STEM Sims™

Balancing Equations

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Do you need an idea for a scientific study?
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The process of balancing equations ensures the Law of Conservation of Atoms is maintained. Take the following brief quiz to see how much you already know about chemical reactions and balancing equations. See the bottom of page 4 to check your answers.

1. Who is credited for diagramming the first chemical equation?
   a. Aristotle
   b. Henry
   c. Beguin
   d. Rutherford

2. In what year did Lavoisier publish his first work regarding the Law of Conservation of Mass?
   a. 1615
   b. 1743
   c. 1789
   d. 1812

3. Change the subscript on one or more reactants or products to balance a chemical equation.
   a. true
   b. false

4. Earth's atmosphere contains about 78% nitrogen gas. What happens to most of the nitrogen gas inhaled during breathing by a person?
   a. The nitrogen gas is changed into various proteins.
   b. The nitrogen gas is changed into ammonia.
   c. The nitrogen gas takes part in the cellular respiration process.
   d. The nitrogen gas is exhaled unchanged.

5. A person enters a sealed room filled with only nitrogen gas. What would happen to the person?
   a. The person would die in a matter of minutes.
   b. The person would die after a few days.
   c. The person would die after a few months.
   d. Nothing since people breathe nitrogen gas all the time.

Modeling a Chemical Reaction

Models are often used to help visualize things that are too small to see. Since atoms are too small to see, modeling a chemical reaction with larger objects helps people better understand the process. In this investigation, you'll model the chemical reaction between hydrogen gas and nitrogen gas- a reaction that makes ammonia gas.

Materials Required

1 – box of toothpicks 1 – small bag of small white marshmallows

1 – small bag of small colored marshmallows

Procedure

1. Make sure that you get permission before conducting this experiment.
2. Connect two white marshmallows together using one toothpick. This will represent one molecule of hydrogen gas (H_2). Place this on a large flat surface.
3. Repeat step #2 two more times to build two more hydrogen gas molecules.
4. Connect two colored marshmallows together using one toothpick. This will represent one molecule of nitrogen gas (N_2). Place this on a large flat surface.
5. One molecule of ammonia (NH_3) consists of one nitrogen atom and three hydrogen atoms.
6. Remove the toothpicks from the four molecules you just made.
7. Using only these marshmallows, build as many ammonia molecules as possible by connecting three hydrogen atoms to one nitrogen atom using toothpicks.

Questions

1. How many total ammonia molecules did you build?

2. How many hydrogen molecules did you use to build the ammonia?

3. How many nitrogen molecules did you use to build the ammonia?

4. What did the toothpicks used in this investigation represent?

5. Write the balanced chemical equation for hydrogen and nitrogen combining to form ammonia.

Balancing Equations

Fireworks!

Fireworks are often used during times of celebration to light up the sky with fantastic colors of light. But what is needed to make fireworks? Fireworks depend on three major substances to produce their show. The first is a fuel source, such as charcoal-based black powder that makes the part of the burst or explosion. The second part is an oxidizer that supplies a rich source of oxygen to the fuel. Common oxidizers consist of compounds containing nitrates and/or chlorates. This combination of fuel and oxidizer produces the loud sound that is caused when the air around the fireworks expands at a rate faster than the speed of sound. This creates a shockwave that people associate with the firework exploding.

The third part of a firework is the color-making chemical mixture. When various metals contained within the chemical mixer are heated by the fuel source, electrons within the metals become excited. As the electrons return to their normal, non-excited state, they release energy in the form of light. The color produced by a firework depends on the type of metal. Table 1 below shows the metal type and color produced. Multiple metals can be mixed to make other colors, such as copper and strontium to make purple light.

Table 1. Metal Type and Color of Fireworks

Metal Type	Color of Fireworks
Copper	blue
Strontium	red
Sodium	yellow
Barium	green
Calcium	orange
Magnesium	silver
Aluminum	white

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Answers: Page 2 Answers: 1) c, 2) c, 3) b, 4) d, 5) a. **Page 3 Answers: Modeling a Chemical Reaction** 1) two 2) three 3) one 4) chemical bonds between atoms 5) $3\ H_2 + N_2 \rightarrow 2\ NH_3$