Family edition

Reaction Lab: Where Did the Atoms Go?

Ages 11-14 · about 45 minutes, in one sitting

Your child runs a chemical reaction in a sealed flask on a scale in Reaction Lab, and watches every atom move into a new molecule. The point of the lesson is that atoms are never made or destroyed, so the mass stays the same.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/reactionlab?lesson=where-did-the-atoms-go&ref=fam-reactionlab-1. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/reactionlab?lesson=where-did-the-atoms-go&ref=fam-reactionlab-1. A short guide opens over the app. A sealed flask on a scale holds one hydrogen molecule and one oxygen molecule; under it the equation is a row of cards with + and − buttons.

1. **Run it unbalanced.** Press `React`. The molecules bump, their bonds let go, and the atoms move to make one water molecule. The second oxygen atom has nowhere to go: it fades, a red ghost stays where it was, and the scale drops to 18.
2. **Balance it.** Press + under hydrogen and + under water. The Atoms card shows an equals sign on both rows. Press `React`: the scale holds at 36.
3. **Follow an atom.** Rewind, tap any atom, and press `React`. Its path stays drawn. `Show every path` draws them all.
4. **Methane.** Pick Burning methane on the shelf. The answer is one methane and two oxygen molecules making one carbon dioxide and two water molecules; the scale reads 80.

> The moment that lands is the first React. Children have been told mass is conserved; here an equation breaks the rule in front of them, and they see that the equation was wrong, not the atoms.

The ideas, in plain words

In a chemical reaction the atoms of the starting substances regroup into different molecules. No atom is made or destroyed, and each kind of atom has its own mass wherever it is, so the total mass in a sealed container does not change. That is MS-PS1-5. The number of molecules can change: two hydrogen molecules and one oxygen molecule make two water molecules, three in and two out.

A balanced equation has the same number of each kind of atom on both sides. Children balance by changing how many whole molecules there are, never the small numbers in a formula, which would make a different substance:

H_2O_2 is hydrogen peroxide. The app locks those numbers and says so when a child tries.

Common mistakes: counting molecules instead of atoms; matching the total number of atoms instead of each kind; and thinking the flame or the light adds or removes mass. The app shows light and heat but never weighs them.

Do it together

1. Open mytekdev.com/try/reactionlab?lesson=where-did-the-atoms-go&ref=fam-reactionlab-1 together. A short guide opens over the app with hydrogen and oxygen in a sealed flask. Press `React`.

   > **You'll know it worked when:** An oxygen atom fades away and the scale drops from 34 to 18.

2. Ask: can an atom really disappear? Then press the + under hydrogen once, and the + under water once.

   > **If you get stuck:** Look at the Atoms card under the graph: every row needs an equals sign.
   >
   > **You'll know it worked when:** Both rows say =.

3. Tap one red oxygen atom in the flask, then press `React`.

   > **You'll know it worked when:** Your child can point to the water molecule the oxygen atom ended up in.

4. Open `Burning methane` from the list on the right and balance it the same way.

   > **If you get stuck:** Methane needs two oxygen molecules and makes two water molecules.
   >
   > **You'll know it worked when:** The scale reads 80 before and after.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Point to the oxygen row in the Atoms card. How many before, how many after?
- Why could you not just change H_2O to H_2O_2?
- Three molecules became two. Why did the scale not change?
- Where did your followed atom end up?
- What would the scale do if an atom really vanished?

> The third question is the real test: a child who says the atoms are the same, only joined differently, has the idea.

For younger and older kids

Younger: For a younger child, do water together and stop there.

Older: For a teenager, switch the level to high school and add up the mass of each side from the atomic masses.

Keep going

- Balance Burning propane at the high school level (Setup, high school) and compare the masses in atomic mass units.
- Turn on Show every path and explain why two atoms of the same kind could have swapped places.
- Balance photosynthesis and say what it has in common with burning methane.

Bring it into other subjects

- Math: the scale reads 36 for water. Using hydrogen 1 and oxygen 16, show where 36 comes from.
- History: read about Antoine Lavoisier, who weighed reactions in sealed containers in the 1770s.
- English: write the reaction as a short story told by one oxygen atom.
- Life science: balance photosynthesis and say where the oxygen we breathe comes from.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Reaction Lab: Where Did the Atoms Go?
SUBJECTS	Physical science
TIME	45 minutes
WHAT WE DID	Balanced the reactions for making water and burning methane with molecule models, followed an atom through a reaction, and explained why mass is conserved in a sealed container.
SKILLS PRACTICED	Counting atoms; Balancing chemical equations; Conservation of mass

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/reactionlab?lesson=where-did-the-atoms-go

Essential question: When a reaction makes new substances, where do the atoms of the old ones go?

Warm-up: You burn a log and a pile of ash is left. Where did the rest of the log go? _____

1. **Vocabulary.** Atom, molecule, reactant, product, conservation of mass: write each in your own words.

2. **The atom-counting table.** For each reaction: atoms of each kind before _____; after _____; molecules before ____ and after ____; mass before ____ and after ____; the balanced equation _____. Water on the first line, methane on the second.

3. **Follow an atom.** The atom I followed: _____. It started in a _____ molecule and ended in a _____ molecule.

1. Three molecules went in and two came out. Why did the mass not change?

2. Why can you not balance an equation by changing the small numbers in a formula?

Quick check

Name: _____

1. In a sealed flask, what stays the same in every chemical reaction? (A) the number of molecules (B) the number of each kind of atom (C) the substances

2. $2\ H_2 + O_2 \rightarrow 2\ H_2O$. How many oxygen atoms are on each side? (A) 1 and 2 (B) 2 and 2 (C) 2 and 4

3. A reaction in a sealed bag starts at 50 grams. What does the scale read after, and why?

Answers

QUESTION	ANSWER	WHY
1	B	Atoms are not made or destroyed. Molecules can change in number and the substances change.
2	B	One O_2 molecule has 2 oxygen atoms; two H_2O molecules have 1 each.
3	50 grams	The same atoms are in the bag, and each kind of atom keeps its mass. A full answer names the atoms; 50 grams alone is half.

If your state or umbrella school asks, this lesson covers NGSS MS-PS1-5, NGSS MS-PS1-1.

Terms of use

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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