TRB 5:1 - Activity 7: Stomach Chemistry

Summary

Students will create a simulation of the chemical reactions that occur during the digestive process.

Materials

Each group of students need:

- paper bag of classroom supplies and materials (pencil, eraser, paper clip, small vial of water, ping pong ball, chalk, etc.)
- several pieces of paper (used paper is fine)
- tin tray or cookie sheet
- clear, plastic bowl
- red cabbage juice
- dry ice wrapped in heavy paper (represents gas in the stomach)
- acidic liquids (represents food we eat)-- Mountain Dew, Vinegar, Lemon Juice, etc.
- dish soap (emphasizes the gas by creating bubbles)
- antacid (original white,milk of magnesia)

If the Invitation to Learn is used you will also need:

- piece of steel wool
- vinegar
- glass pop bottle
- balloon

Background for Teachers

A physical change occurs when the appearance of matter changes, but the composition of the matter does not change. Changes in size, shape, odor, hardness, and in many cases, phase changes caused by an increase or decrease in temperature are considered physical changes. A chemical change occurs when new kinds of matter are formed. The composition of the matter changes and new kinds of matter have different properties from the old matter. Evidence of a chemical change may include production or use of energy such as heat being given off or absorbed, light given off, the new production of a gas or solid, or a change of color. If the composition of the matter changes chemically during a phase change, it is a chemical change (e.g., a raw egg is changed to a hard-boiled egg). These evidences are called indicators.

Physical and chemical changes occur many times in daily life. As part of this activity students will gain experience with a simulation of a chemical reaction in the stomach. Students will identify and come to understand many of the physical changes and chemical reactions that exist in daily life.

The red cabbage juice used in this activity can easily be made at home in the kitchen. Take four or five leaves of a red cabbage and boil them in a cup of water. Drain off the juice. The cabbage juice will stay good and usable for about two or three days.

The investigation in this activity works best when completed in cooperative groups of three to five students. However, the lesson plan can be adapted and presented as a teacher demonstration for whole class instruction.

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.

5-Demonstrate awareness of social and historical aspects of science.

Instructional Procedures

Invitation to Learn: Wooly Wonder and the Scientific Methods

Push a piece of steel wool that has been soaked in vinegar into a glass bottle. Put five drops of water into the bottle and stretch a balloon over the opening.

Ask the class to suggest possible hypotheses to this question: What will happen to the balloon when the steel wool begins to rust? Some possible hypotheses are: nothing will happen to the balloon, the balloon will inflate on top of the bottle, the balloon will turn inside out and inflate inside the bottle, the balloon will change colors, the balloon will inflate and popes.

Put the items on a table and let them sit for a day.

Observe the items and have students conclude which of the hypotheses was correct. (The balloon turned inside out and inflated inside the bottle.) Ask students to suggest reasons why this happened.

Instructional Procedures:

Give each student group a bag of materials that can be found in a school classroom (see materials list). Ask students to write down on a small white board or piece of paper the physical properties of the matter. Model for them one of the properties (e.g. hard or soft). Give student teams time to identify several of the properties of the different items in the bag. Have student teams share these properties with the class. As you go from group to group have them share only properties that have not been shared before.

Review with students the indicators that show a physical change has occurred (see back-ground material). Give student groups several pieces of paper and invite them to come up with 10 different ways the paper can be changed physically. Explain to students that some of the changes might not be able to take place in class. Have each group make as many changes to the paper as they can and then write down other physical changes that might occur to the paper in other settings (the paper could be cut and folded in several different ways, it could be crinkled into a ball, it could be frozen in the freezer, it could be ripped up into tiny pieces, etc.).

Ask student groups to decide what would need to happen to the paper to make a chemical change occur. Call on someone in each group to share his/her thinking with the class. Take a piece of paper and place it in a tin tray. Light the paper on fire and have students identify the changes that take place (the paper is converted to ash, water, carbon dioxide, and a couple of other things). Review with students what the indicators are that show that a chemical change or reaction is occurring (see background material).

Ask students if they can identify chemical reactions that occur in daily life. Have student groups brainstorm ideas where they think that chemical reactions are occurring in daily life. Have groups record their ideas on paper.

Explain to students that a simulation is creating an event that imitates a real life event. Explain to students that you can 't take them into the stomach of a human being, but today you are going to create a simulation of what happens during the digestive process as we eat and drink. Tell students you want them to draw conclusions about the materials you will give them to represent the real digestive process.

Tell each student group you are going to give them a clear, plastic bowl, dry ice, acidic liquids, and the dish soap. Challenge each group to come up with an explanation of how using these materials might simulate what happens during the digestive process. What might each item represent? Call on a few groups to share their responses with the class.

Explain to students that you are also going to give them some red cabbage juice to pour into their simulated stomachs (bowl) to act as an indicator to determine if a chemical change is occurring in the contents of their stomachs.

Give each student group the clear, plastic bowl, dry ice (remember to discuss the safety concerns associated with dry ice), acidic liquids, and the dish soap.

Direct students to pour the cabbage juice into their stomach (bowl).

Explain that during the day a person might eat lemon pie, a salad with vinegar and oil dressing, spaghetti and sauce, and drink a Mountain Dew. Ask students what all these food items have in common (they are all acidic foods)?

Have groups pour the vinegar, lemon juice, and Mountain Dew into their stomachs (bowls). Ask them to observe and be prepared to share what happens and why they think it is happening (the cabbage juice turned pink indicating that a chemical reaction is taking place).

Direct students to place a small piece of dry ice and dish soap into their stomachs (bowls) without touching the dry ice directly. Ask them to observe and be prepared to share what happens and why they think it is happening (dry ice is slightly acidic and it sublimates to fill the stomach with gas; the soap is slimy and represents saliva; the bubbles help students see that there is gas in the stomach).

As students observe the reaction of the materials, the bubbles will soon bubble up over the top of the bowl. Explain that when this happens the stomach has acid indigestion. Ask student groups to discuss and be prepared to share with the class what people can do when they experience acid indigestion (they use antacids to reduce the gas that gives a burning sensation to their stomachs).

Give each group of students the antacid and have them pour a tablespoon into the stomach (bowl). Ask them to observe and be prepared to share what happens and why they think it is happening (the bubbles will disperse and settle down, the mixture will return to a purplish color again in a few minutes, the antacid neutralizes the acids and stops the production of gas in the stomach). Call on a few groups to share their conclusions with the class. Make sure their science thinking is accurate.

Clean up the activity by having students pour the liquids down the sink or into a bucket. Rinse out the containers and stack the materials in a designated area of the classroom.

Give students the assessment handout and have them identify the physical and chemical changes that occur to substance s in everyday life.

Extensions

The simulation activity may be organized as a teacher demonstration instead of an individual group activity if desired.

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