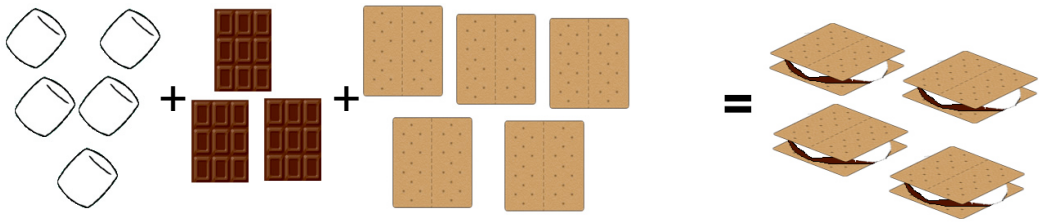
What are Chemical Equations?

Do you know how to make s'mores? What do you need?

___ graham crackers, ___ marshmallows, and ___ pieces of chocolate.

What is wrong with this picture?



Can you make extra s'more parts appear out of nowhere? _____

With the ingredients shown, how many complete s'mores can you actually make? ____

What is left over? ___ graham crackers, ___ marshmallows, and ___ pieces of chocolate

In chemistry, we use these same concepts when we study chemical reactions. We use chemical equations to summarize what happens and how many molecules of each type are involved.

$$Na + Cl_2 \longrightarrow NaCl$$

_____ _____

The arrow means "form" or "**yield**."
This equation can be read as "sodium and chlorine yield sodium chloride"

There is a problem with this equation though: use the table to record how many atoms of each type are shown on each side of the arrow.

Reactant side		**Product side**	
Na		Na	
Cl		Cl	

It looks as if an atom of _____ disappeared! This does not happen in reality. The equation does not accurately describe what really happens. We say it is not **balanced**.

In order to accurately describe the actual chemical reaction, we need to remember three important facts:

1) Atoms do not appear or disappear in a chemical reaction. A chemical reaction breaks old bonds and forms new ones. It simply rearranges the atoms that are there. Our equations must have an equal number of atoms of each type on both sides of the arrow -- the before and after arrangements.

2) We cannot change the <u>subscripts</u> in the chemical formulas of the molecules of the reactants or products. These formulas show the actual content of the molecules and if we change the subscripts, we are no longer describing the number and arrangement of the atoms. Chlorine always comes as Cl_2 and cannot be described as simply Cl.

3) We can <u>only</u> adjust the numbers of molecules of each kind that participate in the reaction. Just like with the s'mores, there is a certain number of each ingredient needed, and if there are any extras they cannot be used -- they are not part of the reaction. We use numbers in front of the chemical formulas to show how many molecules are needed. This number is called a **coefficient** (koh-uh-FISH-unt).

Let's fix our equation: