

## Science 5.1 Valence Electrons

Valence Electrons- The electrons that are in the highest energy level of an atom and that are involved in chemical reactions.

Three important things to remember about valence electrons:

- 1) Located in the outer orbit
- 2) They have the most energy
- 3) They are held most loosely (used for chemical bonding of elements)

Elements want 8 valence electrons to be happy. Elements who have 8 valence electrons on their own (without bonding to another atom/element) are called the noble gases (group 18.) Helium, who is found in this group, only has two valence electrons. There are two elements that only want two valence electrons to be happy: hydrogen and helium. This is because of how many electrons they have. The elements in group 18 are happy because they stable. Elements that don't have eight valence electrons on their own are considered to be reactive. Elements that don't have eight valence electrons on their own will use chemical bonding. We will learn more about chemical bonding in chapter 5 section 2 and section 3.

When we discuss valence electrons, we skip the transition metals (groups 3-12) because there are many exceptions/irregularities.

Electron Dot Diagrams- a representation of the valence electrons in an atom, using dots. You must also write in the chemical symbol for the element when drawing an electron dot diagram. Nitrogen has five valence electrons. This is how the electron dot diagram for nitrogen should look:



Please note: Each side (above, below, left, and right) of the chemical symbol for an element can only have a maximum of two dots.

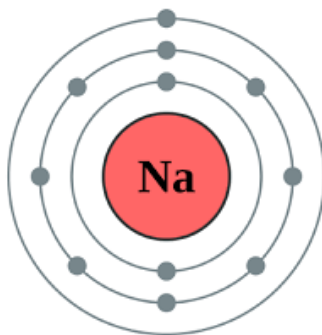
There are two ways for determining the number of valence electrons an element has:

1) Look at the top of the group where an element is found. For example, elements in group 1 have one valence electron. Elements in group 14 have 4 valence electrons.

Please note: When an element is located within a group number that is in double digits (groups 13-18), you must look at the second digit number to determine the amount of valence electrons it will have.

Check: How many valence electrons does elements in group 16 have? Answer: 6 valence electrons

2) Drawing Bohr's Model is another way for determining the number of valence electrons an element has. I will use sodium (Na) as an example for showing this process. You must first find out which period the element is located in. Sodium is in the third period, so I will draw three rings (orbits). Then, I will look at the atomic number, which will tell me how many electrons the atom has. Sodium is atomic number eleven, so it has eleven electrons. You will disburse the electrons on to each orbit. **You must always start with the inner orbit!** The inner orbit only fits a maximum of two electrons. Each orbit after can hold a maximum of eight electrons. This is what the Bohr's Model for sodium looks like:



Notice the outer orbit only has one electron. This means that sodium only has one valence electron. We can confirm that sodium has one valence electron by looking at which group sodium is in on the periodic table. We will see that sodium is located in group 1, so we can confirm that one valence electron is correct!