Where Did It Go?

Test matter conservation with particle, equation, and mass models.

PS.5.d "Utilize multiple types of models to support and verify the claim that matter is conserved during a simple chemical reaction."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the starting and ending amounts of matter, circle the numbers in the particle and equation models, and number the three types of models. Use your marks to compare what each model tracks.

A Metal Turns to Powder

1. A lab team heats magnesium in a sealed, heat-safe chamber containing oxygen gas. Before heating, the chamber holds 48 grams of magnesium and 32 grams of oxygen. After the chamber cools, it contains 80 grams of white magnesium oxide powder, with no magnesium or oxygen gas left. The team measures the contents by subtracting the empty chamber's mass from each total scale reading. The powder looks nothing like the original metal and gas. Appearance alone cannot show whether matter was lost, so the team compares models that track the reaction in different ways.

2. In a particle model, the starting sample has four separate magnesium atoms and two oxygen molecules. Each oxygen molecule contains two oxygen atoms joined together. After the reaction, the sample has four magnesium oxide units, each made of one magnesium atom bonded to one oxygen atom. These counts describe a tiny sample, not every particle in the chamber. A symbolic model records the same reaction as $2\ Mg + O_2 \rightarrow 2\ MgO$. Coefficients in that equation give ratios, so the particle model can show twice as many units as the equation's numbers.

3. A third model tracks mass instead of particle counts. Using rounded atomic masses, a mole of magnesium atoms has a mass of 24 grams, a mole of oxygen molecules has a mass of 32 grams, and a mole of magnesium oxide units has a mass of 40 grams. The team's starting amounts match two moles of magnesium and one mole of oxygen molecules. The final powder matches two moles of magnesium oxide. Because the chamber stays sealed while it cools, gas cannot enter or escape before the final measurement.

2 ANSWER WITH EVIDENCE

Use the passage

1. Count each kind of atom before and after the reaction in the particle model. How do those counts test whether matter was conserved?

2. Use the symbolic equation to count Mg and O atoms on each side. Does this model support the same claim as the particle model? Explain.

3. Use the mole masses in the passage to calculate the total mass before and after the reaction. How does this model test conservation?

4. A student compares only the 48 grams of magnesium with the 80 grams of powder and says matter was created. Use two models from the passage to evaluate that claim.

3 YOUR TURN

Your own words

In a separate sealed chamber, 12 grams of carbon react with 32 grams of oxygen gas to make 44 grams of carbon dioxide. In the box, sketch one C atom and one O_2 molecule before the reaction and one CO_2 molecule after it, then write a mass equation and one sentence explaining how both models test conservation.

Where Did It Go?

PART 1 · READ AND MARK

Underline the starting and ending amounts of matter, circle the numbers in the particle and equation models, and number the three types of models. Use your marks to compare what each model tracks. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Count each kind of atom before and after the reaction in the particle model. How do those counts test whether matter was conserved?	**Before and after, there are four Mg atoms and four O atoms. Neither kind of atom is lost or gained.**
2	Use the symbolic equation to count Mg and O atoms on each side. Does this model support the same claim as the particle model? Explain.	**Each side has two Mg atoms and two O atoms, so the equation also supports conservation of matter.**
3	Use the mole masses in the passage to calculate the total mass before and after the reaction. How does this model test conservation?	**Before: 2 × 24 g + 32 g = 80 g. After: 2 × 40 g = 80 g. The totals match.**
4	A student compares only the 48 grams of magnesium with the 80 grams of powder and says matter was created. Use two models from the passage to evaluate that claim.	**The mass model includes 32 grams of starting oxygen, making 80 grams before and after. The particle model shows that oxygen atoms from the gas become part of the powder.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Sketch: Before, one C atom beside a bonded pair of O atoms. After, one C atom bonded to both O atoms. Mass equation: 12 g + 32 g = 44 g. Both models show that the atoms and total mass are the same before and after.

Accept equivalent atom sketches and calculations. The open response must account for one C atom and two O atoms on each side and compare total starting and ending mass.