Chp 15/Lect 1: Chem Rxn & Writing Chem Formulas:

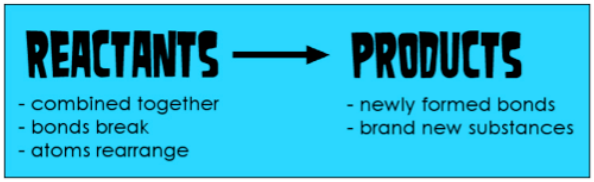
2pts ec printing

Chemical Change: Ice melting & water freezing are both examples of physical changes. During a physical change, a substance changes form, but remains the same substance. A chemical change turns 1 or more substances into different substances that usually have different properties (they now look different, smell different, act differently, etc.) Chemical change is really important & we use it everyday to make necessary substances like rubber, plastic, medicine, etc.

A chemical reaction is material changing from a beginning mass to a resulting substance. The conclusion of a chemical reaction is that new material or materials are made, along with the disappearance of the mass that changed to make the new. This _____ that new elements have been made. In order to make new elements, the nuclear contents must change, and that requires major amounts of energy.

What is a chemical reaction?

A system of chemical changes that involve the breaking & reforming of bonds to create new substances. The result: a brand new substance



Video Notes #1: Bill Nye. Take notes: _____

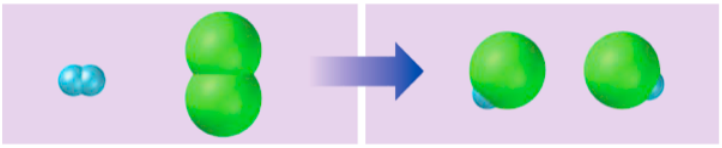
_____

_____

_____

Signs of a Chemical Reaction

1. _____- gas formation
2. _____ solid formation
3. _____
4. _____ change – energy change



Parts of a Chemical Reaction

In cooking, ingredients are combined to make food. In chemical reactions, reactants are combined to make products. The _____ are substances that are combined & changed in the reaction. The _____ are the new substances that result from the reaction.

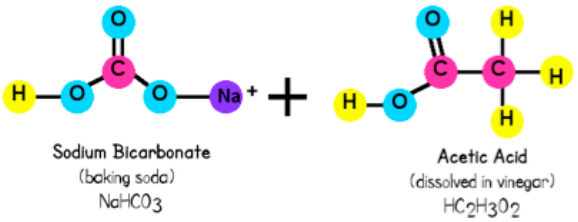
Example #1: Hydrochloric Acid

* Reactants: hydrogen (H_2 - gas) & chlorine (Cl_2 - gas)
*The bonds break, the elements rearrange, and& form new bonds with each other.
* Products: 2 HCl

Example #2: Baking soda & Vinegar

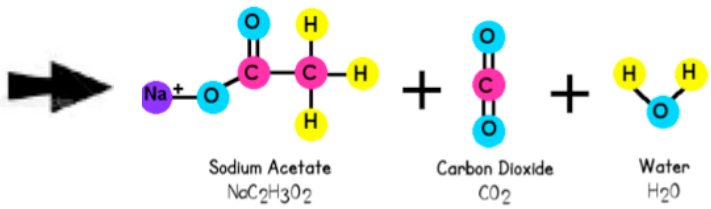
What is the actual reaction between baking soda & vinegar?

Reactants:



Now, break the bonds, rearrange the atoms, and what do you get???

Products:



ADD IT UP: How many total atoms are there?

_____ Hydrogen _____ Sodium

_____ Oxygen _____ Carbon

ADD IT UP: How many total atoms are there?

_____ Hydrogen _____ Sodium

_____ Oxygen _____ Carbon

A chemical reaction rearranges the atoms of the reactants to form new compounds of the products. No new atoms are created!

BrainPop Video: Conservation of Mass. Complete questions on BP page

The Law of _____.**The mass of the reactants _____ the mass or the products OR: Mass is NEVER _____**

Or you can't get somthin' outta nothing.

Video 2: Law of Conservation of Mass Notes:_____

_____

_____

Chemical Formulas/Equations:

A molecule or compound consists of at least **two atoms that are**_____.The chemical formula of a molecule or compound states **how many atoms of each**_____ are in one of its molecules. This formula is similar to an algebraic formula in its use of symbols. The description of a compound with numbers and symbols is called a chemical formula. Some formula can be quite complex.

A _____ is a way to describe what goes on in a chemical reaction, the actual change in a material. Chemical equations are written with the _____ of materials to include elements, ionic or covalent compounds, aqueous solutions, ions, or particles. There is an _____ pointing to the right that indicates the action of the reaction. The materials to the left of the arrow are the _____or materials that are going to react. The materials to the right of the arrow are the _____ or materials that have been produced by the reaction.

Chemical formulas

Chemical formulas are designations of **molecules and compounds in** _____ _____similar to that used in Algebra.

This is a way to show the exact number of atoms & compounds in a chemical reaction. We write the chemical equation for baking soda & vinegar as follows:

$NaHCO_3 + HC_2H_3O_2$ ------>

$NaC_2H_3O_2 + CO_2 + H_2O$

EXAMPLES OF CHEMICAL CHANGES

shown in chemical formulas:

Chemical reactions, also called chemical changes, are not limited to happening in a chemistry lab. Here are some examples of chemical reactions with the corresponding chemical equations:

1. A silver spoon tarnishes. The silver reacts with sulfur in the air to make silver sulfide, the black material we call tarnish.

   2 Ag + S --> _____

2. An iron bar rusts. The iron reacts with oxygen in the air to make rust. 4 Fe + 3 O2 --> _____

3. Methane burns. Methane combines with oxygen in the air to make carbon dioxide and water vapor. CH_4 + 2 O2 -->_____

4. An antacid (calcium hydroxide) neutralizes stomach acid (hydrochloric acid). $Ca(OH)_2$ + 2 HCl --> _____

BrainPop: Chemical Equations

Complex formulas

Just as in Algebra, you can use parentheses to separate parts in a complex formula. One example is the formula for nitroglycerin, a highly explosive substance. **$C_3H_5(NO_3)_3$**

This formula shows that nitroglycerin consists of 3 atoms of C, 5 atoms of H and then 3 NO_3 nitrate ions. If the parentheses were not used, you might have a formula like: **$C_3H_5N_3O_9$**

The number of atoms for each element would be correct, but it wouldn't help to describe the true structure of the nitroglycerin molecule. Remember that molecules are 3-dimensional collections of atoms.

In more complex molecules--especially in organic substances--the configuration becomes important. **Carbon dioxide is CO_2,** which means there is one atom of carbon and two atoms of oxygen in the molecule. To show the **number of molecules,** a full sized number is located in front of the molecule. This is called a _____

For example 4 molecules of carbon dioxide is designated as: **$4CO_2$** This means there are a total of 4 C atoms and 8 O atoms in the combination. A way to remember this--taken from Algebra--is to think of it as 4 x (CO_2).

BALANCING EQUATIONS

Now comes the fun part, balancing the reaction. The **Law of Conservation of Mass** states that **in a chemical reaction there _____** Each type of element will have the same amount before the reaction and after the reaction, or as reactant and product. But you cant change the materials that participate in the reaction, so you must write an integer coefficient in front of (to the left of) each material in the reaction to make sure every type of atom has the same number on each side of the reaction.

1. Nitrogen gas plus hydrogen gas under pressure and at high temperature turn into ammonia. **First** write the materials correctly. Nitrogen and hydrogen are diatomic gases. Ammonia is a binary covalent memory item. The nitrogen and hydrogen are the reactants, and the ammonia is the product. Leave room for the coefficients in front of the materials.

$$\_\ N_2 + \_\ H_2 \rightarrow \_\ NH_3$$

2. You can begin with either the nitrogen or the hydrogen. There are two nitrogen atoms on the left and only one on the right. In order to balance the nitrogen atoms, place a 2 in front of the ammonia.

$$\_\ N_2 + \_\ H_2 \rightarrow 2\ NH_3$$

3. There are two hydrogens on the left and six on the right. We balance the hydrogens by placing a 3 in front of the hydrogen gas.

$$\_\ N_2 + 3\ H_2 \rightarrow 2\ NH_3$$

4. Now go back and check to make sure everything is balanced. There are two nitrogen and six hydrogens on both sides of the reaction. It is balanced. There is no coefficient shown in front of the nitrogen. There is no need to write ones as coefficients. The reaction equation is: _____

$$N_2 + 3\ H_2 \rightarrow 2\ NH_3$$

THE 4 RULES OF CHEMICAL REACTIONS

1. Chemical reactions are processes in which **atoms are _____** into different combinations of molecules.
2. Reactants interact, change bonds, and **form products with _____ chemical properties**.
3. In a reaction, **the number of atoms stays the _____**, no matter how they are arranged, so their total mass stays the same.
4. Chemical reactions **usually liberate/_____ or absorb heat**.

In Conclusion:

The number of atoms of each element in a chemical formula is designated by the small number behind each element symbol. If there is no number, it is assumed there is only one of that element. A large number in front of a compound designates how many units there are of that compound. Parentheses can be used to designate a special structure, where other molecules are attached to the larger, complex molecule.

TYPES OF BONDS

*Write **I** for ionic bond, **C** for covalent bond, or **M** for metallic bond.* *(1/2 point each)*

1. _____ An attraction between positive & negative ions
2. _____ An attraction between a positive metal ion & the negative electrons in a metal
3. _____ When two atoms share electrons equally
4. _____ Created when two atoms transfer electrons
5. _____ Occurs between two metals
6. _____ Occurs between a metal & a nonmetal
7. _____ Occurs between two nonmetals
8. _____ Found in regular sugar, Splenda, & equal
9. _____ Found in regular table salt (NaCl)
10. _____ Possess high melting & boiling points
11. _____ Possess low melting & boiling points
12. _____ Create rigid crystalline substances
13. _____ Do not conduct electricity
14. _____ Great conductors heat or electricity
15. _____ Conducts heat or electricity only when dissolved in water

*Use your periodic table to classify the substances as **Ionic** (metal – nonmetal), **Covalent** (nonmetal – nonmetal), or **Both** (contains both).* *(1/2 point each)*

Example: $CaCl_2$ Calcium is a metal & chlorine is a nonmetal, so $CaCl_2$ contains an **ionic** bond.

16. _____ CO_2
17. _____ H_2O
18. _____ $BaSO_4$
19. _____ K_2O
20. _____ NaF
21. _____ Na_2CO_3
22. _____ CH_4
23. _____ SO_3
24. _____ LiBr
25. _____ MgO
26. _____ NH_4Cl
27. _____ HCl
28. _____ KI
29. _____ NaOH
30. _____ NO_2
31. _____ $AlPO_4$
32. _____ $FeCl_3$
33. _____ P_2O_5
34. _____ N_2O_3