Count Every Atom

Use a molecule model to test whether atoms are conserved.

8.8.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 numbers of starting and formed molecules, and circle each statement that gives the atom count for one molecule. Label the starting side 1 and the formed side 2 to prepare for counting atoms on both sides.

What Is in the Foam?

1. In a lab demonstration, a teacher adds yeast to hydrogen peroxide, causing it to foam. The foam contains oxygen gas released as hydrogen peroxide breaks apart into water and oxygen. To study the change without seeing individual atoms, imagine building molecules from small circles labeled H or O. Each circle represents one atom, and circles joined together represent a molecule. Place the starting molecules to the left of an arrow and the molecules formed to the right. The arrow shows a change, not a path that atoms travel across the page.

2. Start the model with two hydrogen peroxide molecules. Each hydrogen peroxide molecule contains two hydrogen atoms and two oxygen atoms. After the change, the model shows two water molecules and one oxygen gas molecule. Each water molecule contains two hydrogen atoms and one oxygen atom. The oxygen gas molecule contains two oxygen atoms joined together. To check this model, count the H circles on both sides, then count the O circles on both sides. Count atoms inside every molecule, even when several molecules have the same name.

3. A molecule can split, and its atoms can join other atoms, but the atoms do not change into different elements during this reaction. If a drawing shows water but no oxygen gas, some oxygen circles have disappeared from the product side. A drawing with extra oxygen gas would have the opposite problem: it would invent circles. Both drawings might seem to show bubbling, yet neither would verify conservation. A useful model must show the correct kinds and numbers of atoms before and after the reaction, not just name the substances.

2 ANSWER WITH EVIDENCE

Use the passage

1. How many hydrogen atoms are on each side of the model? Show how you counted them.

2. How many oxygen atoms are on each side of the model? Show how you counted them.

3. Suppose a model shows the two water molecules but leaves out oxygen gas. How many oxygen atoms are missing from the formed side?

4. A classmate draws two water molecules and two oxygen gas molecules on the formed side. Does this model conserve oxygen atoms? Compare both sides.

3 YOUR TURN

Your own words

In the box, draw a lettered-circle model for one methane molecule, CH_4, reacting with oxygen gas, O_2, to form carbon dioxide, CO_2, and water, H_2O. Use enough molecules to conserve every kind of atom, then write one sentence comparing the atom counts on both sides.

ANSWER KEY

Count Every Atom

GRADE 8 · 8.8.a

PART 1 · READ AND MARK

Underline the numbers of starting and formed molecules, and circle each statement that gives the atom count for one molecule. Label the starting side 1 and the formed side 2 to prepare for counting atoms on both sides. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How many hydrogen atoms are on each side of the model? Show how you counted them.	**Starting side: 2 peroxide molecules × 2 H atoms = 4 H atoms. Formed side: 2 water molecules × 2 H atoms = 4 H atoms.**
2	How many oxygen atoms are on each side of the model? Show how you counted them.	**Starting side: 2 peroxide molecules × 2 O atoms = 4 O atoms. Formed side: 2 water molecules × 1 O atom, plus 1 oxygen gas molecule × 2 O atoms, equals 4 O atoms.**
3	Suppose a model shows the two water molecules but leaves out oxygen gas. How many oxygen atoms are missing from the formed side?	**Two oxygen atoms are missing. The starting side has 4 O atoms, but the two water molecules have only 2.**
4	A classmate draws two water molecules and two oxygen gas molecules on the formed side. Does this model conserve oxygen atoms? Compare both sides.	**No. The starting side has 4 O atoms, but the formed side has 6: 2 in water and 4 in oxygen gas.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Starting side: one C circle joined to four H circles, plus two pairs of joined O circles. Formed side: one C circle joined to two O circles, plus two groups with one O circle joined to two H circles. Each side has 1 C atom, 4 H atoms, and 4 O atoms.

Accept different circle arrangements if they show the correct molecules and conserve 1 C, 4 H, and 4 O atoms on each side. Joined circles must make one methane and two oxygen gas molecules on the starting side, and one carbon dioxide and two water molecules on the formed side.