Where Atoms Go

Test a claim about matter with atom counts.

8.8 "Engage in an argument from evidence to support the claim that matter is conserved in a chemical reaction. a. Use a model to verify that atoms of reactants are conserved as products in a chemical reaction."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two magnesium equations and the hydrogen peroxide equation. Circle their coefficients, then write each element's atom total beside both sides of the hydrogen peroxide equation.

The Case of the Missing Matter

1. An open jar can seem lighter after a reaction if a gas escapes before anyone weighs it. That change in the reading does not mean atoms vanished. A chemical equation can act as a model of where atoms go. In the model $N_2 + 3H_2 \rightarrow 2NH_3$, each small number tells how many atoms are in one molecule, while a number in front tells how many molecules there are. Count each kind of atom on both sides to test whether the model supports conservation.

2. A strip of magnesium burns with a bright white light when it reacts with oxygen in the air. The white powder it forms is magnesium oxide. A student first writes $Mg + O_2 \rightarrow MgO$, then checks the atoms represented on each side. After revising the model, the student writes $2Mg + O_2 \rightarrow 2MgO$. Both equations name the same substances, but they do not represent the same numbers of particles. A chemical model must account for every atom, even when the visible material changes completely.

3. Hydrogen peroxide can break apart into water and oxygen gas. The equation $2H_2O_2 \rightarrow 2H_2O + O_2$ models this change. If the reaction happens in an open cup, bubbles rise and leave the liquid. The liquid left behind may have less mass than the peroxide that was poured in. In a closed container, the oxygen stays inside, so the mass of the entire container and its contents stays the same. Decide what belongs in the system before using a mass reading as evidence that matter was lost.

2 ANSWER WITH EVIDENCE

Use the passage

1. Count magnesium and oxygen atoms on each side of the student's first equation. Does this model show that atoms are conserved? Explain.

2. Count each kind of atom on both sides of the revised magnesium equation. How do the counts support conservation?

3. Count hydrogen and oxygen atoms on both sides of the hydrogen peroxide equation. Does this model support conservation?

4. The liquid in the open cup loses mass. Use the hydrogen peroxide equation and the passage to explain why this does not show that atoms were lost.

3 YOUR TURN

Your own words

Make an atom-count model for $2CO + O_2 \rightarrow 2CO_2$ by listing the carbon and oxygen totals on each side. Then write two sentences arguing whether this model supports the claim that matter is conserved.

Where Atoms Go

PART 1 · READ AND MARK

Underline the two magnesium equations and the hydrogen peroxide equation. Circle their coefficients, then write each element's atom total beside both sides of the hydrogen peroxide equation. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Count magnesium and oxygen atoms on each side of the student's first equation. Does this model show that atoms are conserved? Explain.	**The reactants have 1 Mg and 2 O atoms; the product has 1 Mg and 1 O atom. The model does not conserve oxygen atoms.**
2	Count each kind of atom on both sides of the revised magnesium equation. How do the counts support conservation?	**Each side has 2 Mg and 2 O atoms, so the model accounts for every atom.**
3	Count hydrogen and oxygen atoms on both sides of the hydrogen peroxide equation. Does this model support conservation?	**Each side has 4 H and 4 O atoms. The matching counts support conservation.**
4	The liquid in the open cup loses mass. Use the hydrogen peroxide equation and the passage to explain why this does not show that atoms were lost.	**Oxygen gas leaves the liquid and can escape the cup. The equation accounts for that oxygen in the products, with 4 oxygen atoms on each side.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Reactants: C 2, O 4. Products: C 2, O 4. The model has the same number of carbon and oxygen atoms on both sides. This supports the claim that matter is conserved because the atoms are rearranged, not lost.

Accept any clear atom-count model with 2 carbon and 4 oxygen atoms on each side. The argument must connect the matching counts to conservation of matter.