements" in a logical sequence. Keep in mind that the vertical columns and horizontal rows must be grouped by specific properties.

Step 6 Measure the mass of each element. Measure the length of bolts and screws and the diameter of washers and wing nuts. Organize this information in the **Data Table** provided.

Step 7 Provide the following information in each box on the nuts and bolts "periodic table."

- A sketch of the item placed in the box
- The mass (g) of the item
- The length/diameter (mm) of the item

Data

Data Table: Mass and Length/Diameter of Nuts and Bolts

Element Number (table box #)	**Mass** (g)	**Length or Diameter** (mm)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Analysis

1. (a) Give your reasons for the organization of the horizontal rows.

   (b) Give your reasons for the organization of the vertical columns.

2. On graph paper, create two graphs using the data in your data table. Use the **Graphing Directions and Checklist** (p. 13) to guide you. (Note: Round your mass and length data to the nearest 0.1 g before graphing).

   Graph 1: Element number (x-axis) versus mass of "element" (y-axis)

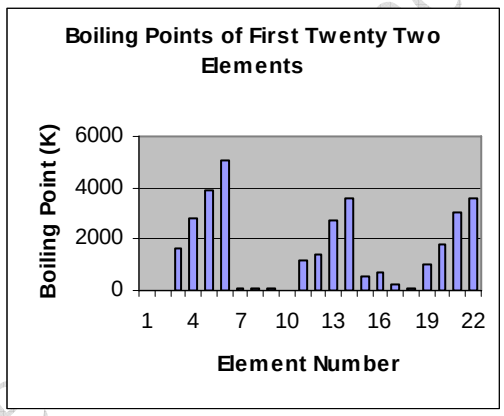
   Graph 2: Element number (x-axis) versus diameter or length (y-axis)

3. Describe the "periodic" or repeating patterns exhibited by the data on your graphs.

Application

1. What if you were to be given an additional wing nut? How would you determine where it belonged on your table?

2. Observe the graph of boiling points for the first twenty two elements of the periodic table.



   (a) What pattern do you observe?

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   (b) How does this relate to the "periodic" pattern you observed in this activity?

3. Look at the Periodic Table of the Elements and note that there some empty boxes shown in the table (e.g., 113, 115). How might a scientist use "periodicity" to predict the properties of these elements?