

## JSD 3D Learning Activity Template

**Grade:** 6<sup>th</sup> Grade

**Title:**

Baking Soda and Vinegar— What Really Happens?

**Utah Science with Engineering Education Standard (SEEd):**

**Standard 6.2.1:** Develop models to show that molecules are made of different kinds, proportions, and quantities of atoms. Emphasize understanding that there are differences between atoms and molecules, and that certain combinations of atoms form specific molecules. Examples of simple molecules could include water (H<sub>2</sub>O), atmospheric oxygen (O<sub>2</sub>), and carbon dioxide (CO<sub>2</sub>)

**Key crosscutting concept(s) (CCC):** Proportions and Quantities

**Key science and engineering practice(s) (SEP):** Develop Models

**Materials:** 16 oz. plastic soda bottle; funnel; balloon; balance; vinegar; baking soda; ml spoon; graduated cylinder; four different colors of clay, gumdrops, or beads; toothpicks or pipe cleaners

**Time:** 45 minutes

**Teacher background, key content information and hints:**

A *chemical change* occurs when new kinds of matter are formed. The composition of the matter changes and the new kinds of matter have different properties from the old matter. Evidence of a *chemical change* may be the result of chemicals reacting with one another. When chemical changes occur, the proportions and quantities change for the new products formed. Even though there are new products, the number of atoms has not changed during the reaction. The chemical make-up of Baking Soda: NaHCO<sub>3</sub>; Vinegar: HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>; New products made: Water: H<sub>2</sub>O; Carbon Dioxide: CO<sub>2</sub>; Salt Vinegar--NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>

**Prior knowledge that students need:**

Students need to know that when a chemical change has occurred and new products have been made, that the number of atoms stays the same from the beginning to the end. They need to know what atoms and molecules are.

### Learning Activity Plan

***These three aspects of a lesson should be identified in your learning activity.***

**Gathering:** *(Obtain Information, Ask Questions/Define Problems, Plan & Carry Out Investigations, Use Models to Gather Data and Information, Use Mathematics/Computational Thinking.)*

The students will plan out and do the vinegar and baking soda experiment. They will ask questions as to what the results are. They will gather information and make a model by drawing pictures of what happened.

**Reasoning:** *(Evaluate Information, Analyze Data, Use Mathematics/Computational Thinking, Construct Explanations/Solve Problems, Develop Arguments from Evidence, Use Models to Predict & Develop Evidence.)*

The students can look up on Google what the chemical make up of vinegar and baking soda are and then make inferences as to what happened. The students can be told or they can look for themselves that the water is the liquid and carbon dioxide is the gas and then infer what the chemical make-up is of the unknown particulate at the bottom of the bottle is. The students will make simple calculations of what the chemical make-

**Communicating:** *(Communicate Information, Argue from Evidence (written & oral), Use Models to Communicate).*

The students will show the model that they made. They will communicate their findings and argue how they were able to figure out what the new substances were and their chemical make-ups.

	<p>up of the beginning substances were and the chemical make-up of the final substances.</p> <p>With different colors of clay, the students will make a model of the beginning two substances and the final three substances. Using computational thinking they can figure out how many atoms they started with and how many they ended with.</p>	
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**Phenomenon:** When doing the vinegar and baking soda experiment, what are the new substances made and what are their chemical make-ups?

**Learning Activity:**

1. In groups of two, three, or four have the students will be given the equipment they need to do the baking soda and vinegar experiment along with these directions:
  - a. Have the students put the end of a funnel in the mouth of the balloon and measure out 10 ml of baking soda and put it in the funnel so the baking soda will go into the balloon. Have the students weigh the balloon with the baking soda in it and record it.
  - b. Have the students measure out 25 ml of vinegar into a graduated cylinder. With a funnel, pour it into the 16 oz. plastic soda bottle. Have the students weigh the bottle with the vinegar in it and record it.
  - c. Carefully put the mouth of the balloon over the mouth of the soda bottle without letting the baking soda get into the bottle.
  - d. When ready, have the students lift up the balloon so the baking soda goes into the bottle. Shake the balloon so it all falls into the bottle. Shake the bottle so that the baking soda mixes well with the vinegar. Have them record on their data sheet what they observed happening.
2. Have the student write down what they saw happen during the experiment. (It fizzed, there is a liquid, there is a solid, it is cold on the bottom, and there is a gas in the balloon.)
3. Have the students write three or four questions they may have about the experiment.
4. Have them draw a picture of what happened in the experiment.
5. Ask them, "What would be important to know as to why this experiment happened as it did?"

**Assessment of student learning**

*Short description of the evidence the teacher is willing to accept that a student is proficient with the performance expectations.*

*This may be a rubric, narrative, or other set of descriptors that are useful for distinguishing proficient from non-proficient performances.*

1. The students know what the chemical make-up of baking soda and vinegar.
2. The students know that new products were made.
3. The students can find out what the new products are.
4. The students can find out the chemical make-up of the new products.
5. The students can explain how the new products were made.
6. The students can explain the models that they made.

**Student Sheet**

## **Title:** Baking Soda and Vinegar—What Really Happens?

### **Introduction:**

You are going to do the baking soda and vinegar experiment. You will be given directions on how to do it. You will be looking for data to write down at the completion of the experiment. You will be given the chemical make-up of baking soda and vinegar. With a little research you will need to find out what the new products are and the make-up of the new products. You will need to explain your findings and why you chose those elements of the products.

### **Materials:**

16 oz. plastic soda bottle; funnel; balloon; balance; vinegar; baking soda; ml spoon; graduated cylinder; four different colors of clay, gumdrops, or beads; toothpicks or pipe cleaners

### **Procedures:**

#### **Part 1:**

1. In your groups of two, three you will need to do the following for the baking soda and vinegar experiment:
  - a. Put the end of a funnel in the mouth of the balloon and measure out 10 ml of baking soda and put it in the funnel so the baking soda will go into the balloon. Weigh the balloon with the baking soda in it and record it.
  - b. Measure out 25 ml of vinegar into a graduated cylinder. With a funnel, pour it into the 16 oz. plastic soda bottle. Weigh the bottle with the vinegar in it and record it.
  - c. Carefully put the mouth of the balloon over the mouth of the soda bottle without letting the baking soda get into the bottle.
2. The chemical make-up of Baking Soda:  $\text{NaHCO}_3$ ; Vinegar:  $\text{HC}_2\text{H}_3\text{O}_2$ . Make a model of these two substances with your model making things.
3. When ready, lift up the balloon so the baking soda goes into the bottle. Shake the balloon so it all falls into the bottle. Shake the bottle so that the baking soda mixes well with the vinegar.
4. Write down what you saw happen during the experiment.
5. Weight the whole thing and record it.
6. Write three or four questions that you now have about the experiment.
7. Draw a picture of what happened before the experiment and after the experiment and label all the parts.
8. Discuss among your group "What would be important to know as to why this experiment happened as it did?"

#### **Part 2:**

1. Discuss how many new products were made.
2. Discuss what do you think those new products are.
3. Look up on Google what those new products might be.

4. When you find out, make models of the chemical make-up of the three products.
5. Discuss within your group what happened from the baking soda and vinegar make-ups to the three new products.
6. Discuss your conclusions from the former substances to the new substances.
7. Communicate to the class your findings. Use your models as evidence to argue your findings.

**Analysis:**

1. What are the chemical make-ups of vinegar and baking soda?
2. How did you know new products were made?
3. How did you find out what the chemical make-up of the new products was?
4. How did you know that it would contain the same elements as the vinegar and baking soda?
5. Explain in your own words how the new products were made.
6. How did the models you made help you in understanding what happened in the experiment?

**Conclusion:** Describe in a paragraph what you learned in this activity.