Activity 1: Ion Formation and Prediction

(Topic 6 Reactivity)

Directions: Using the model ion cards, work with a partner to construct your given atoms/ions. Then, present your findings to the class by writing your results on the projected data table. Fill in your own data table with the class results. Finally, complete the predictions below the data table.

To make the atoms/ions:

a) Find your given element on the periodic table of elements. Use the periodic table to determine how many energy levels, electrons, protons, and neutrons a neutral atom would have. Fill in the information according to the example below.

b) Using the beads to represent electrons and the colored paper to represent energy levels, “build” a Bohr diagram of a neutral atom of your element. Sketch the neutral atom as shown in the example.

c) With your partner, decide if the neutral atom will GAIN or LOSE electrons when becoming an ion. Also, decide HOW MANY will be gained or lost. Place your answers in the data table. Then, draw arrows going toward your neutral atom to indicate a gain, or arrows going away from your atom to indicate a loss.

d) Using the information below, fill in the rest of the data table for your given element. Then, write your responses on the projected data table.

Atoms need a total of 8 valence electrons to be considered stable. If they do not have 8 valence electrons, atoms will become ions by gaining or losing electrons in their valence shell. Atoms that **GAIN** electrons are called **ANIONS**. They are usually nonmetals, and will have a **NEGATIVE** charge (oxidation number) due to the presence of more electrons than protons. Atoms that **LOSE** electrons are called **CATIONS**. They are usually metals, and will have a **POSITIVE** charge due to the presence of more protons than electrons. When CATIONS are formed, the outermost (valence) energy level is dropped completely, leaving a complete energy level as the “new” valence level. This makes the atom stable.

**Example:**

Element: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Sketch of Neutral Atom/Ion:

# of protons:

# of neutrons:  
Mass Number:

# of energy levels:

Total # of electrons:

# of valence electrons:

**Data Table:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Element Symbol | Did the atom **gain or lose** electrons? | How many electrons were gained/lost? | Number of Protons | Total Number of electrons (in ion) | Charge of Ion (Oxidation Number) | Type of element (Metal or Nonmetal) |
| H |  |  |  |  |  |  |
| He |  |  |  |  |  |  |
| Li |  |  |  |  |  |  |
| Be |  |  |  |  |  |  |
| B |  |  |  |  |  |  |
| C |  |  |  |  |  |  |
| N |  |  |  |  |  |  |
| O |  |  |  |  |  |  |
| F |  |  |  |  |  |  |
| Ne |  |  |  |  |  |  |
| Na |  |  |  |  |  |  |
| Mg |  |  |  |  |  |  |
| Al |  |  |  |  |  |  |
| Si |  |  |  |  |  |  |
| P |  |  |  |  |  |  |
| S |  |  |  |  |  |  |
| Cl |  |  |  |  |  |  |
| Ar |  |  |  |  |  |  |
| K |  |  |  |  |  |  |
| Ca |  |  |  |  |  |  |

Element: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Sketch of Neutral Atom/Ion:

# of protons:

# of neutrons:  
Mass Number:

# of energy levels:

Total # of electrons:

# of valence electrons:

Element: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Sketch of Neutral Atom/Ion:

# of protons:

# of neutrons:  
Mass Number:

# of energy levels:

Total # of electrons:

# of valence electrons:

**Application Questions:**

1. What trends do you notice as you look at the oxidation numbers for elements going across a period?

2. What trend do you notice for elements that are in the same group/family? Why do you think this trend occurs?

3. Using what you now know about an element’s placement on the periodic table, predict the number of valence electrons and oxidation numbers for each of the following elements:

Complete this table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element Symbol | Element Name | # of Valence Electrons | Oxidation Number | Atom will **GAIN OR LOSE** electrons during ionization |
| Ba |  |  |  |  |
| Sn |  |  |  |  |
| Bi |  |  |  |  |
| Te |  |  |  |  |
| I |  |  |  |  |
| Fe |  |  |  |  |
| Rb |  |  |  |  |
| Ag |  |  |  |  |
| Fr |  |  |  |  |
| Xe |  |  |  |  |

4. Which group/family on the periodic table is most likely the most reactive metals? Why?

5. Which group/family on the periodic table is most likely the most reactive nonmetals? Why?

6. Which group/family on the periodic table is the least reactive? Why?