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# Reaction Lab: Lid On, Lid Off

## Grades 6-8 · 45 minutes

Physical science · Chemistry




**Slides, rubric and answer key** | **Print and go** | **No student accounts** | **Chromebook friendly**

### What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a data table for the sealed bag and the open cup
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 4 and 5 and in high school chemistry
- Standards: NGSS

# Reaction Lab: Lid On, Lid Off

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Students run the zip bag lab on the app's kitchen scale: sealed, the reading holds; in an open cup it drops. A magnifier shows the particles. Then they switch to the particle view, take the lid off, and watch the carbon dioxide molecules leave the flask and the scale drop by exactly their mass. If your class can run the real bag lab, run it alongside.

## At a glance

### ESSENTIAL QUESTION

**If mass is never destroyed, why does the scale go down when the cup is open?**

### OBJECTIVES

Students will be able to:

- compare a reaction in a closed system and in an open one, using a scale
- explain a drop in mass in an open container as gas leaving, not matter destroyed
- use a particle model to show the gas molecules have mass
- say why a sealed bag can read a little lower than it should

### VOCABULARY

Closed system, Open system, Gas, Carbon dioxide, Conservation of mass

### STANDARDS

MS-PS1-5, MS-PS1-2

### TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work
- Optional, for the real lab: zip bags, small cups, vinegar, baking soda, and a scale that reads tenths of a gram for each group

### PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/reactionlab?lesson=lid-on-lid-off&ref=tpt-reactionlab-3 once on a student computer: it opens on the zip bag lab, sealed. Tip the cup once sealed and once as an open cup, about five minutes. If you run the real lab too: a zip bag, a small cup of vinegar, a spoonful of baking soda, and a scale that reads tenths of a gram for each group.

### ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

### TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

## Lesson sequence

| MINUTES | STAGE | WHAT YOU DO | WHAT STUDENTS DO |
|---|---|---|---|
| 0 to 5 | **Warm-up**<br>Hook | Show the title, essential question and Today I can slides (about 1 minute). Then the soda can warm-up. Write the answers on the board. | Answer the warm-up on the worksheet. |
| 5 to 12 | **Direct instruction (I do)**<br>Model it | Project the app with the starter open on the zip bag lab. Read the scale aloud: 152.4 g. Ask the class to predict, then Tip the cup. The bag puffs up and the scale holds. Show Sealed: the mass holds and Open: the gas leaves.<br><br>> **It's working when:** If you run the real lab, do the sealed bag for real here instead and project the app beside it. | Predict, watch, and fill in the vocabulary on the worksheet. |
| 12 to 22 | **Guided practice (We do)**<br>The bag together | Students open the link or scan the QR code. A short guide walks them through: Tip the cup, the magnifier, the open cup. Check that every table has 152.4 and 151.4.<br><br>> **Watch for:** Students who think the open cup lost mass because the reaction destroyed some. Ask what was coming out of the top. | Run the bag sealed and open, and fill in the data table. |
| 22 to 38 | **Independent practice (You do)**<br>The particles | Students press Particles, take the lid off, balance the equation and React, then put the lid back on and run it again. Walk the room with the What to look for questions.<br><br>> **If they ask:** "You cannot see carbon dioxide. How do you know it has mass?" The gas | Compare the drop on the scale with the mass of the carbon dioxide molecules that left, and fill in the second part of the table. |
| 38 to 45 | **Closure**<br>Showcase and exit ticket | Show the Showcase slide. Go back to the soda can: the gas left and took its mass with it. Mention that a sealed bag that puffs up a lot can read a few tenths of a gram low, because the air around it lifts it a little like a balloon. Hand out the exit ticket. | Answer the exit ticket. |

## Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/reactionlab?lesson=lid-on-lid-off&ref=tpt-reactionlab-3. A short guide opens over the app on the zip bag lab: a sealed bag on a kitchen scale reading 152.4 g, with a magnifier beside it.

1. **Sealed.** `Tip the cup`. The vinegar spills onto the baking soda, it foams, the bag puffs up, and the scale holds at 152.4 g. Drag the magnifier over the bag to see the particles.

2. **Open.** Press `Make it an open cup` and tip again. Carbon dioxide bubbles away and the reading falls to 151.4 g.
3. **Particles.** Press `Particles`. With the lid off, a balanced reaction ends with the carbon dioxide escaping up the neck; the scale drops by its mass and the molecules wait above the flask under "Left the flask".

> A real sealed bag that puffs up a lot can read a few tenths of a gram low: the bigger bag pushes aside more air, and the air lifts it a little, like a balloon. A capped plastic bottle does not puff up and shows no change. The app tells students this after the sealed run.

## Background for the teacher

Baking soda (sodium bicarbonate) and vinegar (acetic acid) make sodium acetate, water and carbon dioxide gas. In a closed system the carbon dioxide stays and the mass holds. In an open one it leaves, and the scale drops by its mass. Nothing is destroyed: the atoms are in the room.

Students often believe gases have no mass, especially gases they cannot see. Showing the gas as molecules that keep their mass when they leave is the point of the particle view. The research the app was built from found that open systems are the part students understand least, even after teaching.

The real lab works with a spoonful of baking soda and a small cup of vinegar; the carbon dioxide from a spoonful weighs about a gram, so the scale needs to read tenths of a gram.

## What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- Why did the sealed bag puff up?
- Where did the gram from the open cup go?
- You cannot see carbon dioxide. How do you know it has mass?
- Is the open cup a closed system or an open one?
- Why might a real sealed bag read a little lower than it should?

> The second question is the real test: the answer is "into the air of the room", not "it was used up".

## Cross-curricular extensions

- Math: the open cup lost 1.0 g. Carbon dioxide is 44 mass units a molecule. Which reactant was used up first, and how do you know?
- Earth science: where does the carbon dioxide from a campfire go, and what takes it back out of the air?
- English: write a lab report for the sealed bag and the open cup, with a claim, evidence and reasoning.
- Engineering: design a container for the lab that will not puff up, and say why it gives a truer reading.

## Vocabulary

| | |
|---|---|
| **Closed system** | A container nothing can get into or out of, like a sealed bag. |
| **Open system** | A container where gases can leave or come in, like an open cup. |
| **Gas** | Matter whose particles spread out to fill their container. A gas has mass, even when you cannot see it. |
| **Carbon dioxide** | $CO_2$, the gas that makes the fizz when baking soda meets vinegar. |
| **Conservation of mass** | In a closed system the total mass stays the same in a reaction. |

## Differentiation

### ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the atoms on the board as you say each word: the letters on the balls carry the meaning.
- Pair each learner with a partner for the bag; the data table is numbers.
- Accept the explanation as a labeled drawing of the cup with arrows for the gas.

### STUDENTS WITH IEPS OR 504 PLANS

- Pair students, one reading the scale and one pressing the buttons.
- Zoom the browser to 150%.
- Allow the sealed and open bag runs alone where the IEP allows a modified assignment.

### STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "The open cup got lighter because ___ left."
- A check-in after the bag: every table has both readings before the particle view.
- Do the particle run together on the board.

### STUDENTS READY FOR MORE

- Burning methane with the lid off: the carbon dioxide and the hot water vapor both leave. Compare the drop with the masses.
- Work out why a puffed-up bag reads a little low, and design a container that would not.
- Find a reaction on the shelf where taking the lid off changes nothing, and say why.

### Adapting for other grades

**Younger students:** In grades 4 and 5, do the bag sealed and open together and stop there; drop the third rubric row; total 8, and 6 meets the objectives.

**Older students:** In high school chemistry, pick high school in the level menu and compare the drop in atomic mass units with the molar mass of carbon dioxide, 44.01.

# Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/reactionlab?lesson=lid-on-lid-off

Essential question: If mass is never destroyed, why does the scale go down when the cup is open?

Warm-up: An open can of soda sits out all day. Would it weigh less by evening? Why?

_____

1. **Vocabulary.** Closed system, open system, gas, carbon dioxide, conservation of mass: write each in your own words.

2. **The data table.** Sealed bag: before _____ g, after _____ g, change _____. Open cup: before _____ g, after _____ g, change _____. Particles, lid off: before _____, after _____, molecules that left _____.

3. **The magnifier.** What I saw inside the bag: _____.

1. Where did the mass from the open cup go?

2. Why might a real sealed bag that puffs up read a little lower than it should?

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## Exit ticket

Name: _____

1. Baking soda and vinegar react in a sealed bag on a scale. The reading after is: (A) lower (B) the same (C) higher

2. The same reaction in an open cup reads lower after because: (A) matter was destroyed (B) a gas left the cup (C) the vinegar dried up

3. Does carbon dioxide gas have mass? Use the lab to explain.

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3. Does carbon dioxide gas have mass? Use the lab to explain.

# Answer key: exit ticket

| QUESTION | ANSWER | WHY |
|---|---|---|
| 1 | B | A closed system: the carbon dioxide stays in the bag. |
| 2 | B | The carbon dioxide escaped into the room. Matter is not destroyed. |
| 3 | Yes | When it left the open cup, the scale went down by its mass. A yes with the lab as evidence is a full answer; yes alone is half. |

## Rubric

Score each row from 1 to 4.

Name: _____

| CRITERIA | 4 EXCEEDS | 3 MEETS | 2 APPROACHING | 1 BEGINNING |
|---|---|---|---|---|
| **The data** | Both readings recorded for the bag and the cup, the drop worked out, and the particle drop matched to the molecules that left. | Both readings recorded and the drop worked out. | One reading recorded. | No data recorded. |
| **Open and closed** | Explains the sealed bag and the open cup in the words closed and open system, with the gas as the reason. | Says the gas left the open cup. | Says the open cup got lighter with no reason. | Says matter was destroyed. |
| **The particles** | Uses the particle view to show the gas molecules have mass, with the molecules counted. | Says the molecules that left have mass. | Describes the particles without linking them to the scale. | No particle explanation. |

Total: ____ / 12. A score of 9 or more meets the objectives.

## Standards

The lesson is built for MS-PS1-5, with the fizz and the change in mass as evidence of a new substance for MS-PS1-2.

| FRAMEWORK | CODE | GRADES | STANDARD | HOW THE LESSON MEETS IT |
|---|---|---|---|---|
| NGSS | **MS-PS1-5** | 6-8 | Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. | Students use the model to show the mass stays the same in a closed system and to explain the drop in an open one. |
| NGSS | **MS-PS1-2** | 6-8 | Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. | The gas given off and the change of mass in the open cup are data that a reaction made a new substance. |

Checked November 2026 against: NGSS MS-PS1-5, Matter and its Interactions, NGSS MS-PS1-2, Matter and its Interactions.

## Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/reaction-lab/lessons/lid-on-lid-off/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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