Balancing Equations Using Stop-Motion-Video

Teacher's Guide

1. Each student should prepare his/her own paper to be turned in after completing the lab. There are enough parts in the kit for 15 groups.

2. You may wish to review, **Demonstration 2: Balancing Equations**, listed above.

3. You might want to tie in how the next lab, **Lab 6: Modeling Enthalpy Changes Using Stop-Motion-Video**, depends on a knowledge of how to balance equations.

4. Each student writes the skeleton and the balanced equation for the reaction:
   $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

5. The group then attaches the iPhone, android phone, or iPad with the Stop-Motion-Video app to a ring stand as shown in the introduction to Stop-Motion-Video section above.

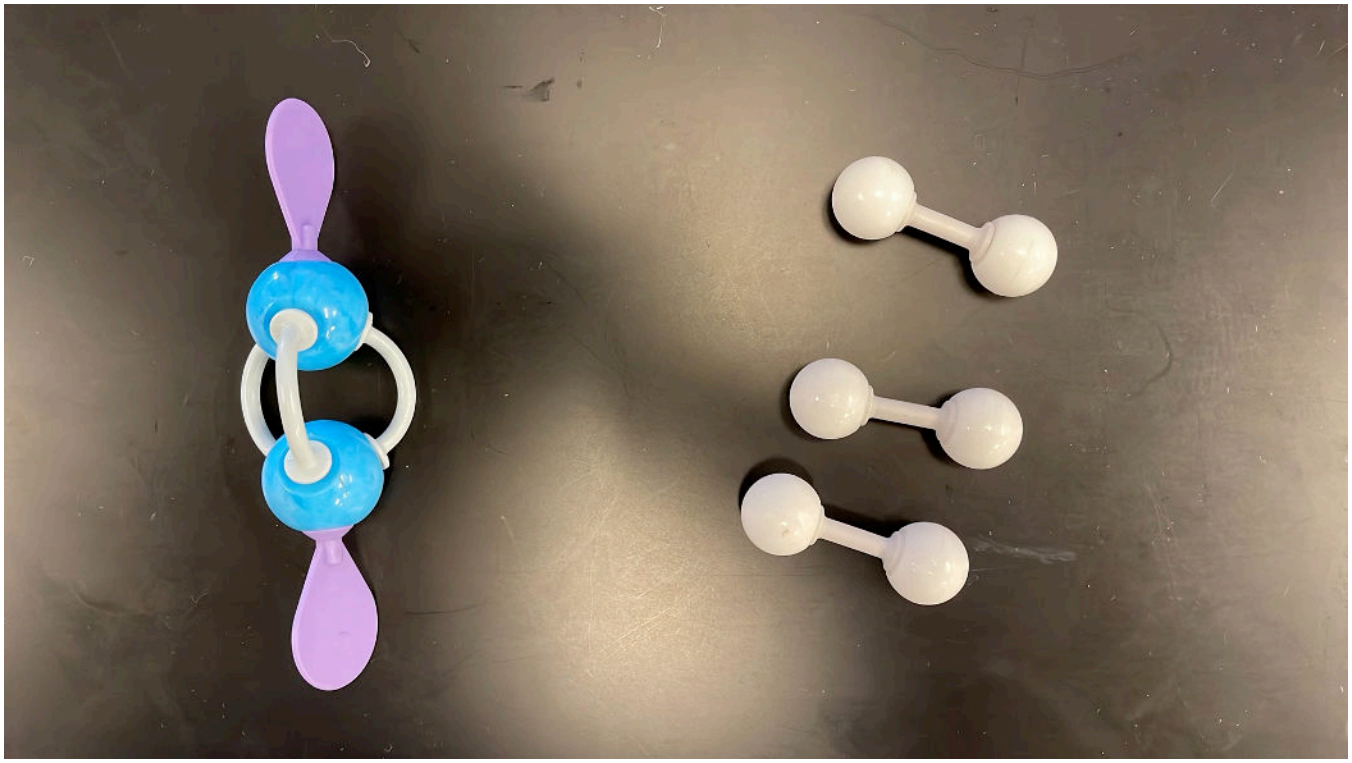
6. Have students set up one nitrogen molecule (two blue, 4-hole atoms and three long flexible bonds) and three hydrogen molecules (six white, 1-hole atoms and three short rigid bonds), two purple lone pair paddles. Three additional short bonds must be supplied.

7. Students will then make a stop action video of the original bonds breaking, the rearrangements of atoms, and the making of new bonds. The additional short bonds can be set aside. You can decide how the students will separate the atoms and original bonds, or you can tell them to try to create their own method of bond changes.

8. Have the students turn in their papers with the completed balanced equation for the reaction and the answers to the five questions. Explain how students will share their videos with you. For instance they can email the stop motion video to you or if there is enough time you can check their videos as they complete them.

9. Below, you will find a sample Stop-Motion-Video for this procedure.

Example Stop-Motion-Video:



Key:

1. What is a skeleton equation? An equation that has the correct subscripts on all molecules and formula units but may not have the correct coefficients (it may be unbalanced).

2. How are the subscripts determined when writing chemical formulas? Either the charges on the ions that make up the compound have to be balanced, or the molecule's proper formula based on covalent bonding and the name of the molecule is used.

3. How are coefficients determined when writing a balanced equation? By counting the number of atoms of each element on each side of the equation and finding a common multiple to balance the atoms on each side of the equation.

4. What changes take place in a chemical reaction? A rearrangement (separation and recombination) of atoms.

5. What is wrong with this equation, $Na + Cl_2 \rightarrow NaCl_2$? The formula should be NaCl not $NaCl_2$ and there should be a coefficient of 2 in front of Na on the left and a 2 in front of NaCl on the right.

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Student Procedure

Objective: To model and visualize the process and stoichiometry of a chemical reaction.

Materials: Ryler Enterprises model kit parts: 6 white (hydrogen) atom centers, 2 blue (nitrogen) atom centers, 6 single bonds, 3 double/ triple bonds, two purple lone pairs, Stop-Motion-Video app, ring stand, ring clamp(s), rubber bands.

1. Write the skeleton equation for the reaction of a molecule of nitrogen gas with three molecules of hydrogen gas to form two molecules of ammonia.
2. Balance the equation. Each student will show the balanced equation to the teacher.
3. Your teacher will demonstrate how to attach one or two rings to one or more ring stands with rubber bands on the rings. Place an iPhone, android phone, or iPad on the ring(s) about 10 cm above the lab table. Next open a Stop Motion app to create a stop motion video detailing the breaking and making of bonds to form a new product. The video should show the rearrangements of the atoms to form the products. Adjust the speed of the movie so that the process details are clearly observable.
4. Each student will turn in a copy of the skeleton equation and balanced equation for the reaction, and the answers to the questions below. Each lab group will share its video with the instructor.

Questions:

1. What is a skeleton equation?

2. How are the subscripts determined when writing chemical formulas?

3. How are coefficients determined when writing a balanced equation?

4. What changes take place in a chemical reaction?

5. What is wrong with this equation, $Na + Cl_2 \rightarrow NaCl_2$?