

Unit 4: Proportion and Quantity of Atoms and Molecules in Chemical Reactions

Standard(s):

8.1.3 **Plan and conduct an investigation** and then analyze and interpret the data to identify patterns in changes in a substance's properties to determine whether a chemical reaction has occurred. Examples could include changes in properties such as color, density, flammability, odor, solubility, or state. (PS1.A, PS1.B)

8.1.6 **Develop a model** to describe how the total number of atoms does not change in a chemical reaction, indicating that matter is conserved. Emphasize demonstrations of an understanding of the law of conservation of matter. Balancing equations and stoichiometry will be learned at the high school level. (PS1.B)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Students develop physical, conceptual, and other models to represent relationships, explain mechanisms, and predict outcomes.	PS1.A Structure and Properties of Matter PS1.B Chemical Reactions	Scale Proportion and Quantity Students compare the scale, proportions, and quantities of measurements within and between various systems. Patterns Students observe patterns to organize and classify factors that influence relationships.
Big Ideas: Materials can be characterized by their intensive measurable properties. Many substances react chemically with other substances to form new substances with different properties. The total number of each type of atom is conserved (does not change) in any chemical process, and thus mass does not change either.		
Preceding Grade Bands: - Matter can be described and classified by its observable properties (e.g., visual, aural, textural), by its uses, and by whether it occurs naturally or is manufactured. - The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish (e.g., sugar in solution, evaporation in a closed container). - Measurements of a variety of properties (e.g., hardness, reflectivity) can be used to identify particular materials.	Target Grade Bands: - Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. - Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. - The total number of each type of atom is conserved, and thus the mass does not change.	Following Grade Bands: - The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. - The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.

When two or more different substances are mixed, a new substance with different properties may be formed; such occurrences depend on the substances and the temperature. No matter what reaction or change in properties occurs, the total weight of the substances does not change.		
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Proficiency Scale:

4 Advanced	3 Proficient	2 Approaching Proficiency	1 Beginning Proficiency
I Can: Develop a model based on evidence that shows what happens to the <u>quantity</u> (mass) of substances during a chemical reaction. AND Use <u>patterns</u> in data as evidence to support a claim that a chemical reaction did or did not occur between substances. AND Construct an argument based on data to justify claims for why some data are stronger or weaker evidence that a chemical reaction has occurred.	I Can: Develop a model based on evidence that shows what happens to the <u>quantity</u> (mass) of substances during a chemical reaction. AND Use <u>patterns</u> in data as evidence to support a claim that a chemical reaction did or did not occur between substances.	I Can: Develop a model that shows what happens to the <u>quantity</u> (mass) of substances during a chemical reaction. AND Use data to support a claim that a chemical reaction did or did not occur between substances.	I Can: Describe what happens to the mass of substances during a chemical reaction. AND Make a claim about whether or not a chemical reaction occurred between substances.

Anchoring Phenomenon

Burning rubbing alcohol

Burning steel wool on a scale

Other demos - some are chemical reactions some are not, can you guess if this is a chemical reaction or not?

Essential Question:

What happens when new materials are formed? What stays the same and what changes?

Learning Goals:**Students will be able to:**

4A: Plan an investigation to gather evidence to determine whether a chemical reaction has occurred between substances.

4B: Develop a model to show what happens to the mass of substances during a chemical reaction.

	Learning Opportunities		Formative Assessments
Learning Goal: 4A: Plan an investigation to gather evidence to determine whether a chemical reaction has occurred between substances.			
Engage	Breathing Phenomenon: Ask and discuss if breathing is a chemical reaction.		
	Teacher: lead students in a discussion about breathing.	Student: Take a deep breath and answer the following questions in your journal: 1) What do you breathe in? 2) What do you breathe out? 3) Are they the same or different? 4) Is breathing a chemical reaction why or why not?	
Explore	Slime: Patterns ● Make Slime - Discuss is it a chemical reaction or not? How do we know? (exit ticket) ● Read and take notes from the OER textbook page 33-35. ○ https://www.uen.org/emedialresources/oer/2022-2023-8thGradeSEEd.pdf ● Chemical Reactions in Everyday Life ● Chemical Reactions in Everyday Life-Spanish		Chemical Reaction Prequiz
	Teacher: The “Make Slime” powerpoint has informational slides (pink), teacher prep (green) and recipes for students (white). We usually offer 2 to 3 recipes for students to pick from.	Student: Students make the slime and compare the difference between the different types of slime. They discuss at the end whether it was a chemical reaction or not, and what evidence they have to back up their claim.	Chemical Reaction Pre Quiz-Spanish

Explain	Chemical Reactions: Evidence & Patterns • What Evidence, Something New Student Sheet : Apply list of signs to different examples <i>(AND/OR)</i> • What Evidence, Something New -Spanish • Smores Reading, Questions & C.E.R./A.C.E. Response - Help connect the s'mores making activity to looking for evidence of a chemical reaction. • Smores Reading, Questions-Spanish • Chemical Reaction Student Notes and Demos: • Chemical Reaction Student Notes and Demos-Spanish • Slideshow That Can Guide the Notes • Slideshow for Suggested Demos: Includes slide showing the equation for the chemical reaction in the demo. • Videos of Teacher Demos for reference or use with absent students.	
Elaborate	Chemical Reactions Lab Stations: Conduct investigations & Analyze and Interpret Data • Identifying Chemical Reactions Lab student sheet - Lab stations, students practice identifying signs of a chemical reaction. • Identifying Chemical Reactions Lab Student Sheet-Spanish • Student Lab Station Instructions - Student lab sheet with videos and readings included. • Student Lab Station Instructions-Spanish • Answer Key • Answer Key-Spanish • Revisit phenomenon - is breathing a chemical reaction? What evidence do we have? Discuss this with your students and have them explain their reasoning with evidence.	
	Teacher: We set up 8 stations and have each student fill out an assignment but complete the lab together as a table. It Student: Students record observations as they go through each lab station and determine whether a chemical reaction	

	takes about 6-8 minutes per station. They rotate through each of the stations or just some of them you can choose. We have tried putting the readings with the lab and then after the lab, we found having them collect evidence from the reading was more effective after the lab was done. There are videos of each lab included in the document for you to watch and for absent students to make up the assignment.	happens. They complete the lab as a group but each student fills out their own assignment. After the lab they go through readings to collect evidence on whether it was a chemical reaction or not. Lab Stations Student Note Sheet : Student sheet Ls less guidance if you students are more independent Lab Stations Student Note Sheet-Spanish	
Evaluate	Chemical Reactions Assessment: • Chemical Reaction Test Review • Chemical Reaction Test Review- Spanish • Chemical Reaction Test Review - Answer Key • Chemical Reaction Test Review-Answer Key-Spanish		Chemical Reactions Quiz Dye Answers (OR) Identifying Chemical Reactions Lab Assessment Students plan an investigation (OR) Glow Stick Test Glow Stick Test-Spanish
	Teacher: We don't use this as a graded assignment but we use it as a requirement for a quiz retake.	Student: A good review to have the students practice all the things they have learned and prepare for the quiz.	

Learning Goal: 4B: Develop a model to show what happens to the mass of substances during a chemical reaction.		
Engage	Revisit Phenomenon:	Conservation of Matter Prequiz

	● Photosynthesis & Respiration Phenomenon Student Sheet: Students investigate how photosynthesis and cellular respiration follow the law of conservation of matter in a class discussion or as individuals ● Photosynthesis & Respiration Phenomenon Student Sheet-Spanish		Conservation of Matter Prequiz-Spanish
	Teacher: Use this to facilitate a class discussion. Make sure to emphasize the 2 numbered questions. You can pose questions throughout with the class or as a follow up after completing the handout.	Student: Students complete handout or brainstorm questions posed by teacher and participate in class discussion. Students can journal thoughts throughout or complete an exit ticket if not completing a handout.	
Explore	Conservation of Matter: Model ● Bead Sorting Activity Student Sheet: Students sort, count and weight beads, making different “molecules” in a chemical equation and then explain how it was a model of the conservation of matter. ● Bead Sorting Activity Student Sheet-Spanish		
	Teacher: Items needed: About 150 - 200 beads per partnership, small paper cups, scales ● This is a very tedious process and some students will complain but that is what makes it such an effective and memorable learning activity. ● We use small letter beads so they can make molecules with them. We use H’s, C’s, and O’s. ● If you don’t have beads you can use anything instead, for example beans, trail mix, legos, cereal, ect. ● Alternate: Trail Mix Trail Mix-Spanish	Student: Students sort beads into different arrangements, weigh them and count them in the different arrangements. Then in the end they come to the conclusion that no matter how they rearranged the beads they had the same amount and weight. Matter was conserved and never lost.	
Explain	Conservation of Matter: Obtain, Evaluate and communicate & Analyze Data ● Conservation of Matter Video Student Sheet: Defining conservation of matter and taking notes about it from videos. ● Conservation of Matter Video Student Sheet-Spanish ● Math and Lab : Short lab where students mix baking soda and vinegar in a closed bag and measure the bag before and after the reaction. Then they use the same idea to calculate the mass of different parts of chemical equations. ● Math and Lab-Spanish ○ Math and Lab Alternate Assignment: Students use pictures to explain how chemical reactions follow the law of conservation of matter, then they watch a video of the lab and answer questions. ○ Math and Lab Alternate Assignment-Spanish		

	Teacher: The math sheet: can be done together as a class. The idea is for students to see the mass will be the same on both sides of the equation, as well as the kinds and number of elements. For the lab: ziplock bags, film canisters, baking soda and vinegar, scales. Works best in pairs if you can. Emphasize that they must not open the bag until after they have weighed it after the reaction.	Student: Students will research and watch videos to understand what conservation of matter is and see evidence of conservation of matter. The lab allows students to test & prove the law of conservation of matter with data.	
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Elaborate	Conservation of Matter: Analyze Data, Mathematical models • Graphing Conservation of Matter Student Sheet: Modeling conservation of matter by counting atoms, finding the mass, and graphing it. • Graphing Conservation of Matter Student Sheet-Spanish		
	Teacher: Do the first first page with the students as practice. This video can walk you through what the students should be doing: https://youtu.be/G9oBkONPVGc	Student: Students will look at chemical equations of cellular respiration and photosynthesis and count how many of each atom there is on each side of the equation. They will then make a simple graph to model that there is the same amount of each atom on both sides of the equation. • Video for students to watch to walk them through the first page if they need it: https://youtu.be/G9oBkONPVGc	
Evaluate	Conservation of Matter Assessment: • Conservation of Matter Review • Conservation of Matter Review-Spanish • Conservation of Matter Review - Answer Key <i>(Not available in Spanish)</i>		Conservation of Matter Quiz
	Teacher: We don't use this as a graded assignment but we use it as a requirement for a quiz retake.	Student: A good review to have the students practice all the things they have learned and prepare for the quiz.	Conservation of Matter Quiz-Spanish

Evaluate For the Unit	Burning Steel Wool https://docs.google.com/document/d/1YQj2_4zG9-C-ky5qsnMyCf-pHIdsfAO2kzO3UIsa7B4/template/preview	
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	Teacher:	Student: