#### Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

##### When Do Atoms Bond Together To Make Molecules

OBJECTIVES

* To become familiar with the structure of an atom
* To utilize the periodic chart to determine the structure of an atom
* To recognize polar and non-polar covalent bonds, hydrogen bonds, and ionic bonds

BACKGROUND

All matter on planet Earth is made of pure substances called **elements**. An element cannot be broken down into substances of other kinds. For example, iron is an element. If you had a handful of iron and kept breaking into smaller parts, you would never get a small enough sample that you would be holding anything other than iron. You would however, with the aid of laboratory equipment, eventually reach the smallest part of the iron that retains all the properties of iron. This would be one **atom** of iron. All living organisms are made of atoms. Thus understanding what atoms look like and how they function is essential for understanding the characteristics of living organisms.

Elements/Atoms bond together to form molecules and molecules then create various things. A **chemical bond** is the physical process responsible for the attractive interactions between atoms and molecules. Bonds are made between the electrons of an atom. Electrons are found on the shell region of an atom. Protons and neutrons are found within the nucleus of an atom, and help with distinguishing between various elements. Bonding will change the charge of an atom as well. This charge is what allows various items to bond to each other. When an atom gains one or more electrons they will have negative charge, and will be called an **anion**. When an atom loses one or more electrons they will have positive charge and will be called a **cation**.

Valence electrons are what help bonding occur. **Valence electrons** are found on the outer most shell of an atom. If the valence shell is full, then the element is called **inert.** If the valance shell isn’t full, then the element is **reactive**, which means that it can form a bond. In order for a molecule to be happy, they must fill the electron shell to either: full capacity or a multiple of 8, this is called the **octet rule**. But how do you calculate how many electrons are available for bonding? There is a simple equation: 2(n2). The first shell holds 2 electrons, and the second holds 8 electrons. We know this because if “n” equals the shell number, then for shell 1 the equation would read: 2(12)= 2. For the 2nd shell the equation would be: 2(22)=8 and so forth.

Bonds are formed so that the valence shell is either full or at a multiple of eight. There are a number of different types of bonds:

|  |  |  |  |
| --- | --- | --- | --- |
| **Bond type** | **Happens between** | **Electrons are** | **Examples** |
| Ionic | Metal & non-metal | Transferred | Table salt, calcium chloride |
| Covalent | Non-metals | Shared (spend equal time between atoms) | Hydrogen, and Polymers – Like the bouncy ball |
| Polar Covalent | Non-metals | Shared unevenly (spend more time with one atom) | Water |
| Metallic | Metals | Pool (similar to sharing) | Brass (copper and zinc), steel (carbon and iron) |

Pre Lab Questions:

1. What is an element?
2. What is an ion?
3. What is a chemical bond?
4. Why are valence electrons important?
5. When is a molecule inert? Reactive?
6. What is the octet rule?
7. What is the equation for finding out how many electrons can fit onto the outer part of an electron shell?
8. How many electrons fit on the 10th shell?
9. Create the table from above with the bonding information.

MATERIALS

* Element cards
* Strings of various lengths
* Pony Beads

PROCEDURE

You will be creating various molecules through bonding of elements/atoms. Create this chart in your lab book and then fill it out so you can reference it for the rest of the activity.

**Section A:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Element** | **Atomic Symbol** | **Total # of electrons** | **# of valence electrons** | **# of electrons needed to gain or lose (to fill outer shell)** | **Number of Shells needed** |
| Chlorine |  |  |  |  |  |
| Aluminum |  |  |  |  |  |
| Sodium |  |  |  |  |  |
| Nitrogen |  |  |  |  |  |
| Oxygen |  |  |  |  |  |
| Hydrogen |  |  |  |  |  |
| Carbon |  |  |  |  |  |
| Calcium |  |  |  |  |  |

**Section B:**

Ionic Bonds

You will be using the pony beads, and strings to create various molecules using the elements that you looked at earlier.

We will do the first example together, and then you will work thru the rest on your own.

|  |  |
| --- | --- |
| **Example:** Aluminum +Chlorine  Common Name/Use: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Picture: |  |
| **1:** Sodium and Chlorine | **2:** Sodium + Oxygen |
| **3.** Calcium + Chlorine |  |

Covalent Bonds

You will be using the skittles, and strings to create various molecules using the elements that you looked at earlier.

We will do the first example together, and then you will work thru the rest on your own.

|  |  |
| --- | --- |
| **Example:** Hydrogen +Chlorine  Common Name/Use: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Picture: |  |
| **1:** Oxygen + Oxygen | **2:** Carbon + 4 Hydrogen |
| **3.** Carbon + 2 Oxygen | **4.** Nitrogen + 3 Hydrogen |

Polar Covalent Bonds

You will be using the skittles, and strings to create various molecules using the elements that you looked at earlier.

|  |  |
| --- | --- |
| **1:** 2 Hydrogen + Oxygen  Common Name/Use: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Picture: |  |