SCIENCE LAB PREP WORK

LAB DATE: January 22, 2007

LAB TITLE: The Periodic Table

INTRODUCTION:

Now that we understand what an atom and an element are we can begin to understand what the creation of element 118 might be all about. Our next step is to place element 118 in context – that is, to understand how it "fits" with the rest of the elements. In order to do this we need to gain a better understanding of the periodic table of the elements. In this "lab" we will be constructing our own table of elements and learning about how it is organized and how it can be used.

PURPOSE:

To answer the following questions –

What is the periodic table of elements?
What important information is summarized in the periodic table?
How are elements grouped in the periodic table and why?
How can we use the periodic table to better understand what element 118 might be like?

HYPOTHESIS:

1. What is the periodic table of elements?

I hypothesize that the periodic table of elements is a collection of all the known elements that either occur naturally or are made in a particle accelerator by humans.

2. What important information is summarized in the periodic table?

I hypothesize that in the periodic table of elements the following information is summarized in each box. It includes the real name of the element, and the abbreviation. It includes the atomic number of the element and the atomic mass of the element. And the shade of the box determines the type of element it is.

3. How are the elements grouped in the periodic table and why?

I hypothesize that the elements are grouped by what form they are in at room temperature.

4. How can we use the periodic table to better understand what element 118 might be like?

I hypothesize that by looking at the periodic table we cannot tell what element 118 is like because it has no relation to the particles we accelerated in the particle accelerator. The reason why it is different than any other element is because its atoms have a completely different amount of protons, neutrons and electrons then any other element, thus having completely different properties to all other element.

MATERIALS & EQUIPMENT:

Markers: red, blue, and black
Computer with Internet access
Tape
Colored paper in the following colors:
Purple – Alkali Metals
Blue – Alkali Earth Metals
Dark Green – Transition Metals
Light Green – Poor Metals
Yellow – Non-Metals
Peach - Halogens
Pink – Noble Gases
Aqua – Lanthanides (Rare Earth Metals) & Actinides
White – Other

PROCEDURE:

Adapted from "Acquiring the Foundation: The Periodic Table for Middle School Science"
by Annette Boles of Sharpstown Middle School.

For this lab you will be working in teams of two, but the entire class will be working together. Each pair of students will choose 10 elements by drawing them out of a bag. For each of the elements assigned to your pair you will design a tile. The color of the tile will be determined by the element's family, as defined in the "Materials" section of the lab. Each tile must also include the following information:

Atomic Number
Element Name
Chemical Symbol
Atomic Mass
Natural State (solid, liquid, gas)
Note: Use the black marker for solids, blue marker for liquids, and red marker for gases.

You may include any other information you wish about your elements on their respective tiles. BE NEAT & BE CREATIVE!!!

You will then work together AS A CLASS to build the periodic table using your completed tiles. The attached blank periodic table will be your data table where you will record your findings and those of your classmates (though you should still create a data table in which to gather the required information for your pair's ten elements).

Data Tables

Element	Chemical Symbol	Atomic Number	Atomic Mass	Phase of Matter
Lithium	Li	3	6.94	Solid
Xenon	Xe	54	131.29	Gas
Arsenic	As	33	74.92	Solid
Chlorine	Cl	17	35.45	Gas
Silicon	Si	14	28.09	Solid
Cesium	Cs	55	132.91	Solid
Sulfur	S	16	32.07	Solid
Protactinium	Pa	91	231.04	Solid
Praseodymium	Pr	59	140.91	Solid
Neptunium	Np	93	237.00	Solid

Observations: When I looked at the periodic table I noticed that the atomic mass is a little larger than the atomic number. I also noticed that the higher the atomic number the larger the difference between the atomic mass and the atomic number. I also noticed that most of the elements are solid a few are gases and only two elements at room temperature are liquids. One more thing that I noticed was that some of the chemical symbols did not match the element name. I also noticed that as you go up every period they all add a shells worth of electrons to the element. For instance Lithium has three electrons hence one in its outer shell and Sodium (one period below Lithium) has exactly eight more electrons therefore having one electron in its outer shell. As you move to the next period (same group) you can see that the elements continue to have one electron in their outer shells and as the we move down each period at a time in group one each element begins to have eighteen more electrons then the previous period and then thirty-two. Now that I realize this I hypothesize that the some elements are in the group that they are because they all have the same number of electrons in the outer shell, and they named the groups one, two, three and so on because they all need and have the same amount of electrons in their outer shell. I also noticed that on the far right of the periodic table under group eighteen that as you go down each period again you can see a pattern. The period number is the exact amount of shells that the element in group eighteen has filled up. Here is an example: Helium is located in group eighteen, period one and it has filled up one shell the exact number of the period it is located in. It is the exact same case with Neon it fills up exactly two shells and it’s in group two. Note: this is only true in group eighteen.

Data Analysis And Results:

I created ten different pieces of paper including the atomic number, element name, chemical symbol, atomic mass and the natural state of each element that I chose out of the cup. By doing this it helped me better understand how the periodic table was formed, important facts about many elements, and most importantly I learned how the periodic table is organized. The periodic table is organized by groups, families and periods. Groups are the vertical columns. Example: Lithium and Sodium are in the same group, group one. Elements in the same group are similar because they usually have the same number of electrons in their outer shell. Therefore they all have and want the same number of electrons. Families are the type of element such as Nonmetals, Noble gases or Halogens. A period is a horizontal row of the table. Every element in the same period has the same amount of shells filled up with electrons. I also learned that the reason why the atomic mass of any element is around twice as large as the atomic number of that element is because usually for every proton there is in an atom there is usually one neutron, thus making the atomic mass twice as large. I also learned that the reason why the atomic mass was a little more than twice the atomic number was because the scientists averaged the different isotopes of the element. For instance there is two isotopes of Hydrogen, deuterium and tritium. Most hydrogen atoms have one proton and one electron. But some have one proton, one neutron and one electron and others have one proton, two neutrons and one electron. Deuterium has one neutron opposed to tritium, which has two neutrons. Adding a neutron does not change the atoms charge

because the neutron itself is neutral but it does change the atomic mass. So by averaging the different isotopes of Hydrogen our result would be higher than twice the number of protons (the atomic number) because we averaged deuterium and tritium, which have a higher average than the atomic mass of hydrogen.
(That was hard to explain).

My observational data indicates the higher the atomic number the larger
the difference between the atomic mass and twice the atomic number. This is because the higher the atomic number the larger the difference between the isotope or isotopes of the element and the more abundant element. And when you average the isotope or isotopes and the more abundant element and the atomic number is higher you will come out with a higher difference result than twice the atomic number. (That was even harder to say).
I don't think that there were any sources of error.

It would be interesting to conduct further research to answer the question:

Why is there less liquid elements than solid or gas elements?

QUESTIONS TO CONSIDER:

What is the largest group of elements on the periodic table of elements?

The largest group is VIIIA.

List all the elements that occur naturally as gases.

Hydrogen, Helium, Nitrogen, Oxygen, Fluorine, Neon, Chlorine, Argon, Krypton, Xenon, Radon and Ununoctium.

What do elements in the same family have in common?

They have similar reactive properties because they have or need the same number of available electrons.

What do elements in the same group have in common?

All my research shows is that family and group are the same thing. Here is what I Searched on google: Periodic table groups and families

What do elements in the same period have in common?

They all have the same number of electron shells.

Which of the non-metal elements are not gases?

Boron, Carbon, Silicon, Phosphorus, Sulfur, Arsenic, Selenium and Tellurium.

Fill in the table below:

Element	Chemical Symbol	Atomic Number	Atomic Mass	Phase of Matter
Hydrogen	Hg	1	1.01	Gas
Krypton	Kr	36	83.8	Gas
Silver	Ag	47	107.87	Solid
Helium	He	2	4.004	Gas
Xenon	Xe	54	131.29	Gas
Americium	Am	95	243.00	Solid

Note: Rounded to the second decimal place.

Conclusion:

I learned how the periodic table was formed, important facts about many elements, and most importantly I learned how the periodic table is organized. I was surprised that by just looking at the periodic table closely you can really see how it is organized and how frustrating it must have been to make it. I was also surprised by just looking at it you can see all the amazing things there are to our world and that we have reached the capability to make new elements that to our knowledge have never been created by nature. The only question that was not answered about this lab was:

Why is there less liquid elements than solid or gas elements?

In my opinion this lab was very interesting and I enjoyed it deeply. I hope we continue to Do more labs that relate to this one.

WEB LINKS:
http://www.webelements.com/webelements/scholar/index.html
http://www.chemicool.com/
http://www.chem4kids.com/files/elem_pertable.html