

Law of Conservation of Matter Lab: Teacher Notes

Lesson Essential Question: What is Matter and the Law of Conservation of Matter?

General Objective: Students create their own experiment to prove the Law of Conservation of Mass after conducting a guided practice lab.

Instructional Goals:

1. Given vinegar and baking soda along with specific directions, students prove the Law of Conservation of Mass.
2. Given Alka-Seltzer and a flask, students design and conduct an experiment to prove the Law of Conservation of Mass.

The law of conservation of mass indicates that mass cannot be created nor destroyed. This means the total mass of reactants in a chemical reaction will equal the total mass of the products. If a gas is produced during a reaction, which mass is often forgotten when calculating the final mass because the students are unable to see the gas. For this reason, balloons or zip lock bags may be used to collect the gas and preserve the mass.

When balancing chemical equations, the law of conservation of mass is also demonstrated because the total number of atoms that goes into the reaction must be produced. So if 14 atoms are on the reactant side, then 14 atoms must be on the product side. Equations often require balancing to correctly demonstrate the law of conservation of mass.

Students work in small cooperative groups to complete a laboratory exercise related to conservation of mass. Using vinegar, baking soda and a sealed plastic bag, students determine the mass of the vinegar and baking soda. Students then seal the vinegar and baking soda in a plastic bag and mix the substances. A gas is formed which will inflate the bag. The mass of the sealed bag will then be determined in order to ascertain if there has been any change in the mass of the reactants and product before and after the reaction took place.

In the second activity, students design their own investigation to observe and prove the law of conservation of mass. The first investigation should provide them with the knowledge they need a closed system so the mass of the gas is included. Depending on the restrictions you provide, this activity could use a large number of seltzer tablets. Consider restricting their supply to 2 or 3 tablets, depending on your supplies. Allow students to ask you for additional supplies they might need. Ensure students have a plan in writing before they start testing.

We have long known that atoms can be neither created nor destroyed during a chemical reaction. The number of atoms of each element must be the same before and after the chemical reaction.

If the number of atoms of each element remains the same, then the mass can never change in a chemical reaction. The total mass of the reactants must equal the total mass of the products. This observation that mass must remain constant in a chemical reaction as known as the law of conservation of mass

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Materials Per Group:

- 2 small plastic cups
- vinegar (acetic acid)
- baking soda (sodium bicarbonate)
- triple beam balance
- flask
- Alka-seltzer tablets (2-3 per group)
- zip lock bags (1 for first lab and additional bags for possible usage in second experiment)
- balloons (for possible usage in second experiment)

SAFETY NOTE:

Safety goggles and aprons must be worn.

Students must seal the bag completely in the first experiment so that the chemicals do not spray out during the experiment. During the second part when students design their own experiment, care must be taken to keep the glass flask from breaking due to the pressure of the gas. If the students request a rubber stopper, make sure that it is larger than the opening so that the flask does not crack due to gas exerting pressure.

Engagement:

Drop an Alka-seltzer tablet into a beaker of water. Discuss the Law of Conservation of Mass. Why is it hard to prove the law when a gas is produced? That's your job today in the second part of this lab experiment.

Explore:

1. Fill one cup halfway with vinegar.
2. Fill a second cup halfway with baking soda.
3. Put both cups in the plastic bag. Take care NOT to spill the contents of either cup.
4. Determine the mass of the cups and their contents, and the plastic bag. Write the values in your data table.
5. Seal the plastic bag.
6. Without opening the bag, pour the vinegar into the cup of baking soda.
7. Without opening the bag, record the mass of the contents of the plastic bag. Take care not to break the seal of the plastic bag.

Explain:

Initial Mass (g)	Final Mass (g)	Change in Mass (g)

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1. Describe what happens when the vinegar was poured into the cup of baking soda. *Answers may vary, but students should mention release of a gas. This is a typical chemical reaction in which an acid - vinegar, reacts with a base - baking soda, to produce a new chemical - a salt.*

2. The gas produced in this reaction can put out fires. Can you make an educated guess about its identity? What is the name of the gas? *Carbon dioxide*

4. What is conservation of mass and how does it relate to this exercise? *Conservation of mass says the total mass of the reactants must equal the total mass of the products. As long as the carbon dioxide was not allowed to escape, the change in mass that occurred during the reaction should be zero.*

Elaborate:

Design an investigation to demonstrate the law of conservation of mass using a seltzer tablet and flask. Be specific in your procedures so another person or group could reproduce your investigation and gather the same data and observations. Once the procedures are written, conduct your investigation. Be sure to collect data and observations during each trial. If you change your procedures along the way, make adjustments to your procedures on paper.

Students should ask for balloons or something to put the flask in (large zip lock bag) to create a closed system. The students will have varying procedures. Hopefully they will create a closed system by placing the seltzer tablet in a balloon on the top of the flask. When the seltzer tablet is dropped in the water, the balloon will capture the gas and the initial mass should equal the final mass.

Sample Rubric:

POINTS	Scientific Accuracy	Reasoning	Communication	Collaboration	
4 Excellent	Measurements and answers are very accurate.	Investigation was very well designed and implemented.	Team discussed ideas completely and fully answered all questions with clear and concise answers.	Team members worked very effectively to design their experiment.	
3 Good	Measurements and answers are accurate.	Investigation was well designed and implemented.	Team discussed ideas and fully answered most questions with clear and concise answers.	Team members worked effectively to design their experiment.	
2 Fair	Measurements and answers are fairly accurate.	Investigation was adequately designed and implemented	Team discussed some ideas completely and fully answered some questions with clear and concise answers.	Team members worked in an average way to design their experiment.	
1 Poor	Measurements and answers are not accurate.	Investigation was poorly designed and implemented.	Team discussed few ideas completely and fully answered few questions with clear and concise answers.	Team members worked poorly to design their experiment.	
Subtotal: _____ Subtotal: _____ Subtotal: _____ Subtotal: _____					TOTAL: _____/16pts

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Lesson Essential Question: What is Matter and the Law of Conservation of Matter?

General Objective: Students create their own experiment to prove the Law of Conservation of Mass after conducting a guided practice lab.

Materials for First Experiment:	Materials for Designed Experiment:
<ul style="list-style-type: none">• 2 small plastic cups• vinegar (acetic acid)• baking soda (sodium bicarbonate)• triple beam balance	<ul style="list-style-type: none">• flask• water• Alka-seltzer tablets (2-3)• optional materials provided by the teacher upon request

SAFETY NOTE:

Safety goggles and aprons must be worn.

Students must seal the bag completely in the first experiment so that the chemicals do not spray out during the experiment.

Explore:

1. Fill one cup halfway with vinegar.
2. Fill a second cup halfway with baking soda.
3. Put both cups in the plastic bag. Take care NOT to spill the contents of either cup.
4. Determine the mass of the cups and their contents, and the plastic bag. Write the values in your data table.
5. Seal the plastic bag.
6. Without opening the bag, pour the vinegar into the cup of baking soda.
7. Without opening the bag, record the mass of the contents of the plastic bag. Take care not to break the seal of the plastic bag.

Explain:

Initial Mass (g)	Final Mass (g)	Change in Mass (g)

1. Describe what happens when the vinegar was poured into the cup of baking soda.
2. The gas produced in this reaction can put out fires. Can you make an educated guess about its identity? What is the name of the gas?
4. What is conservation of mass and how does it relate to this exercise?

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Group Members: _____

Design an investigation to demonstrate the law of conservation of mass using a seltzer tablet and flask. Be specific in your procedures so another person or group could reproduce your investigation and gather the same data and observations. Once the procedures are written, conduct your investigation. Be sure to collect data and observations during each trial. If you change your procedures along the way, make adjustments to your procedures on paper.

Materials: _____

Procedures:

Results:

Explanation of Results:
