Making Foam with Chemistry!

Credits: Elizabeth Gall & Laura Moribe, University of Tennessee Extension

Skill Level

8th grade

Learner Outcomes

Youth will be able to define the terms reactant and product in relation to chemical reactions.

Youth will be able to communicate the relationship between reactants and products in a chemical reaction.

Education Standard(s)

CCSS.ELA-Literacy.SL.8.1.C
GLE 0807.Inq.1
GLE 0807.9.3

Success Indicator

Conduct an experiment involving chemical reactions.

Life Skill(s)

Teamwork

Tags

STEM, science, chemistry, reactants, products

Time Needed

30-45 minutes

Materials

1 cup, dropper, 1/2 teaspoon, tablespoons, vinegar, baking soda, liquid detergent, water, graduated cylinder (50 mL)

Per Group: 2 graduated cylinders (50 mL), 1/2, 1/4, 1/8 teaspoons, tablespoons, 1 waste container, paper towels, goggles, 3 cups

Background

Note: Background information is provided here; facilitators do not distribute to the learners. It can be discussed briefly after youth have completed the experience.

Chemistry is found all around us and is used in almost every aspect of life from cooking dinner to creating medicines for the sick. Chemistry is defined as the study of matter and the changes it can undergo. The changes matter undergo can be physical or chemical. Physical changes include freezing, melting, and crystallization and alter only the shape or form of a substance. It does not alter the inner composition of a substance. Chemical changes on the other hand alter "inner" composition, or chemical composition, of a substance. Chemical changes include change of smell, color, or temperature as well as formation of solids or gases/bubbles. Physical changes are reversible whereas chemical changes cannot be reversed.

Each chemical reaction involves two components – the reactants and the products. The reactants are the substances that undergo the change during the reaction while the products are the substances that are formed during the reaction. The amount of products produced depends on the amount of reactants used. In chemistry, it is important to know how much of each reactant to use in order to prevent major explosions or unwanted products from forming. For example, in medicine, too much of one reactant can lead to ineffective drugs which prevents major diseases from being cured. Therefore, it is important to know how much of a reactant to use in a reaction in order to achieve the desired product.

Introduction and Opening Questions

Script: Today we will be experimenting with chemical reactions using baking soda and vinegar and observing how they interact with each other.

Have you ever put too much/too little sugar in your hot chocolate? What happened when you added too much/too little sugar? Were you able to drink your hot chocolate?

Experience *(use the Experiential Learning Model and encourage critical thinking and the use of science abilities and skills)*

Preparation:

Each group will need 3 cups – one for dish detergent solution, one for vinegar, and one for baking soda. Prior to completing the activity, make enough dish detergent solution for the class by adding 2 teaspoons of liquid detergent to 4 tablespoons of water and stirring gently until solution is well mixed – place 1 teaspoon of the detergent solution into the cup labeled "detergent" for ***each*** *group.*

Demonstration:

During this activity, students will be trying to control the amount of gas produced in a reaction between vinegar and baking soda. For students to understand what they must do, the facilitator must first demonstrate what happens to a regular, uncontrolled reaction between vinegar and baking soda. Once the demonstration has been completed, students will then decide what they must do to control the gas produced and prevent it from overflowing the container.

1) Measure 10 mL of vinegar using a graduated cylinder.
2) Pour the vinegar in a small cup and add 1 drop of dish detergent – swirl gently to mix (the dish detergent helps make a longer-lasting foam).
3) Add ½ teaspoon of baking soda to the empty graduated cylinder.
4) Stand the graduated cylinder in the center of a plastic waste container.
5) Pour the vinegar and detergent from the cup into the graduated cylinder.
6) Have the students observe the level of the foam in the graduated cylinder (it will rise and should eventually overflow).
7) Rinse the graduated cylinder over a sink, bucket, or separate waste container.

Discussion:

Discuss with students what they might change to create a foam that rises to the top of the graduated cylinder without overflowing. Students may mention changing the amount of vinegar, baking soda, or detergent – vinegar and baking soda volumes can be changed but the volume of detergent added will remain the same for all trials because the detergent is only being used as an indicator to help measure the amount of gas produced in the baking soda and vinegar reaction.

It is important to note the order in which you added the chemicals – in the demonstration you added vinegar to the graduated cylinder already containing the baking soda. All other tests must be done in the same order to maintain consistency – facilitator should communicate this with students so they are aware of the order in which they need to add the chemicals in the reaction.

Experience (cont.)

Procedure:

Each group can perform three different tests with different volumes of the reactants. Inform students that their goal is to try to get the foam to rise all the way to the top of the cylinder without overflowing.

1) Divide class into groups of 3-4 students.
2) Give each group a cup labeled **detergent** already containing the detergent solution prepared prior to class.
3) Have each group label 2 additional small cups **vinegar** and **baking soda**.
4) Place 3 tablespoons of vinegar and 1 tablespoon of baking soda in their labeled cups.
5) Now that each group has all the materials necessary to perform the reaction, have each individual record the amounts of vinegar and baking soda they plan to use in each trial on the Student Handout provided at the end (*they can record one trial at a time or all three trials at once if they know what amounts of vinegar and baking soda they will be using from the start).*
6) Have students measure their desired amount of vinegar in the graduated cylinder.
7) Pour vinegar into a small cup and add 1 drop of detergent solution to the cup with the vinegar.
8) Have students measure their desired amount of baking soda in the second graduated cylinder.
9) Stand the graduated cylinder containing the baking soda in the center of a plastic waste container.
10) Have students pour the vinegar and detergent from the cup into the graduated cylinder containing the baking soda.
11) Have students record the results on the handout (students may record the level of the foam in milliliters using the graduated cylinder or they can simply write down “foam almost reached the top,” “foam reached the top,” “there was a little overflow of foam,” “there was a lot of overflow of foam”).
12) Repeat steps 6-11 for the other two trials involving different amounts of vinegar and baking soda.
13) Have each group share their best results with the class (what amounts of vinegar and baking soda created the highest foam without any overflow?).

[**Expected:** *Using 1/8 teaspoon of baking soda, 5 mL of vinegar, and 1 drop of detergent will cause foam to rise to the top of the cylinder without overflowing; results may vary].*

Talk It Over...

Share…

1) What were your reactants? What were your products?
2) Did it make a difference how much of the reactants you used in the chemical reaction?
3) How did you decide how much of the baking soda and vinegar to use in each reaction?

Process…

1) How did changing the volume of each reactant used affect your results?
2) How were you able to or what could you have done differently to keep your foam from overflowing?
3) Why is it important to have a control in a science experiment?
4) Why is it important to communicate your results with other groups?

Generalize…

1) Have you ever added too much salt or too much sugar to your food? What did this do to the final dish?
2) How can you control what the final dish will taste like when adding sugar or salt to your food? Which components would be the reactants and what would be the product?

Apply…

1) What are other situations in which it may be crucial to mix the correct amount of substances?
2) Besides science experiments, what are other scenarios where it is necessary to communicate information with others?

Term and Concept Discovery

Matter—anything that has mass and occupies space

Reactant—the substance that changes in a chemical reaction

Product—the substance that forms during a chemical reaction

Appendix

Standards:

CCSS.ELA-Literacy.SL.8.1.C – Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.

GLE 0807.Inq.1 – Design and conduct open-ended scientific investigations.

GLE 0807.9.3 – Interpret data from an investigation to differentiate between physical and chemical changes.

Resources:

Adapted from: American Chemical Society – "Controlling the Amount of Products in a Chemical Reaction"

Controlling the Amount of Products in a Chemical Reaction. (2015). Retrieved from: http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson2

Student Instructions

Procedure Instructions:

In your group, you will perform three different tests with different volumes of the reactants. Your goal is to try to get the foam to rise all the way to the top of the cylinder without overflowing.

1) You should have already received a cup labeled **detergent** containing the detergent solution.
2) Label 1 small cup **vinegar** and the other **baking soda**.
3) Place 3 tablespoons of vinegar and 1 tablespoon of baking soda in their labeled cups.
4) Record the amounts of vinegar and baking soda you plan to use in each trial on the Student Handout provided at the end (*you can record one trial at a time or all three trials at once if you know what amounts of vinegar and baking soda you will be using from the start).*
5) Measure your desired amount of vinegar in the graduated cylinder.
6) Pour vinegar into a small cup and add 1 drop of detergent solution to the cup with the vinegar.
7) Measure the desired amount of baking soda in the second graduated cylinder.
8) Stand the graduated cylinder containing the baking soda in the center of a plastic waste container.
9) Pour the vinegar and detergent from the cup into the graduated cylinder containing the baking soda.
10) Record the results on the Student Handout.
11) Repeat steps 6-11 for the other two trials involving different amounts of vinegar and baking soda.
12) Share your best results with the class (what amounts of vinegar and baking soda created the highest foam without any overflow?).

Making Foam with Chemistry!

Student Handout

Name: _____

Use the table provided below to record the amount of vinegar and baking soda used in each trial.

Trial	Amount of Vinegar	Amount of Baking Soda	Amount of Detergent	Results: How close did the foam get to the top of the graduated cylinder?
Demonstration	10 mL	1/2 teaspoon	1 drop	It overflowed a lot.
1			1 drop	
2			1 drop	
3			1 drop	

Which trial worked best, why?

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