Boswell & Fitts

Work for week of May 4, 2020

Objectives:

❑ Apply prior knowledge of writing formulas for covalent compounds, ionic compounds, and elements to writing chemical equations

❑ Balance chemical reactions to obey the law of conservation of mass

**Writing and Balancing Chemical Equations**

* Previous to this assignment:

In previous assignments we learned how to write the formula for ionic compounds. Here are some examples:

sodium chloride Na1+Cl1- = NaCl calcium oxide Ca2+ O2- = CaO

magnesium chloride Mg2+ Cl1- aluminum chloride Al3+ Cl1-

+ Cl1- Cl1-

MgCl2 + Cl1-

AlCl3

aluminum sulfide Al3+ O2- strontium nitride Sr2+ N3-

Al3+ O2- Sr2+ N3-

+ O2- Sr2+ +

Al2O3 Sr3N2

Hopefully you have mastered this process and can now build on what you know.

In the real world, things get just a bit more complicated. In other words, we’re going to try and grasp something a little closer to reality. So, here we go. We will try to be as brief as possible.

First of all, there are elements that are too unstable in single atom form. Therefore, when their formulas are written, they are never written as single formulas. You may have seen oxygen, for example, written as O2. That’s because oxygen is too unstable in the single atom form. Another example is ozone, O3, which is written with three oxygen atoms. In the processes that separate O2 into two single atoms, leave the atoms in a highly unstable state. They immediately look for something else to cling to. Sometimes they simply reunite, but other times they latch onto other oxygen molecules, forming O3. To keep from getting in too deep, here is a list of the elements that also exist as pairs of atoms:

H2, N2, O2, F2, Cl2, Br2, I2

They are referred to as the **diatomic elements or diatomic molecules.**

An easy way to remember them is by looking at their positions on the periodic table. They form a seven, and coincidently, they form a group of seven elements. Another way to remember them is to simply remember hydrogen, nitrogen, oxygen, and all of the halogens. Astatine is usually left out of our discussions.

* Chemical Equations Represent Chemical Changes:

Let’s reexamine the magnesium chloride from a chemist’s point of view.

If we write all of the words involved in the process, here’s what we would have:

magnesium, chlorine, magnesium chloride

Chemists sometimes use what is called a ***word equation*** to express what happens to form a compound.

**Word Equation:** magnesium + chlorine ---> magnesium chloride

On the left side of the arrow we place the ***reactant(s)***. These are the materials used to make the ***product(s)***, which we place on the right side of thearrow. The arrow is called the ***yields sign***.

reactant + reactant *yields* product

magnesium + chlorine ---> magnesium chloride

Make sense?

Next we write the symbols or formulas for everything we see:

**Formula Equation:** Mg + Cl2 ---> MgCl2 **\***Remember, chlorine is **diatomic**.

Finally, chemists write what is known as a **balanced equation**. Back in an earlier chapter we learned about something called the **Law of Conservation of Mass**. Remember? It said that the amount of matter in the universe is fixed and cannot be changed. Therefore, if we write an equation about what is happening to a sample(s) of matter, then we must show the same amount of matter (*mass*) before and after the happening (*chemical change*).

If you add up the mass of both sides of the above equation, here’s what you get:

**Balanced Equation:**

Mg + Cl2 ---> MgCl2

1 atom Mg = 24.31 1 atom Mg = 24.31

2 atoms Cl = 79.90 ---> 2 atoms Cl = 79.90

Total = 104.21 Total = 104.21

If you are describing a **chemical change** with a **chemical equation**, this must happen ***every time***. The **mass** on both sides **must** be the same. There is an easier way to determine if the masses are the same. Notice, both sides have the same **number of atoms** of each element. If the **number of atoms** is the same on both sides, then the masses will be the same on both sides.

Let’s take another example, but this time I’ll give you the condensed version:

**Word Equation:** sodium + fluorine ---> sodium fluoride

**Formula Equation:** Na + F2  ---> NaF

Now, notice that fluorine is diatomic, and there is something else wrong. The masses aren’t the same on both sides of the yields sign. If you add the atoms up, you will see. As I said earlier, that process is not necessary. All you need to do is add the atoms on both sides. If the atom count is the same, the mass total will be the same.

Na + F2  ---> NaF

1 atom + 2 atoms ---> 1 atom 1atom

The masses will not be the same. This happens most of the time in equation writing. Sometimes the masses (number of atoms) are the same on both sides, but more often they are not. In that case, as in this one, we will use a process to balance the atoms on both sides. I could go through this process for you, but I have often relied on a young man on the internet to help out, especially since he does a wonderful job.

Here is the link to his video:

<https://www.youtube.com/watch?v=yA3TZJ2em6g&t=447s>

All of the reactions we’ve looked at are **synthesis or composition reactions.** Sometimes, because these contain only two elements, they are called **simple composition reactions**. If you take one of these reactions and work it backwards then you have the **reverse reaction.** When this occurs, it is called a decomposition reaction. Any reaction is balanced the same way.

MgCl2 ---> Mg + Cl2 Final Answer

(1 Mg, 2 Cl---> 1 Mg, 2 Cl)

NaCl ---> Na + Cl2

2 NaCl ---> 2 Na + Cl2 Final Answer

(2 Na, 2 Cl---> 2 Na, 2 Cl)

Al2O3 ---> Al + O2

Al2O3 ---> 2Al + O2

2 Al2O3 ---> 2 Al + 3 O2

2 Al2O3 ---> 4 Al + 3 O2 Final Answer

(4 Al, 6 O ---> 4 Al , 6 O)

When you finish the video, come back and work the following equations:

CHEMISTRY WORKSHEET: Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Chapter 8 - *Simple Composition and Decomposition* Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_Block\_\_\_\_\_\_\_\_\_\_\_

I. For the following, give the completed a) word equation, b) formula equation, and c) balanced equation.

1. a. francium + sulfur --------->

b.

c.

2. a. iron (III) fluoride ------->

b.

c.

1. a. gallium phosphide --------->

b.

c.

4. a. magnesium + tellurium ---------->

b.

c.

5. a. zinc oxide --------->

b.

c.

6. a. manganese + oxygen -------->

b.

c.

7. a. silver chloride -------->

b.

c.

1. a. scandium + iodine ------->

b.

c.

1. a. gold (I) sulfide ------->

b.

c.

10. a. lead (IV) + arsenic ------->

b.

c.

11. a. niobium (II) phosphide -------->

b.

c.

12. a. aluminum + nitrogen-------->

b.

c.

13. a. cesium sulfide -------->

b.

c.

14. a. sodium + selenium -------->

b.

c.