# Where Did It Go?

Design a fair test of mass during a reaction

**PHS.4.2** "Design and conduct investigations to produce evidence that mass is conserved in chemical reactions (e.g., vinegar and baking soda in a Ziploc© bag)."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline the parts weighed as one system, circle two steps that make the before-and-after measurements comparable, and number each pair of mass readings. Use your marks to decide whether the measurements support conservation of mass.

### The Swelling Bag

1. At a school science fair, a balloon-shaped zipper bag raises a question: Did a reaction make new matter? Inside the bag, a small open cup holds vinegar, while baking soda rests in one corner. The materials have not touched. When they mix, bubbles of carbon dioxide gas form and the bag expands. The gas is matter, even though it cannot be seen. If the bag stays sealed, the gas remains part of the system being measured. To test whether mass changes, the students must weigh the whole system, not just the liquid left at the bottom.

2. Before mixing, the team checks the bag's zipper for gaps and wipes its outside dry. They place the bag, the cup, the vinegar, and the baking soda together on a balance. The reading is 68.42 grams. Without opening the bag, they tip the cup and gently mix the reactants. They wait until bubbling slows, then dry the outside again and return the entire bag to the same balance. It reads 68.42 grams. Keeping the same parts inside the bag makes the two measurements comparable. The swelling shows that a gas formed, but the balance reading tests whether mass was conserved.

3. The team repeats the test with fresh materials in a new bag. This time the readings are 71.10 grams before mixing and 71.09 grams after mixing. A difference of 0.01 gram is the balance's smallest displayed step, so the team does not claim that matter vanished. They inspect the zipper and consider whether moisture on the bag or a slightly shifted balance reading affected the result. If the bag were opened before the final weighing, some carbon dioxide could escape. A lower mass would then describe what left the bag, not prove that the reaction destroyed matter.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. What must the team include in both weighings to test whether the reaction conserves mass? Explain why weighing only the liquid would not work.

2. How do the first trial's readings support conservation of mass, even though the bag expands?

3. Does the second trial give strong evidence that matter vanished? Use its readings and one check the team makes to support your answer.

4. Why would opening the bag before its final weighing make the test less useful as evidence about conservation of mass?

## 3 YOUR TURN

Your own words

A different team wants to test whether mass is conserved when an effervescent tablet reacts with water. Write a brief investigation plan that says what you will weigh, how you will start the reaction without opening the container, when you will weigh again, and how repeated trials will help you judge the results.

ANSWER KEY

# Where Did It Go?



## PART 1 · READ AND MARK

Underline the parts weighed as one system, circle two steps that make the before-and-after measurements comparable, and number each pair of mass readings. Use your marks to decide whether the measurements support conservation of mass. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | What must the team include in both weighings to test whether the reaction conserves mass? Explain why weighing only the liquid would not work. | **They must weigh the entire bag and everything inside it, including the cup, reactants, and gas. Weighing only the liquid would leave out matter in the carbon dioxide gas.** |
| 2 | How do the first trial's readings support conservation of mass, even though the bag expands? | **The sealed system reads 68.42 grams both before and after mixing. The bag expands because gas forms, but that gas remains inside the weighed system.** |
| 3 | Does the second trial give strong evidence that matter vanished? Use its readings and one check the team makes to support your answer. | **No. The readings differ by only 0.01 gram, the balance's smallest displayed step. The team checks the zipper because escaping gas could lower the final reading.** |
| 4 | Why would opening the bag before its final weighing make the test less useful as evidence about conservation of mass? | **Carbon dioxide could escape. The final weighing would then leave out matter that was included in the first weighing.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

Place water in a small cup and a dry effervescent tablet beside it inside a clear, sealable container. Seal the container and weigh the entire setup. Tilt it so the tablet falls into the water without opening the lid. After bubbling stops, wipe the container and weigh it again on the same balance. Repeat with fresh materials, checking each seal. Similar before-and-after masses across trials support conservation; a leak could explain a lower reading.

Accept plans that weigh the same complete, sealed system before and after each reaction and repeat the test. Students may describe a different workable way to keep the tablet and water apart until after the first weighing.