

Unit 3: Structure of Matter Determines Function

Standard(s):

8.1.1 Develop a model to describe the scale and proportion of atoms and molecules. Emphasize developing atomic models of elements and their numbers of protons, neutrons, and electrons, as well as models of simple molecules. Topics like valence electrons, bond energy, ionic complexes, ions, and isotopes will be introduced at the high school level. (PS1.A)

8.1.2 Obtain information about various properties of matter, evaluate how different materials' properties allow them to be used for particular functions in society, and communicate your findings. Emphasize general properties of matter. Examples could include color, density, flammability, hardness, malleability, odor, ability to rust, solubility, state, or the ability to react with water. (PS1.A)

8.1.4 Obtain and evaluate information to describe how synthetic materials come from natural resources, what their functions are, and how society uses these new materials. Examples of synthetic materials could include medicine, foods, building materials, plastics, or alternative fuels. (PS1.A, PS1.B, ESS3.A)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Students obtain, evaluate, and derive meaning from scientific information or presented evidence using appropriate scientific language. They communicate their findings clearly and persuasively in a variety of ways including written text, graphs, diagrams, charts, tables, or orally.	PS1.A Structure and Properties of Matter PS1.B Chemical Reactions ESS3.A Natural Resources	Structure and Function Students relate the shape and structure of an object or living thing to its properties and functions.
Overarching Concepts from Framework: - While too small to be seen with visible light, atoms have substructures of their own. They have a small central region or nucleus—containing protons and neutrons—surrounded by a larger region containing electrons. - Each element has characteristic chemical properties. - The varied properties (e.g., hardness, conductivity) of the materials one encounters, both natural and manufactured, can be understood in terms of the atomic and molecular constituents present and the forces within and between them. - Materials can be characterized by their intensive measurable properties. Different materials with different properties are suited to different uses. - Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources, including air, water, soil, minerals, metals, energy, plants, and animals.		

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. Different properties are suited to different purposes. ● Measurements of a variety of properties (e.g., hardness, reflectivity) can be used to identify particular materials. ● All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.	Target Grade Bands: ● Pure substances are made from a single type of atom or molecule; each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. ● Atoms form molecules that range in size from two to thousands of atoms. ● Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes.	Following Grade Bands: ● Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. ● Resource availability has guided the development of human society. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits. New technologies and regulations can change the balance of these factors.
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Proficiency Scale:

4 Advanced	3 Proficient	2 Approaching Proficiency	1 Beginning Proficiency
I Can: Obtain information from a variety of reliable scientific sources about the types of natural resources humans use, their properties, how the <u>structure</u> of these atoms and/or molecules determine their properties (<u>function</u>), how they are used to make synthetic materials, and what the natural and/or synthetic materials are used for. AND Describe how harvesting and using natural resources impacts society	I Can: Obtain information from a variety of reliable scientific sources about the types of natural resources humans use, their properties, how the <u>structure</u> of these atoms and/or molecules determine their properties (<u>function</u>), how they are used to make synthetic materials, and what the natural and/or synthetic materials are used for.	I Can: Obtain information about the types of natural resources humans use, their properties, how the <u>structure</u> of these atoms and/or molecules determine their properties (<u>function</u>), how they are used to make synthetic materials, and what the natural and/or synthetic materials are used for.	I Can: Obtain information about the types of substances (atoms and molecules) humans use.

and/or the environment.			
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Anchoring Phenomenon Balloons - Helium balloon vs. Air Filled Balloon
Essential Question: How do Humans Depend on Earth’s Resources?
Learning Goals: Students will be able to. . . ● 3A: Develop a model that describes the structure of atoms and molecules by comparing the scale and proportion of their parts. ● 3B: Obtain and evaluate information to explain how the properties of a substance make it valuable to us as humans. ● 3C: Obtain and evaluate information to describe how synthetic materials come from natural resources, and how society uses these materials.

	Learning Opportunities		Formative Assessments
Engage	Balloons - Helium balloon vs. air filled balloon ● What do you notice as the differences between these two balloons? ● What is different about the stuff inside the balloons that allow them to do what they do. ● How would we use these (or the stuff inside) balloons different		
	Teacher:	Student:	
Learning Goal: 3A Develop a model that describes the structure of atoms and molecules by comparing the scale and proportion of their parts.			

Explore	Structure of Atom: • Atom Phenomenon Student Sheet • Atom Phenomenon Student Sheet-Spanish • Atoms Phenomenon Answers • Atoms Phenomenon Answers-Spanish • Building an Atom Simulation Student Sheet • Building an Atom Simulation Student Sheet-Spanish • Building an Atom Simulation Answers • Building an Atom Simulation Answers-Spanish		Complete the Atom & Molecule Pre-test Pre-test Atoms Pre-test Atoms-Spanish Atoms and Molecules Unit Quiz Atoms and Molecules Unit Quiz-Spanish Evaluate your pretest Pretest Evaluation Rubric Pretest Evaluation Rubric-Spanish
	Teacher	Student:	
Explain	Parts of Atom: Proportion & modeling. • Atom Notes • Atom Notes-Spanish • Atoms Notes Answers • Atoms Notes Answers-Spanish • Practice identifying parts of atoms from the periodic table ○ Additional Practice: Introduction to The Periodic Table ○ Introduction to The Periodic Table-Spanish ○ Introduction to Periodic Table Answers ○ Introduction to Periodic Table Answers-Spanish		Learning Goal 3A Assessment Drawing Atom Quiz Drawing Atom Quiz-Spanish

	● Revisit phenomenon: Students practice drawing the atoms of helium vs oxygen/nitrogen/carbon. Compare the differences. Why does helium float?		Drawing Atom Answer Key
	Teacher:	Student:	
Explore	Size and Scale of Atom ● Size & Scale of Atom Student Sheet ● Size & Scale of Atom Student Sheet-Spanish		
	Teacher:	Student:	
Explain	Walk an Atom - Scale & Proportion ● Class activity & discussion: (<i>Not available in Spanish</i>) ○ Video of a class doing the activity ○ Different Size & Scale of Atoms PPT: ends with developing to walk an atom. ○ Evaluate Atomic Models PPT: Discussion		
	Teacher:	Student:	
Explore	Molecules: Atoms make molecules ● Pencil Phenomenon Student Sheet ● Pencil Phenomenon Student Sheet-Spanish ● Hands on activity to connect atoms and molecules ○ Grab 3 sticky notes or scratch pieces of paper. ○ On one sticky note draw an atom of oxygen. ○ On the second sticky note draw an atom of hydrogen. ○ On the last sticky note draw another atom of hydrogen. ○ Then arrange the three sticky notes with oxygen in the middle and one hydrogen on each side raised slightly higher than the oxygen. Congratulations! You just built a model of a molecule of water(H₂O)! <u>Remember: atoms bond together to make molecules.</u> We will be learning about molecules next week. ○ Watch this 10 Minute Video about how to find the amount of different atoms in molecules ● Macaroni Salad Video and Practice Reading Chemical Formula Student Sheet ● Macaroni Salad Molecules Practice Sheet-Spanish		
	Teacher:	Student:	

Explain	Molecule: Modeling & Proportion ● Making a Molecule ● Making a Molecule-Spanish ● Revisit phenomenon: Students practice drawing the molecules of helium vs Nitrogen and carbon dioxide in the air. Compare the differences. Why does helium float?		Atom and Molecule Quiz Review
	Additional Options if you have the supplies ● Lego Molecules Student Sheet ● Legos Molecules Student Sheet-Spanish ● Molecule Kits Student Sheet ● Molecules Kits Student Sheet-Spanish ○ Video showing what students do with the molecule kits (<i>Not available in Spanish</i>)		Answer key Draw models
	Teacher:	Student:	Atoms and Molecules Quiz

	Learning Opportunities		Formative Assessments
Learning Goal: 3B Obtain and evaluate information to explain how the properties of a substance make it valuable to us as humans.			
Engage	Properties Phenomenon: ● Balloons: ○ Journal/Brainstorming ○ Journal/Brainstorming-Spanish ○ Teacher Tips: Get a helium filled balloon & you inflate one. Use the same color of balloon. If you give a prize to the first student(s) with 15 different characteristics, they can do it. Alternate: Burning Dollar: ● Lesson Plan explains engage, explore, and explain sections ● Lesson Plan-Spanish		
	Teacher: Student:		
Explore	Properties of Matter ● Pretest and Research ○ Pretest - Students fill out as much as they can ○ Pretest-Spanish		Properties of matter Pretest

	○ Resources Page - Students now use these resources and a search engine to fill in all the remaining squares on the pretest (and check the ones they already filled in). ○ Resources Page-Spanish ○ Property Use Sentence Frames ○ Property Use Sentence Frames-Spanish Possible Additional Activities ● Humanities Favorite Color Data <i>(Not available in Spanish)</i> ● Odor Expert	Students fill out as much as they can Pretest-Spanish
Explain	Evaluate Properties & Uses ● Class discussion with household items: ● Teacher Resources ● Teacher Resources-Spanish ● Revisit phenomenon: What are the properties of matter for helium? Why do we fill balloons with helium? ● Evaluate Properties: Identify examples of things with certain properties & how we use them. ○ Student Sheet ○ Student Sheet-Spanish ● Melting and boiling point ○ Article Students Read to understand ○ Slideshow to facilitate class discussion ● 3 states of matter for water: Venn Diagram Venn Diagram-Spanish	
Elaborate	Properties & Uses: Obtain, evaluate, communicate ● What If Student Sheet - This assignment helps kids think about how important properties really are. ● What if Student Sheet-Spanish ● Properties of Unknown Liquids Lab - This lab allows students to test properties to determine the unknown liquid. ● Properties of Unknown Liquids Lab-Spanish	

	● Properties of Unknown Liquid Page - Students use this to compare the properties they tested in the lab to the actual properties of unknown liquids to complete the last part of the lab Identifying the Mystery Substances ● Properties of Unknown Liquid Page-Spanish ○ individual alternate if student is absent for the lab - ○ Unknown Liquids Lab ○ Unknown Liquids Lab-Spanish ● Class lead Alternate: ● Clear Liquid Investigation - Students use their understanding of the properties of matter to explain and identify the 10 different clear liquids. ● Clear Liquid Investigation-Spanish ○ Lesson Plan explains engage, explore, and explain sections ○ 10 Liquids Properties options (<i>includes decoys</i>) ○ 10 Liquids Properties-Spanish		
	Teacher:	Student:	
Evaluate	Properties: Obtain, Evaluate, Communicate Functions ● Element Research Assignment - graded as assessment ● Element Research Assignment-Spanish ● To show that you have used reliable resources, fill out the ● Favorite Element Sources Assignment while you are doing your research. Use any three websites that you used to get information about your element to fill out the assignment. You will explain why the resources you used were reliable. ● Favorite Element Sources-Spanish ○ Resource - Interactive Periodic Table (<i>Not Available in Spanish</i>) ○ Resource - Elements In Words		Properties Quiz
	Teacher:	Student:	

Learning Goal: 3C Obtain and evaluate information to describe how synthetic materials come from natural resources, and how society uses these materials.

Explore	Natural vs Synthetic: Obtain & Evaluate basics ● Natural and Synthetic Insulin Student Sheet - Students define natural and synthetic then explore how insulin is made ● Natural and Synthetic Insulin Sheet-Spanish	
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	○ Natural vs. Synthetic Answer Key ○ Natural vs. Synthetic Answer Key-Spanish ● Obtain and Evaluate Information ● Obtain and Evaluate Information-Spanish ● Natural or Synthetic Student Sheet - Students Read the article “Materials that Changed History and evaluate whether each of the materials are natural or synthetic. ● Obtain and Evaluate Information ● Natural or Synthetic - Spanish	
	Teacher: Student:	
Explain	Natural vs Synthetic: Obtain & Evaluate specific material examples ● Latex & Mylar ● Latex & Mylar-Spanish ○ Revisit phenomenon: Discuss what the balloons from phenomenon is made from	LG 3C quiz
	Teacher: Student:	
Elaborate	Natural vs Synthetic: Obtain & Evaluate-Apply ● Natural & Synthetic Clothing Student Sheet: look at fabrics - synthetic or natural? what do we use the different fabrics for (properties of matter), what are molecules and atoms made of. ● Natural & Synthetic Clothing Student Sheet-Spanish	
	Teacher: Student:	
Evaluate		Natural Vs Synthetic Quiz Natural vs Synthetic Quiz-Spanish

