



Balancing Chemical Equations Investigation

Use coefficients, atom counts, and calculated mass to show that chemical reactions rearrange atoms without creating or destroying them.

NGSS: HS-PS1-7 - Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Name: _____ Class / Period: _____ Date: _____

Core Idea

Coefficients change how many particles take part in a reaction. **Subscripts** are part of a substance's chemical formula and must not be changed when balancing an equation.

1. Why would changing a subscript change the identity of a substance, while changing a coefficient does not?

Part A - Balance and Classify

Use the model to balance each equation in the **simplest whole-number ratio**. Then use the model's classification tool to identify the reaction type.

#	Unbalanced equation	Balanced coefficients	Reaction type
1	$\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$		
2	$\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$		
3	$\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$		
4	$\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$		
5	$\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{NaCl}$		
6	$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$		

Reaction types available in the model: synthesis, decomposition, single replacement, double replacement, combustion.

Part B - Atom Accounting

Choose **one** equation above. Record the total number of each type of atom after the equation is balanced.

Element	Reactant-side atoms	Product-side atoms	Equal?

2. What does the atom-count table show about atoms during a chemical reaction?

Part C - Mass Conservation

Use the model's mass display for two different balanced equations. Record the calculated total mass on each side.

Reaction	Reactant mass	Product mass	Difference
1. _____			
2. _____			

3. The particles are rearranged into new substances. Why does the total calculated mass remain the same?

Part D - Challenge Mode

Start the five-equation challenge. Record your final score and one equation that required you to revise your coefficients.

Challenge score	Longest streak	Equation that made you revise	What did you change?

CER: Conservation of Matter

Claim: Are atoms and mass conserved during the reactions in this simulation?

Evidence: Use one atom-count example and one mass example from your investigation.

Reasoning: Explain why a balanced equation is a mathematical representation of conservation of matter.

4. Why must a correctly balanced equation be written using the **smallest** whole-number coefficient ratio?
