Changes in Matter, Not in Weight

Summary

Students will explore the law of conservation of mass by tearing paper, observing a reaction between baking soda and vinegar, and predicting whether melting, freezing, and dissolving will cause a change in mass.

Time Frame

1 class periods of 45 minutes each

Group Size

Small Groups

Materials

For the each group of 2-4 students:

- 1 sheet of light cardboard, such as half a manila file folder
- 1 plastic 2-liter pop bottle
- 1 tablespoon baking soda.
- 2 tablespoons vinegar
- balloon
- funnel
- scale or balance

Background for Teachers

A chemical reaction 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 production or use of energy such as heat or light. The mass remains the same before the reaction and after. A chemical reaction takes place when vinegar and baking soda are mixed. One of the new substances formed is carbon dioxide gas. If the carbon dioxide gas is contained, the mass of the substances will stay the same according to the Law of Conservation of Mass. If the gas is allowed to escape, the mass will be less.
Communication of scientific thinking is an important skill. Praise students for valid reasoning and identifying supportive data. If their reasoning is incorrect, help them clarify their thinking.

Intended Learning Outcomes

- Observe events and report observations.
- Measure mass.
- Plan an experiment.
- Predict results of investigations.
- Record data accurately.

Instructional Procedures

Give the students the following instructions and questions.
Step 1. Using the balance, record the weight of the sheet of cardboard. Tear or cut the cardboard into small pieces. Using the balance, again record the weight. Is the weight the same or different? How would you explain this? [Mass is conserved.]
Step 2. Place 2 tablespoons of vinegar into the bottle. Using the funnel, pour 1 tablespoon of baking soda into the balloon. Carefully attach the balloon to the top of the bottle. Do not allow any baking

soda to pour into the bottle. Using the balance, record the mass of the bottle, soda, balloon, and vinegar.
Step 3. Mix the vinegar into the baking soda by lifting the balloon and allowing the baking soda to pour into the bottle. Make sure the balloon remains attached to the neck of the bottle. After the fizzing stops, again record the mass of the items. Is the weight the same or different? How would you explain this? [Mass is conserved.]
Step 4. Remove the balloon. Put the balloon and bottle on the balance. Weigh the items. Is the weight the same or different? How would you explain this? [Air has weight. The air escaped from the balloon, making the total weight less than before.]
Step 5. Compare the data from the cardboard experiment with the data from the baking soda and vinegar experiment. What is similar and what is different? How would you explain this?
Step 6. Write an explanation for the following phenomena.

- Why did the weight of the paper remain the same after it was torn apart?
- Why was the weight of the vinegar, balloon, baking soda, and bottle the same before the reaction as it was after?
- Why did the weight change when the balloon was removed?

Step 7. Predict the results of the following actions:

- 10 g of water is frozen. What will its weight be when it melts? Explain your answer.
- 5 g of salt is dissolved in 10 g of water. What will the weight of the salt water be? Explain your answer.

Step 8. Plan an experiment that will demonstrate that matter is neither created nor destroyed even though it may undergo change.

Extensions

Allow the students to conduct the experiment they planned in Step 8.

Assessment Plan

1. Get an old appliance, an old phone for example. Weigh the phone and tell the students its weight. Take the phone apart. Ask the students to predict the weight of the disassembled phone.
2. Weight 2 cup sugar, 1 quart of water, and the contents of 1 pkg drink mix. Tell the students the weight. Mix the ingredients. Have them predict the weight of the mixed drink.
3. Weigh 1 cup cream and 1/2 cup lemon juice. Tell the students the weight. Mix the two. Show the students the mixture. Ask them to predict its weight.

Authors

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