**Periodic Table of the Elements Activity**

*Earth Materials—Prof. Laura Wetzel*

**Purpose**

To become familiar with the organization within the Periodic Table of the Elements and how that organization relates to minerals.

**Background**

Dmitri Mendeleev liked to play solitaire. He also liked to mix chemicals and consider their properties. He wrote the name, atomic mass, and chemical properties of each element on individual cards and then organized them like a game of solitaire. Mendeleev sometimes made exceptions in his list and ended up ordering the elements by their atomic number. In this way, he developed the Periodic Table of the Elements in 1869.

What are “atomic mass” and “atomic number?” Define and give examples.

Why is the atomic number a better choice for organizing the Periodic Table?

**Guidelines**

In class today we are going to follow a similar strategy to recreate the Periodic Table. Each person created cards indicating the properties of select elements from atomic number 1 to 92. If someone did not complete the assignment or if someone is absent, then let me know and we will have to complete the table without their cards. This is similar to what Mendeleev would have done as not all elements were discovered at the time he created the Periodic Table.

First, pool all cards to create full sets of elements (1-92). Divide the class evenly, each group of students at a table with a full set of element cards.

**The goal:** Create the Periodic Table with the element cards. Do not use any outside references—no books, no notes, no internet. Use the information provided on each card and your memory of how the Periodic Table is constructed. You may talk amongst groups. Perhaps it will be useful to remember that Mendeleev created the Periodic Table using solitaire as his inspiration.

When you are done creating the periodic table, alert your professor so that she may admire your work. Then move on to answer the questions on the following page.

**Questions**

Work together as a group at your table and and use outside references, including your notes, textbooks, and a periodic table, to answer the following questions.

1. Are you missing any element cards, from atomic numbers 1 to 92? If you are, then create cards for those elements. Include the basic information: element name, abbreviation, atomic number, atomic mass, electron configuration, and element classification.
2. Consider the 13 most abundant elements in Earth’s crust, listed from most to least abundant:

*Oxygen*

*Silicon*

*Aluminum*

*Iron*

*Calcium*

*Sodium*

*Magnesium*

*Potassium*

*Titanium*

*Hydrogen*

*Phosphorus*

*Sulfur*

*Carbon*

Turn these 13 cards over and on the back indicate the element name, abbreviation, atomic number, and orbital configuration at the top. Then draw the corresponding orbital configurations and indicate the number of protons and neutrons in the nucleus of the most abundant isotope. Group electrons in the principal shells, K, L, M, N ignoring the subshells.

Iron is shown as an example: The orbital configuration is 1s22s22p63s23p64s23d6, so there are two electrons in the first shell (K), 2+6=8 electrons in the second shell (L), 2+6+6=14 electrons in the third shell (M), and two electrons in the fourth shell (N). The atomic number is 26, so there are 26 protons (and electrons). The atomic mass is 55.85, so we round that up to 56 to obtain the most abundant isotope, which means there are 56-26=30 neutrons.

What are the common characteristics of the orbital configurations between the rows and columns of the Periodic Table? Give examples using some of these 13 elements.

Rows:

Columns:

1. Fe has three major isotopes, with masses of 54, 56, and 57. Fill in the following information for each isotope:

|  |  |  |  |
| --- | --- | --- | --- |
| Atomic Mass | **54** | **56** | **57** |
| Atomic Number |  |  |  |
| # Protons |  |  |  |
| # Electrons |  |  |  |
| # Neutrons |  |  |  |
| Electron Configuration |  |  |  |

1. Look up information for these minerals and fill in the table. The Periodic Table will also be helpful. “Min. Group” refers to one of the categories: halides, sulfides, oxides, and silicates. Classification refers to the element classification: halogen, metal, etc. A few answers have been provided for you.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Mineral | **Halite** | **Fluorite** | **Pyrite** | **Hematite** | **Quartz** |
| Formula |  |  |  |  |  |
| Min. Group |  |  |  |  |  |
| Cation |  |  |  |  |  |
|  Valence |  |  |  |  |  |
|  Classification |  |  |  |  |  |
| Anion |  |  |  |  |  |
|  Valence |  |  |  |  |  |
|  Classification |  |  | Non-metal | Non-metal | Non-metal |
| Hardness |  |  |  |  |  |
| Bond Type | Ionic | Ionic | Covalent/Ionic | Covalent/Ionic | Covalent/Ionic |

How does valence relate to electron orbital configurations?