Name:
Period:

Title: Building the Periodic Table from Scratch

Introduction:
Before the periodic table could be built, the individual elements had to be found and their properties tested. Although elements such as gold, silver, tin, copper, lead and mercury have been known since antiquity, the first scientific discovery of an element occurred in 1649 when Hennig Brand discovered phosphorous. During the next 200 years, a vast body of knowledge concerning the properties of elements and their compounds was acquired by chemists. By 1869, a total of 63 elements had been discovered. As the number of known elements grew, scientists began to recognize patterns in properties and began to develop classification schemes.

The Russian scientist, Mendeleev noticed patterns in the properties and atomic weights of halogens, alkali metals and alkaline metals. In an effort to extend this pattern to other elements, he created a card for each of the 63 known elements. Each card contained the element's symbol, atomic weight and its characteristic chemical and physical properties. When Mendeleev arranged the cards on a table in order of ascending atomic weight grouping elements of similar properties together in a manner not unlike the card arrangement in his favorite solitare card game, the periodic table was formed. From this table, Mendeleev developed his statement of the periodic law and published his work *On the Relationship of the Properties of the Elements to their Atomic Weights* in 1869. The advantage of Mendeleev's table over previous attempts was that it exhibited similarities not only in small units such as the triads, but showed similarities in an entire network of vertical, horizontal, and diagonal relationships. In 1906, Mendeleev came within one vote of being awarded the Nobel Prize for his work.

In this activity, you will use the same information they had to construct your own periodic table.

Materials: “elements” page, scissors, glue

Procedure:

1. Work in pairs.
2. Cut out the cards for each element from the elements page.
3. Without using a periodic table, arrange the elements in rows and columns in a logical manner so that:
    a. atomic mass increases
    b. each column has elements having similar properties
    c. each row has elements showing a change in properties from metal to nonmetal

4. Compare with a group either in front of you or behind you. If your arrangements aren't the same, work it out. Be ready to explain your logic!
    Other group check-off: _____

5. Once another group has checked your work, have your teacher check it, too.

    Teacher check-off: _____

6. Check your table by looking a periodic table in your book. Glue your chart to a piece of paper and use a marker to add group and period numbers.

Questions:

1. On which side of the chart do you find the metallic elements? _____

2. What happens to the mass (and also the atomic size) of atoms of each element as you move *down* a group? Write a sentence that describes the relationship of the sizes of the atoms of elements in the same group (family).

3. What might account for the trend described in the previous question? Explain.

4. Elements in the same group (family) usually share some similar chemical properties. Find the element sodium. List the symbols for four other elements in the same family.

5. Look at the chemical properties of the elements in the group in question 4. Are they similar or different? How?

6. The word “periodic” refers to the rows of elements whose properties repeat themselves. Boron and aluminum are members of the same group. How are they similar?

7. How are boron and aluminum different?

8. The blank card represents one of the three undiscovered elements for which Mendeleev left gaps in his chart. He was able to predict the properties of this unknown element by looking at the properties of aluminum and indium. Using the properties for these two elements, predict the following about the unknown element:
   - **a.** Atomic mass (approximate range): _____
   - **b.** Metal or nonmetal: _____
   - **c.** Color: _____
   - **d.** Hard or soft: _____

9. Francium is a radioactive element that appears directly below cesium in the periodic table. Make predictions for the following properties of francium:
   - **a.** Atomic mass (approximate) _____
   - **b.** Metal or nonmetal _____
   - **c.** Color _____
   - **d.** Number of electrons in outer shell _____