TRB 5:1 -- Act. 4: Chem. Reactions - Borax & Glue, Cream

Summary

Students will conclude at the end of this activity that the combined weight of the reactants in a chemical reaction is always equal to the combined weight of the products.

Materials

Activity A :Borax and Glue
For the class:
- 4% sodium borate solution (Prepare by mixing one cup borax powder to 2 liters of water, shake well.)
- food coloring (optional)

For each team of 3-5 students:
- scales
- 8--oz.paper cup
- ruler
- permanent felt tipped marker
- graduated cylinder
- quart--sized plastic locking bag
- bottle of white glue
- plastic spoon for stirring

Activity B:Vinegar and Cream
For each team of 3-5:
- 2 clear plastic cups
- plastic spoon for stirring
- 1/2 cup heavy whipping cream
- 5 ml of vinegar
- scale

Background for Teachers

Both suggested learning activities in this lesson will help students understand the relationship between the weight of reactants and the weight of the products involved in chemical reactions. Each activity can be completed in about 40 minutes of class time. If sufficient time and materials are available, conduct both activities in class, but if you must choose between the two, your students will be thrilled with the Borax and Glue activity. The Cream and Vinegar activity could be assigned as homework and the results reported to the class.

Intended Learning Outcomes

1-Use science process and thinking skills.
2-Manifest scientific attitudes and interests.
3-Understand science concepts and principles.
4-Communicate effectively using science language and reasoning.
6-Understand the nature of science.

Instructional Procedures

Activity A: Borax and Glue
Cooperative teams of 3-5 students should complete the following steps:(See "Team Procedures")

Using a ruler and a permanent felt tipped marker, make a mark 1/2 inch from the bottom on the

inside of the paper cup. Fill the cup to the mark with white glue. This will be about 25 ml.
Using a graduated cylinder, measure out 25 ml of water and add it to the glue in the cup. Add 1-5 drops of food coloring, if desired, and stir well.
Using a graduated cylinder, measure out 15-20 ml of sodium borate solution: pour it into the plastic locking bag and seal the bag. The glue solution and sodium borate solution are the reactants.
Find the combined weight of the reactants by placing the bag with the sodium borate solution and the cup with the glue solution on the scale at the same time. Record the combined weight.
Pour the glue solution into the plastic bag with the sodium borate solution. Seal the bag and knead the mixture for a few seconds. Make and record observations.
Remove the solid mass from the bag. As you remove the solid mass from the bag, hold the mass over the bag for a few seconds to allow any liquid to drip back into the bag.
Reseal the bag and set it aside. Work the mass with your hands until it forms a "Silly Putty "-type solid. Experiment with this material and record observations of its special properties. The solid material and the liquid left in the bag are the products of this chemical reaction.
Find the combined weight of the products by placing the bag with the remaining liquid, the "Silly Putty "-type solid, and the cup on the scale. (Make sure students understand that it is necessary to weigh the cup because its weight was included when the glue was weighed.) Record the weight.
Compare the combined weights of the reactants and the products. Record what you have learned.

After the teams have completed the activity lead a discussion about what they learned. The following questions may be helpful:

What evidence shows this is a chemical reaction? (Formation of a solid-like material that is a completely new substance with different properties from the glue and borax solutions.)
Was the weight of the reactants equal to the weight of the products? (The answer should be yes, but the students may have differences in their data. Have them compare their data and discuss why they may not agree. Some possibilities may be: Some of the liquid might have come off on hands while the "Silly Putty " was being worked; scales are inaccurate; mistakes might have occurred in taking or recording data; some "Silly Putty " may have stuck to their hands.)
Challenge students to write an equation that demonstrates what they have learned. weight of reactants +bag and cup = weight of products + bag and cup
Have a contest to name the "Silly Putty."

Activity B: Vinegar and Cream

Cooperative teams of 3-5 students should complete the following steps: (See Team Procedures)

Fill a clear plastic cup about 1/2 full of cream. Observe the cream and record its properties.
Pour about 15 ml of vinegar into another cup. Observe the vinegar and record its properties. The cream and the vinegar are the reactants in this activity.
Find the combined weight of the reactants by placing the cup of cream and the cup with vinegar on the scale. Record the combined weight.
Pour the vinegar into the cream and stir once or twice. Observe the mixture. Describe what you see, feel and smell. (Make sure students understand that while it is safe to smell cream and vinegar, it is unsafe to smell or inhale some chemicals. Caution them never to smell unknown chemicals.) Is there evidence of new substances being formed? Explain. Record your observations. New substances formed from a chemical reaction are called products.
Find the combined weight of the products by placing both cups on the scale. Record the weight. (Make sure students understand that it is necessary to weigh the empty cup because its weight was included when the vinegar was weighed.)
Compare the combined weight of the reactants to the combined weight of the products. Record

what you have learned.

After the students have completed the activity, lead a discussion. The following questions may be helpful.

Did a chemical reaction take place when the vinegar and cream were mixed?

What evidence suggests that a chemical reaction has taken place? (Formation of a solid after two liquids have been mixed.)

Is it possible to get the cream and vinegar back after they have been mixed? (No)Why? (They have chemically changed into a completely different substance.)

Challenge students to write an equation to show the relationship between the weight of the reactants and the products. Combined weight of reactants +(cups)=Combined weight of products +(cups).

Have students write a statement to explain the relationship between the weight of the reactants and the products. The combined weight of the reactants in a chemical reaction is always equal to the combined weight of the products.

Extensions

This activity is preparing and consuming food in the classroom. Utah state law requires that a person with a food handler 's permit be present when food is prepared for student consumption. Sanitary conditions must exist, such as a kitchen or cafeteria.

Lemon Cheese:

After students have experimented with making curds in cream by adding vinegar, they will enjoy applying their knowledge in making cheese. Lemon Cheese is simple to make and is a tasty spread for crackers.

To make 6-8 ounces of Lemon Cheese you will need:

sauce-pan
large spoon
colander
2 quart canning jar
thermometer
1 quart of whole milk
hot plate
juice from two lemons
cheesecloth

Step 1 Acidifying and Coagulation

Heat the milk to 100 degrees F in the canning jar in the saucepan of water. Add the juice for two lemons and stir well. Let the milk set for 15 minutes.

Step 2 Draining

Pour the curds into a cheesecloth-lined colander. Tie the four corners of the cheesecloth into a knot and hang the bag to drain for 1 to 2 hours or until the curds stop draining. The drained liquid is whey. Chilled, with mint leaves added, whey makes a refreshing drink.

Step 3 Mixing, Salting, and Spicing

Take the cheese out of the cheesecloth. You may have to scrape some cheese from the cloth. The cheese can be lightly salted and herbs may be added if desired.

Additional Experiments with Borax and Glue:

After mixing glue and borax allow your students to explore further by predicting the effects of altering the amounts of glue, water and borax, and have them design experiments to test their hypotheses.

Experiment with Laundry Starch and Glue:

125 ml of liquid laundry starch
65 ml of white glue

2.5 ml of salt

First, mix the laundry starch and salt. Then add glue and stir continually. Once a lump of material forms (making it difficult to stir), squeeze remaining liquid from the lump. Compare this “Slime ” to the “Silly Putty.” Experiment with the proportions.

Assessment Plan

Use this rubric to assess your students ' performances:

Student 's Name

	4	3	2	1
Journal Page	Descriptions and data clear and accurate. All observations completed.	Descriptions and data mostly clear and accurate. All observations completed.	Descriptions and data somewhat clear and accurate. All obervations incomplete.	Descriptions and data unclear and inaccurate. All observations incomplete.
Participation in Activity	Used time well and focused attention on the activity.	Used time fairly well. Stayed focused on the activity most of the time.	Did the activity but did not appear very interested. Focus was lost on several occasions.	Participation was minimal OR student seemed negative about participating.

Bibliography

This lesson is part of the Fifth Grade Science Teacher Resource Book (TRB3) http://www.usoe.org/curr/science/core/5th/TRB5/. The TRB3 is designed to be your textbook in teaching science curriculum to your students. This book covers all the objectives of each standard and benchmark. If taught efficiently, a student should do well on the End-of-Level (CRT) tests. The TRB3 is designed for teachers who know very little about science, as well as for teachers who have a broad understanding of science.

Authors

Utah LessonPlans