Colorado Teacher-Authored Instructional Unit Sample

Science
6th Grade

Unit Title: Building Blocks of Life

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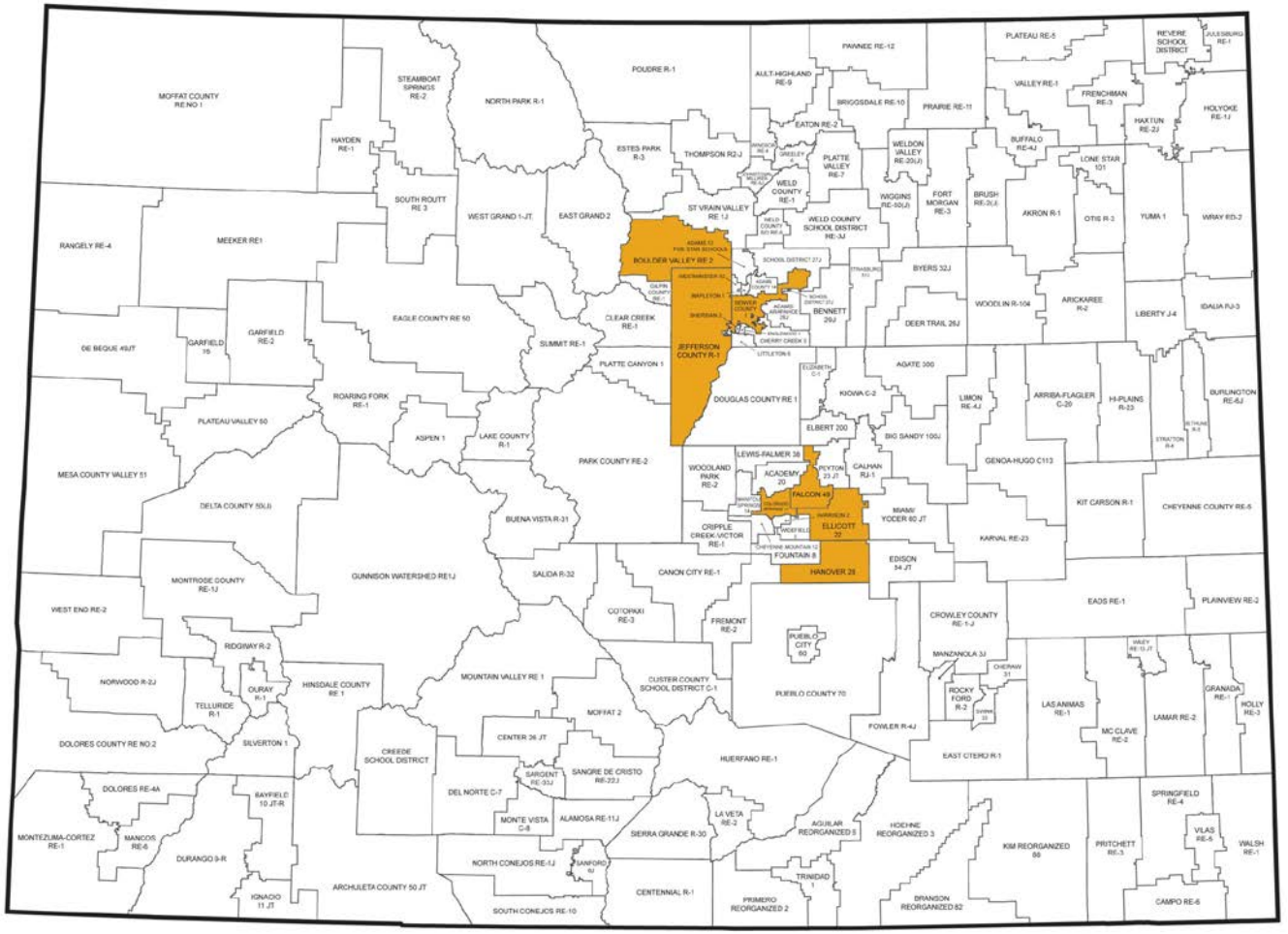

This unit was authored by a team of Colorado educators. The template provided one example of unit design that enabled teacher-authors to organize possible learning experiences, resources, differentiation, and assessments. The unit is intended to support teachers, schools, and districts as they make their own local decisions around the best instructional plans and practices for all students.

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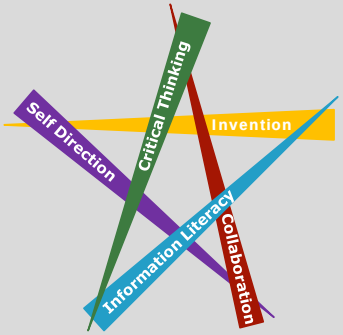
Colorado Teacher-Authored Sample Instructional Unit

Content Area	Science	Grade Level	6th Grade
Course Name/Course Code			

Standard	Grade Level Expectations (GLE)	GLE Code
1. Physical Science	1. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles	SC09-GR.6-S.1-GLE.1
	2. Atoms may stick together in well-defined molecules or be packed together in large arrangements. Different arrangements of atoms into groups compose all substances.	SC09-GR.6-S.1-GLE.2
	3. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model	SC09-GR.6-S.1-GLE.3
	4. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density	SC09-GR.6-S.1-GLE.4
2. Life Science	1. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species	SC09-GR.6-S.2-GLE.1
	2. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem	SC09-GR.6-S.2-GLE.2
3. Earth Systems Science	1. Complex interrelationships exist between Earth's structure and natural processes that over time are both constructive and destructive	SC09-GR.6-S.3-GLE.1
	2. Water on Earth is distributed and circulated through oceans, glaciers, rivers, ground water, and the atmosphere	SC09-GR.6-S.3-GLE.2
	3. Earth's natural resources provide the foundation for human society's physical needs. Many natural resources are nonrenewable on human timescales, while others can be renewed or recycled	SC09-GR.6-S.3-GLE.3

Colorado 21st Century Skills



Critical Thinking and Reasoning: *Thinking Deeply, Thinking Differently*

Information Literacy: *Untangling the Web*

Collaboration: *Working Together, Learning Together*

Self-Direction: *Own Your Learning*

Invention: *Creating Solutions*

Reading & Writing Standards for Literacy in Science and Technical Subjects 6 - 12

Reading Standards

- Key Ideas & Details
- Craft And Structure
- Integration of Knowledge and Ideas
- Range of Reading and Levels of Text Complexity

Writing Standards

- Text Types & Purposes
- Production and Distribution of Writing
- Research to Construct and Present Knowledge
- Range of Writing

Unit Titles	Length of Unit/Contact Hours	Unit Number/Sequence
Building Blocks of Life	4-6 weeks	3

Unit Title	Building Blocks of Life	**Length of Unit**	4-6 weeks
Focusing Lens(es)	Complexity Structure	**Standards and Grade Level Expectations Addressed in this Unit**	SC09-GR.6-S.1-GLE.1 SC09-GR.6-S.1-GLE.2 SC09-GR.6-S.1-GLE.4
Inquiry Questions (Engaging-Debatable):	• Are space travel and the colonization of places like the moon or mars possible? • Do the Laws of Physics apply constantly across the universe? • How would the human body be affected by space travel? • Is anything in the world not made of matter?		
Unit Strands	Physical Science		
Concepts	Properties, structure, function, substance, energy, relationship, foundation, order, patterns, bonds, interaction, matter, atoms, molecules, mass volume, density, weight		

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Relationships between atoms and molecules determine the complexity and properties of matter (SC09-GR.6-S.1-GLE.1-EO.a) and (SC09-GR.6-S.1-GLE.2-EO.b)	In what ways does the relationship between atoms and molecules determine the complexity of matter? (SC09-GR.6-S.1-GLE.1,2)	How does the interaction of things we can't see affect what we can see?
Structure of matter creates predictable patterns in the universe. (SC09-GR.6-S.1.GLE.1-EO.b,c)	In what ways does the arrangement of atoms in elements create predictable structures of matter? (SC09-GR.6-S.1.GLE.1-EO.b,c)	How does the understanding of the basic building blocks of matter help us to predict the substance of the universe? (SC09-GR.6-S.1.GLE.1-EO.b; IQ.1; RA.1)
Gravitational forces interact and act with matter in the universe in predictable ways. (SC09-GR.6-S.1-GLE.4)	What is the relationship between mass, volume and density, and do these terms relate to weight? (SC09-GR.6-S.1.GLE.2-EO.b)	If weight and mass are not the same thing, why might people use the words interchangeably? (SC09-GR.6-S.1.GLE.4; IQ.2)
Mass, weight, and volume determine an object's or a liquid's density. (SC09-GR.6-S.1-GLE.4-EO.c)	What are the differences between mass, volume, and weight?	If two objects have the same mass, how would the density differ if one was larger than the other?
The arrangement of atoms in matter defines the density of matter. (SC09-GR.6-S.1-GLE. 3-EO.c,d)	What state of matter is the densest?	Why is the solid state of matter usually the most dense? Why do balloons float?

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**

• Chemical and nuclear reactions based on atomic and molecular structure (SC09-GR.6-S.1-GLE.1) • The fundamental building blocks of matter(SC09-GR.6-S.1-EO.a) • Particle theory of matter and characteristics of the particle model (SC09-GR.6-S.1-EO.b) • The atomic model as the foundation for all chemistry (SC09-GR.6-S.1-EO.c) • The history of the scientific investigations and the relationship to the understanding of the nature of matter. (SC09-GR.6-S.1-EO.d) • The consistency of living things in relation to the matter in the rest of the universe. (SC09-GR.6-S.1-GLE.1;RA.1) • The similarities and differences between elements and compounds. (SC09-GR.6-S.1-GLE.2-EO.a) • Why atoms form into molecules with different properties than their components. . (SC09-GR.6-S.1-GLE.2-EO.b) • The structure of a molecule. (SC09-GR.6-S.1-GLE.2-EO.c) • How gravitational force can change the weight (and not the mass)of an object. (SC09–GR.6-S.1-GLE.4–EO.d) • The relationship between acceleration due to gravity wand the mass and weight of an object. (SC09-GR.6-S.1-GLE.2-EO.b) • The relationship between mass, volume, and density. (SC09-GR.6-S.1-GLE.2-EO.d & e) • Units of measure for mass, volume, and density. (SC09-GR.6-S.1-GLE.2;N.3)	• Apply an understanding of atomic and molecular structure (SC09-GR.6-S.1-GL.1) • Identify evidence that suggests there is a fundamental building block of matter (SC09-GR.6-S.1-GL.1-EO.a) • Use the particle model of matter to illustrate characteristics of different substances(SC09-GR.6-S.1-GL.1-EO.b) • Develop an evidence based scientific explanation of the atomic model (SC09-GR.6-S.1-GL.1-EO.c) • Find and evaluate appropriate information from reference books, journals, magazines, online references, and databases to compare and contrast historical explanations for the nature of matter(SC09-GR.6-S.1-GL.1-EO.d) • Work in groups using the writing process to effectively communicate an understanding of the particle model of matter. (SC09-GR.6-S.1-GL.1;N.1) • Use technology to share research findings about historical explanations for the nature of matter and to publish information to various audiences. (SC09-GR.6-S.1-GL.1;N.2) • Create models that explain the particle theory of matter. (SC09-GR.6-S.1-GL.1;N.3) • Recognize and describe the ethical traditions of science: (SC09-GR.6-S.1-GL.1;N.4) • Explain the similarities and differences between elements and compounds (SC09-GR.6-S.1-GL.2.EO.a) • Identify evidence that atoms form into molecules with different properties than their components. ((SC09-GR.6-S.1-GL.2.EO.b) • Find and evaluate information from a variety of resources. (SC09-GR.6-S.1-GL.2.EO.c) • Use models and/or electronic media to show and understand how molecules are made of atoms (SC09-GR.6-S.1-GL.2;N.1) • Investigate how our current understanding of matter has developed through centuries of scientific investigations (SC09-GR.6-S.1-GL.2;N.2) • Predict how changes in acceleration due to gravity will affect the mass and weight of an object (SC09-GR.6-S.1-GL.4.EO.b) • Predict how mass, weight, and volume affect density (SC09-GR.6-S.1-GL.4.EO.c) • Measure mass and volume, and use these quantities to calculate density (SC09-GR.6-S.1-GL.4.EO.d) • Use tools to gather, view, analyze, and report results for scientific investigations about the relationships among mass, weight, volume, and density (SC09-GR.6-S.1-GL.4.EO.e)

Critical Language: includes the Academic and Technical vocabulary, semantics, and discourse which are particular to and necessary for accessing a given discipline.
EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*

A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*Substances behave differently based upon their atomic and molecular structure.* *Compounds are a combination of elements and have different properties then their individual elements.* *Mass is the amount of matter in an object and is independent of gravitational force.* *Weight is a measure of gravitational force on an object.*
Academic Vocabulary:	Compare and contrast, interactions, processes, illustrate, explain, examine, interact, analyze, predict, communicate, evaluate, gather, develop, design, justify, apply, interpret, relationship, identify, model, determine, similarities, differences, evidence, investigate, calculate, measure, function
Technical Vocabulary:	Matter, atoms, elements, compounds, properties, particles, building blocks of matter, particle model, particle theory of matter, molecules, arrays, substances, components, mass, weight, volume, density, gravitational force, acceleration, atomic structure, molecular structure, chemical reactions, nuclear reactions

Unit Description:	The unit begins with the teaching of ways to measure mass, volume density, weight and gravity. Next the concepts of matter, atoms, molecules and the properties of matter are introduced. This will lead to the understanding of the states of matter and their molecular structures. The unit culminates in a performance assessment where students discuss the history of the periodic table and the modern day arrangement of the table which will include the concept of the elements and compounds.
Considerations:	This unit was written with the intent that the measurement of volume, mass, density and metric system may be taught during the "Nature of Science" Unit and then reviewed at the start of "The Building Blocks of Life". The order of learning experience 8 and 9 are interchangeable. **Possible Misconceptions:** Weight is the same as mass.
Unit Generalizations	
Key Generalization:	Structure of matter creates predictable patterns in the universe. Gravitational forces interact and act with matter in the universe in predictable ways.
Supporting Generalizations:	Mass, weight, and volume determine an object's or a liquid's density.
	The arrangement of atoms in matter defines the density of matter.
	Relationships between atoms and molecules determine the complexity and properties of matter.

Performance Assessment: *The capstone/summative assessment for this unit.*	
Claims: (Key generalization(s) to be mastered and demonstrated through the capstone assessment.)	Structure of matter creates predictable patterns in the universe. (SC09-GR.6-S.1.GLE.1-EO.b,c) Gravitational forces interact and act with matter in the universe in predictable ways. (SC09-GR.6-S.1-GLE.4)
Stimulus Material: (Engaging scenario that includes role, audience, goal/outcome and explicitly connects the key generalization)	You are taking the role of a chemist who is in charge of saving a particular element. You will need to choose an element of importance to humans to take with you on your journey. Your main job will be to transport this element to a location that is not on Earth. You will be reporting your progress and findings to your NASA representative. Your NASA representative will determine the volume that will be allocated to take with you for each specific element. To better understand the element you will be transporting you must create a visual model of the element (e.g., Bohr's model) and include its' significance to humans. During the course of this journey, you will need to gather the following information about your element in order to secure its' survival: ● A visual diagram of the element (Bohr's model) ● The elements use and significance to humans. ● Why it is important to preserve the element (uses)

	● The new planets gravitational pull. ● The elements mass on the new location compared to Earth ● The elements weight on the new location compared to Earth ● Calculate the density of the element once you get it to your new location compared to Earth The information gathered will be vital to better understand how to save the element and mankind as a whole!!
Product/Evidence: (Expected product from students)	Bohr's Model of their element that includes the proper number and location of electrons, neutron and protons. A written report that includes the following: ● The elements use and significance to humans. ● Why it is important to preserve the element (uses). ● The new planets gravitational pull. ● The elements mass on the new location compared to Earth. ● The elements weight on the new location compared to Earth. ● Calculate the density of the element once you get it to your new location compared to Earth.
Differentiation: (Multiple modes for student expression)	The teacher may provide a list of elements for the student to choose from. The teacher may provide the planet/gravity for the new location. The student may have access to the formula to find density. The teacher may provide an outline of Bohr's model. To extend this work: The student may extend their research to include other research items (e.g., discover, boiling/melting point, luster). OR The student may research how the element may be of importance to the new planet.

Texts for independent reading or for class read aloud to support the content	
Informational/Non-Fiction	**Fiction**
Atoms and Molecules- Aolian, M. [lexile level 860] *Los atomos y las moleculas* -Mauer, T. [lexile level 1220] *Mass and Weight* - Sommervill, B. [lexile level 870] *Measuring Volume* -Vogel, J. [lexile level 660] *Density*- Manolis, D. [lexile level 720] *Measuring Area, Volume, and Density* -Unknown [lexile level 880] *Science Lab: Properties of Matter* - Hirsch,R. [lexile level 780]	*The Earth Cries Out: Forensic Chemistry and Environmental Science* - McIntosh, K. [lexile level 900]

Ongoing Discipline-Specific Learning Experiences				
1.	Description:	Working like a Scientist: Using mathematics to solve problems	Teacher Resources:	http://lamar.colostate.edu/~hillger/common.html (Website listing common metric measurements and units http://www.visionlearning.com/en/library/General-Science/3/The-Metric-System/47

				(website with information and quizzes around the metric system))
			Student Resources:	http://www.visionlearning.com/en/library/General-Science/3/The-Metric-System/47 (website with information and quizzes around the metric system) https://www.khanacademy.org/math/pre-algebra/rates-and-ratios/metric-system-tutorial/v/unit-conversion (Khan Academy video on metric system)
	Skills:	Calculating formulas Measuring objects using correct units	Assessment:	Students will be assessed within the learning experiences

Prior Knowledge and Experiences

Students must have a basic understanding of gravity, solid, liquid, and gas, metric base units, and basic mathematics skills.

Vertical Articulation: The last time students have seen concepts within this unit was 5th, 3rd, and 1st grades.

Learning Experience # 1

The teacher may provide various resources to demonstrate mass, volume, and density so that students can determine the relationship between them and measure and calculate mass, volume, and density in a lab-based format.

Generalization Connection(s):	Mass, weight, and volume determine an object's or a liquid's density. (SC09-GR.6-S.1-GLE.4-EO.c)
Teacher Resources:	http://www.cwcboe.org/page/1824 (mass and volume lab) http://sciencespot.net/Pages/classmetric.html (metric system labs) http://www.usi.edu/media/1751795/density.pdf (density labs) http://www.myteacherpages.com/webpages/mri/science.cfm?subpage=917446 (various labs)
Student Resources:	https://learnzillion.com/lessons/1270-understand-volume-and-how-volume-is-measured (how to measure volume) http://www.mikecurtis.org.uk/measurement.htm (measuring in metric units) https://www.brainpop.com/science/matterandchemistry/measuringmatter/preview.weml (measuring mass)
Assessment:	Students will take part in multiple stations that require measurement(s) of an object's mass, volume, and density. Students will use information gathered at each station to calculate the density of particular objects. The lab report will include: • mass calculations • volume calculations • density calculations • how a change in mass or volume would affect the density

	• correct units for mass, volume, and density http://www.glencoe.com/sites/common_assets/science/virtual_labs/E16/E16.html (Virtual lab to practice use of scientific method and experimentation)	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide formulas for calculations. The teacher may provide a list of units for students to match to the correct measurement. The teacher may provide the measurements for particular objects.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	N/A
Critical Content:	• Grams, cm^2, mass, volume, density, calculate, units	
Key Skills:	• Measure objects' mass, volume, and density	
Critical Language:	Grams, cm^2, mass, volume, density, calculate, units	

Learning Experience # 2	
The teacher may provide different substances so that students may calculate their densities and compare them by creating a density column.	
Generalization Connection(s):	Mass, weight, and volume determine an object's or a liquid's density. (SC09-GR.6-S.1-GLE.4-EO.c)
Teacher Resources:	http://www.explorelearning.com/index.cfm?method=cResource.dspDeta http://www.stevespanglerscience.com/lab/experiments/density-tower-magic-with-science il&ResourceID=362&utm_source=AdWords&utm_medium=cpc&utm_term=%2Bdensity%20%2Blab&utm_content=Density&utm_campaign=GizmosVisibility (lab set up) http://www.stevespanglerscience.com/lab/experiments/seven-layer-density-column (materials list to make density column) http://www.stevespanglerscience.com/lab/experiments/density-tower-magic-with-science (material list for several layered column) https://www.teacherspayteachers.com/Product/Density-Game-Sink-or-Swim-Review-Activity-355808 (resources for purchase) https://www.teachengineering.org/view_activity.php?url=collection/duk_/activities/duk_boat_mary_act/duk_boat_mary_act.xml (buoyancy activity) http://www.tclauset.org/20_ESbk/ch05.pdf (buoyancy and density article) http://www.usi.edu/media/1751795/density.pdf (density labs)
Student Resources:	http://www.middleschoolchemistry.com/lessonplans/chapter3/lesson3 (how to calculate the density of a liquid)

	https://www.youtube.com/watch?v=RnSJSSCfgPc (video on how to calculate density of a liquid) http://www.edinformatics.com/math_science/dens_liquid.htm (practice problems in calculating density) http://cdn.zmescience.com/wp-content/uploads/2012/10/9-Layer-Density-201012080001.jpg (visual for a density column) https://phet.colorado.edu/en/simulation/density (density simulation) http://serc.carleton.edu/mathyouneed/density/index.html (how to measure density) http://tinyurl.com/pkdovtj (density calculator)	
Assessment:	The students will calculate the densities of various liquids. Then ● Predict the order of the liquids in a density column. ● Create a density column of their own, illustrating the order of each liquid and labeling the density of each layer ● Write a brief conclusion, reflecting on whether their prediction was accurate or not and why	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may give the students the densities of the liquids. The teacher may provide formulas for calculations.	The student may only order the substances given the calculations.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide additional liquids and solids for the students to measure and arrange (choose liquids from a list of 20 substances).	The students may predict an order of substances prior to calculating the substances density.
Critical Content:	● Density, buoyancy, measuring matter, mass, volume	
Key Skills:	● Mathematical calculations, use of a formula, measuring mass and volume	
Critical Language:	Density, volume, mass, cubic measurement, float, sink, length, buoyancy	

Learning Experience # 3	
The teacher may introduce the role of gravitational force on an object so that students can calculate the weight of an object based on mass and gravity.	
Generalization Connection(s):	Gravitational forces interact and act with matter in the universe in predictable ways. (SC09-GR.6-S.1-GLE.4)
Teacher Resources:	https://www.teachervision.com/planets/lesson-plan/353.html (example of worksheet) http://www.smartconversion.com/otherInfo/gravity_of_planets_and_the_sun.aspx (chart of locations gravitational pull) http://hyperphysics.phy-astr.gsu.edu/hbase/mass.html (calculating weight based on mass) http://www.thecalculatorsite.com/articles/units/difference-between-mass-and-weight.php (the difference between weight and mass)
Student Resources:	http://www.exploratorium.edu/ronh/weight/ (check your work for various locations) http://www.smartconversion.com/otherInfo/gravity_of_planets_and_the_sun.aspx (chart of locations gravitational pull) http://www.theplanetstoday.com/images/solar_system_map.jpg (image with specific gravities of planets) http://www.mathsisfun.com/measure/weight-mass.html (study resource)

Assessment:	Students will determine their own, individual mass first. Students will then be given a map of our solar system and the gravitational pull of each planet, as well as other celestial bodies. Students will be tasked with calculating which location they would weigh the most and which location where they would weigh the least. Students must then provide evidence as to how the varying gravitational pulls affect their weight.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide formulas for calculations.	The student may only find their mass on a certain amount of planets/ celestial bodies and arrange them in order.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	Students will hypothesize how the size of each location relates to the gravitational pull. Students will research and hypothesize if/how their weight would fluctuate in different locations on planet earth.
Critical Content:	● Gravitational pull, mass, weight, calculate	
Key Skills:	● Determine weight at different locations, based on gravitational pull and mass	
Critical Language:	Gravitational pull, mass, weight, calculate	

Learning Experience # 4	
The teacher may introduce atoms through various forms of media so that students can begin to understand the concept of scale by examining the size of atoms relative to common objects.	
Generalization Connection(s):	Gravitational forces interact and act with matter in the universe in predictable ways.
Teacher Resources:	http://learn.genetics.utah.edu/content/cells/scale/ (size of an atom simulation) http://crystalmaker.com/support/tutorials/crystalmaker/atomic-radii/resources/CPK_Atomic_Radii.jpg (periodic table of atoms size) https://www.ted.com/talks/just_how_small_is_an_atom (Size of an atom)
Student Resources:	http://learn.genetics.utah.edu/content/cells/scale/ (size of an atom simulation) http://crystalmaker.com/support/tutorials/crystalmaker/atomic-radii/resources/CPK_Atomic_Radii.jpg (periodic table of atoms size) https://www.youtube.com/watch?v=yQP4UJhNn0I (video on size of an atom) https://www.youtube.com/watch?v=l1QDGJuJgQE (video about size of an atom) https://www.ted.com/talks/just_how_small_is_an_atom (Size of an atom)
Assessment:	Students will take the role of the first scientist to investigate an atom. Students will describe the experience including: ● The size of an atom compared to other objects ● What tools were used to first observe an atom

Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide objects to compare the size of atoms.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	Students can research the history and discovery of an atom (scientists, time period, etc.)
Critical Content:	● Microscope, atoms, scientific tools	
Key Skills:	● Understand the size of an atom	
Critical Language:	Microscope, atoms, scientific tools, comparison	

Learning Experience # 5		
The teacher may provide various examples of atomic models so that students can use manipulatives to understand the relationship of atoms and molecules.		
Generalization Connection(s):	Mass, weight, and volume determine an object's or a liquid's density. (SC09-GR.6-S.1-GLE.4-EO.c) Structure of matter creates predictable patterns in the universe. (SC09-GR.6-S.1.GLE.1-EO.b,c)	
Teacher Resources:	http://www.molecularium.com/Guides/Molecularium_teachers_guide.pdf (teacher resources on atoms and molecules) http://www.proteacher.org/c/457_Atoms_and_Molecules.html (teacher resources on atoms and molecules) http://www.ck12.org/earth-science/Atoms-to-Molecules/ (multiple forms of media to present to students)	
Student Resources:	https://phet.colorado.edu/en/simulation/legacy/build-a-molecule (build a molecule) http://www.glencoe.com/sites/common_assets/science/virtual_labs/E02/E02.swf (build a model) http://education.jlab.org/qa/ (questions and answers about atoms and molecules)	
Assessment:	The students will build and label models of various molecules using manipulatives as atoms (marshmallows, M&M's, colored dots).	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide a list of simple molecules. The teacher may provide a simplified list of elements and symbols from the periodic table.	N/A

Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide the students with a list of complex structures for the students to build and label.	The student may build singular atoms and then combine them together to make complex molecules.
Critical Content:	● molecules, atom, periodic table of elements	
Key Skills:	● reading the periodic table	
Critical Language:	Atom, element, compound, periodic table	

Learning Experience # 6		
The teacher may lead a discussion on several examples of measurable and observable properties of matter (e.g., volume, density, and odor) so that students can determine the importance of properties when identifying matter.		
Generalization Connection(s):	Structure of matter creates predictable patterns in the universe. (SC09-GR.6-S.1.GLE.1-EO.b,c) Mass, weight, and volume determine an object's or a liquid's density. (SC09-GR.6-S.1-GLE.4-EO.c)	
Teacher Resources:	http://www.science-class.net/archive/science-class/Lessons/Chemistry/Properties/cookie%20lab.pdf (example of a worksheet) http://schools.bcsd.com/fremont/5th_sci__matter_properties_of_matter.htm (content and questions to ask students) http://www.propertiesofmatter.si.edu/contents.html (Possible webquest)	
Student Resources:	http://schools.bcsd.com/fremont/5th_sci__matter_properties_of_matter.htm (review material) http://schools.bcsd.com/fremont/5th_sci__matter_properties_of_matter.htm (properties of matter) http://www.chem4kids.com/files/matter_intro.html (matter all around us)	
Assessment:	Students will participate in an "Observing and Identifying matter" lab. The objects given to the students will all be very similar (e.g., cookies, baseballs, plastic eggs). The students must: ● Identify and record measurable and observational properties of the object ● Measure the mass of an object ● Measure the volume of an object Students will then mix up all of the objects and be tasked with identifying which one was their original object based off of the properties recorded. The student will then write a reflection explaining why it is important to understand and record the properties of matter.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide formulas for calculations.	N/A

Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	Students will research other properties such as conductivity, malleability, boiling/freezing point
Critical Content:	• Mass, volume, physical properties, observational, measurable, matter, odor	
Key Skills:	• Understanding and identifying that all matter has properties that can be observational or measurable	
Critical Language:	Identify, measure, record, mass, volume, physical properties, observational, measurable, matter, odor	

Learning Experience # 7		
The teacher may provide the students with an opportunity to create non-Newtonian substances (such as Oobleck) so that students can identify the properties and characteristics of matter.		
Generalization Connection(s):	Structure of matter creates predictable patterns in the universe. (SC09-GR.6-S.1.GLE.1-EO.b,c) The arrangement of atoms in matter defines the density of matter. (SC09-GR.6-S.1-GLE. 3-EO.c,d)	
Teacher Resources:	http://www.clayton.k12.mo.us/cms/lib/MO01000419/Centricity/Domain/206/Oobleck%20Lab.pdf (Oobleck lab) http://www.instructables.com/id/How-To%3A-Make-Non-Newtonian-Fluid-%26-Experiment-wit/ (how to make a Non-Newtonian fluid) http://sciencelearn.org.nz/Science-Stories/Strange-Liquids/Sci-Media/Video/Oobleck (video on Oobleck) http://www.ge.com/press/scienceworkshop/docs/pdf/Non_Newtonian_Fluid_with_Standards.pdf (lab idea)	
Student Resources:	http://antoine.frostburg.edu/chem/senese/101/liquids/faq/non-newtonian.shtml (what is a non-Newtonian fluid) https://www.youtube.com/watch?v=3zoTKXXNQIU (non-Newtonian fluid in action) https://www.youtube.com/watch?t=24&v=Lb9kt1z3jAA (Video of Oobleck) http://real-science.ifs.hr/wiki/Non-Newtonian_fluids (what is a non-Newtonian substance?) https://www.youtube.com/watch?v=f2XQ97XHjVw (pool filled with non-Newtonian fluids)	
Assessment:	Students will make a non-Newtonian substance and describe the properties that identify it as either a solid, a liquid or a gas.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide students with research material to extend their learning about other non-Newtonian substances.	The student may compare the substance that they created to other substances that are classified as non-Newtonian.

Critical Content:	• Particle arrangement • Solid • Liquid • Gas • Properties of matter • Characteristics of matter
Key Skills:	• Following directions • Describing a substance • Identifying characteristics
Critical Language:	Solid, liquid, gas, non-Newtonian, particle arrangement

Learning Experience # 8		
The teacher may provide the students with various opportunities to model the particle arrangements of matter so that the students can illustrate how the particles are arranged in a solid, liquid, and a gas.		
Generalization Connection(s):	Structure of matter creates predictable patterns in the universe. (SC09-GR.6-S.1.GLE.1-EO.b,c) The arrangement of atoms in matter defines the density of matter. (SC09-GR.6-S.1-GLE. 3-EO.c,d)	
Teacher Resources:	http://betterlesson.com/lesson/reflection/17098/kinesthetic-connection-to-the-lesson (shows videos of students acting out the states of matter) http://tinyurl.com/pzw63b2 (Power Point on particle arrangements) http://www.cpalms.org/Public/PreviewResource/Preview/18949 (lesson plan for teaching particle arrangement of matter) https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/liquids-and-solids-11/kinetic-molecular-theory-of-matter-83/the-kinetic-molecular-theory-of-matter-371-1529/ (movement of particles)	
Student Resources:	http://tinyurl.com/qb2tbb7 (pictures of particle arrangements) https://www.youtube.com/watch?v=v12xG80KcZw (video on particle arrangement) https://phet.colorado.edu/en/simulation/states-of-matter (states of matter)	
Assessment:	Students will illustrate the particle arrangements of the three states of matter by comparing them to everyday experiences (e.g., gas is like people swimming in the ocean, liquid is like kids in the hallway during passing period, and a solid is like spectators at a football game).	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	N/A

Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	The student may provide a written explanation as to the relationship between the particle arrangement and their analogy.
Critical Content:	• Particles • Molecules • Bonding • Atoms	
Key Skills:	• Relating concepts to life experiences	
Critical Language:	Molecules, particles, vibration, flow, fluidity, bonding	

Learning Experience # 9	
The teacher may provide various lab-based learning experiences so that students can convey the importance of patterns in science in relation to the organization of the periodic table.	
Generalization Connection(s):	Relationships between atoms and molecules determine the complexity and properties of matter
Teacher Resources:	http://www.chem4kids.com/files/elem_pertable.html (information) http://www.scientificamerican.com/article/the-evolution-of-the-periodic-system/ (Information about the history of the periodic table) http://www.ptable.com/ (Interactive periodic table) https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CCYQFjABahUKEwil9O_Yh-DGAhVYGpIKHcH-D6w&url=http%3A%2F%2Fwww.collaborativelearning.org%2Fperiodictable.pdf&ei=UtqnVaWDOdi0yATB_b_gCg&usg=AFQjCNEIhA4rkrYB3wFfD8MkzW2TsaurZQ&sig2=mdqdqFAyYPWFiTwjYei29Q (resource for Extension activity)
Student Resources:	http://www.chem4kids.com/files/elem_pertable.html (Study resources for students) http://chemwiki.ucdavis.edu/Inorganic_Chemistry/Descriptive_Chemistry/Periodic_Trends_of_Elemental_Properties/Table_Basics (Resources/Study opportunities) http://www.ptable.com/ (interactive periodic table) file:///C:/Users/presenter/Downloads/4.2_student.pdf (organizing the periodic table)
Assessment:	Students will receive a bag that has a variety of random materials in it. Students will then ● Sort and organize the items in a way(s) they deem logical ● Defend their reasoning as to why they sorted the items the way(s) that they did. ● Continue to sort and organize the materials in various ways until a time limit has been reached. Students will then discuss which organizational strategies worked best and the importance of organization. Students will then reflect and brainstorm ideas of how and why the periodic table is organized.

Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide the student with different categories to sort the materials into.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may challenge the students to see how many different groups they can sort the materials into that include specific categories (e.g., color that has decreasing gradients).	The students may sort the materials using sub groupings for each category.
Critical Content:	• Periodic table • Elements • History of the developments of the first periodic tables	
Key Skills:	• Defending their reasoning • Sorting • Organizing	
Critical Language:	Periodic table, organize, sort, elements,	

Learning Experience # 10	
The teacher may provide a brief history and examples of a Bohr's model referring to particular elements so that students can create a Bohr's model of various elements on the periodic table in order to understand their atomic structure.	
Generalization Connection(s):	Relationships between atoms and molecules determine the complexity and properties of matter
Teacher Resources:	http://www.exo.net/~emuller/activities/M%20and%20M%20Atom%20Model.pdf (good outline for Bohr's model) https://phet.colorado.edu/en/simulation/build-an-atom ("Build an atom" simulation and teacher made activities) http://www.projectsharetexas.org/sites/default/files/resources/documents/EvolutionOfAtomicModel.pdf (history of an atom) http://www.ptable.com/ (interactive periodic table)
Student Resources:	https://phet.colorado.edu/en/simulation/build-an-atom ("Build an atom" simulation) http://www.projectsharetexas.org/sites/default/files/resources/documents/EvolutionOfAtomicModel.pdf (history of an atom) http://www.ptable.com/ (interactive periodic table)
Assessment:	Student will create a Bohr's model for a provided element, labeling the protons, neutrons, and electrons.

Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide formula for calculations. The teacher may provide list of simple elements to choose from. The teacher may provide an outline of Bohr's model to the students.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	N/A
Critical Content:	• Valence electrons • Electrons • Protons • Neutrons • Niels Bohr • Element • Periodic table of elements	
Key Skills:	• Build a Bohr's model of an element	
Critical Language:	Valence electrons, electrons, protons, neutrons, Niels Bohr, element, periodic table of elements	

Learning Experience # 11	
The teacher may provide students with an opportunity to chemically change a compound into an element so that students can recognize that compounds are made by combining elements.	
Generalization Connection(s):	Relationships between atoms and molecules determine the complexity and properties of matter
Teacher Resources:	https://www.youtube.com/watch?v=mvdBhLYFLC0 (video of the lab) https://www.flinnsci.com/media/622135/95000.pdf (written lab directions) https://elements-of-chemistry.wikispaces.com/file/view/Lab+Conclusion+Example.pdf (conclusion example) https://sites.google.com/a/hightechhigh.org/lizzyiscool/10th-grade/chemistry-math2/copper-aluminum-lab (lab directions) https://sites.google.com/a/hightechhigh.org/davidbleshenski/10th-grade-2/math-chemistry/copper-and-aluminum-lab (discussion with equations) http://colemangenchem.weebly.com/uploads/5/2/0/3/5203353/aluminum_and_copper_chloride_lab.pdf (student worksheet)
Student Resources:	https://www.youtube.com/watch?v=mvdBhLYFLC0 (video of the lab) https://elements-of-chemistry.wikispaces.com/file/view/Lab+Conclusion+Example.pdf (conclusion example) https://sites.google.com/a/hightechhigh.org/davidbleshenski/10th-grade-2/math-chemistry/copper-and-aluminum-lab (discussion with equations)

<table>
<tr><td>Assessment:</td><td colspan="2">The students will dissolve Copper Chloride (compound) in water and then add aluminum (element) to the solution. They will then record all of the property changes that the materials will undergo during the experiment. In the end the student will examine how the compound (Copper Chloride) was changed into an element (Copper) and the element (aluminum) has combined to make a compound (aluminum chloride). The students will explain in their lab conclusion how the particle arrangement of atoms determines the arrangement of molecules.</td></tr>
<tr><td rowspan="2">Differentiation:
(Multiple means for students to access content and multiple modes for student to express understanding.)</td><td>Access (Resources and/or Process)</td><td>Expression (Products and/or Performance)</td></tr>
<tr><td>The teacher will provide additional support during the experimentation in order to guide students to the understanding of the double replacement reaction.

The teacher may guide the students in writing a lab conclusion by providing them with specific words that must be included and explained.</td><td>Student may complete written lab format using pictures to illustrate the chemical equation.</td></tr>
<tr><td rowspan="2">Extensions for depth and complexity:</td><td>Access (Resources and/or Process)</td><td>Expression (Products and/or Performance)</td></tr>
<tr><td>The teacher may guide the students in writing a chemical equation for the experiment.</td><td>The students will write a balanced chemical equation for the experiment.</td></tr>
<tr><td>Critical Content:</td><td colspan="2">• Atoms combine to make molecules
• Elements combine to make molecules</td></tr>
<tr><td>Key Skills:</td><td colspan="2">• Lab safety
• Observation skills
• Proper lab procedure
• How to write a lab conclusion</td></tr>
<tr><td>Critical Language:</td><td colspan="2">Compound, element, atom, molecule</td></tr>
</table>