

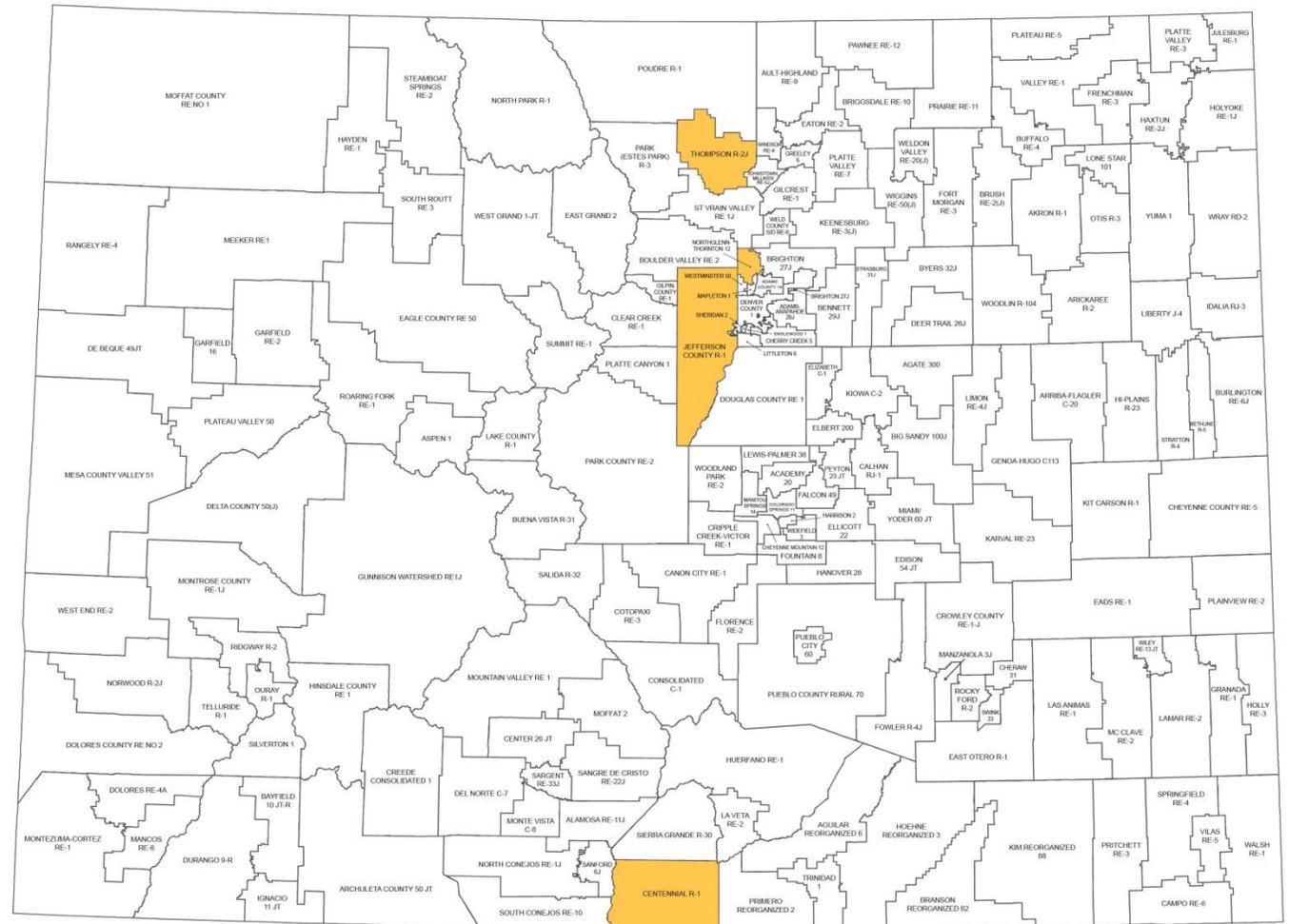
Unit Title: Matter Responds to Energy

INSTRUCTIONAL UNIT AUTHORS

Thompson School District
Melissa Perricone
Sarah Smith
Chastity Stringer
Jen Varrella

BASED ON A CURRICULUM OVERVIEW SAMPLE AUTHORED BY

Adams Five Star School District
Rustie Robison
Centennial School District
Gilbert Apodaca
Jefferson County School District
Dawn Jones

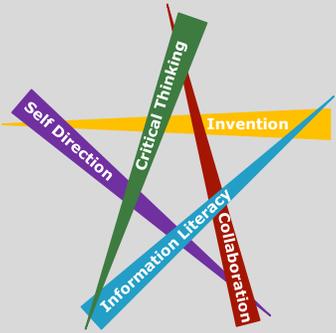


This unit was authored by a team of Colorado educators. The template provided one example of unit design that enabled teacher-authors to organize possible learning experiences, resources, differentiation, and assessments. The unit is intended to support teachers, schools, and districts as they make their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

Colorado Teacher-Authored Sample Instructional Unit

Content Area	Science	Grade Level	8 th Grade
Course Name/Course Code			
Standard	Grade Level Expectations (GLE)	GLE Code	
1. Physical Science	1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion	SC09-GR.8-S.1-GLE.1	
	2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved	SC09-GR.8-S.1-GLE.2	
	3. Distinguish between physical and chemical changes, noting that mass is conserved during any change	SC09-GR.8-S.1-GLE.3	
	4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties	SC09-GR.8-S.1-GLE.4	
2. Life Science	1. Human activities can deliberately or inadvertently alter ecosystems and their resiliency	SC09-GR.8-S.2-GLE.1	
	2. Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation	SC09-GR.8-S.2-GLE.2	
3. Earth Systems Science	1. Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the sun, and can be predicted and described through complex models	SC09-GR.8-S.3-GLE.1	
	2. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location	SC09-GR.8-S.3-GLE.2	
	3. The solar system is comprised of various objects that orbit the Sun and are classified based on their characteristics	SC09-GR.8-S.3-GLE.3	
	4. The relative positions and motions of Earth, Moon, and Sun can be used to explain observable effects such as seasons, eclipses, and Moon phases	SC09-GR.8-S.3-GLE.4	

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
Matter Responds to Energy	7-9 weeks	4

Colorado Teacher-Authored Sample Instructional Unit

Unit Title	Matter Responds to Energy		Length of Unit	7-9 weeks
Focusing Lens(es)	Interdependence Change	Standards and Grade Level Expectations Addressed in this Unit	SC09-GR.8-S.1-GLE.1 SC09-GR.8-S.1-GLE.3 SC09-GR.8-S.2-GLE.1 MA09-GR.8-S.2-GLE.3	
Inquiry Questions (Engaging-Debatable):	<ul style="list-style-type: none"> • How can matter change energy? • Would a world with only physical changes (versus chemical change) differ from Earth? • Would life be easier or harder if mass was not conserved? (SC09-GR.8-S.1-GLE.3; IQ.3) • Do humans have a unique responsibility to the ecosystems in which they live? (SC09-GR.8-S.2-GLE1; IQ.1) 			
Unit Strands	Physical Science, Life Science, RWL – Oral Expression and Listening, RWL – Reading for All Purposes; RWL – Writing and Composition, RWL – Research and Reasoning, Math –Patterns, Functions, and Algebraic Structures, Math – Data Analysis, Statistics, and Probability			
Concepts	Change, Energy/Matter, Conservation, Ecosystem, Models, Force, Motion, Mass			

Generalizations My students will Understand that...	Guiding Questions	
	Factual	Conceptual
Functions, words, tables, and graphs facilitate the modeling of relationships between forces and motion. (SC09-GR.8-S.1-GLE.1-EO.a,b,c) and (SC09-GR.8-S1-GLE1; N1)	What relationships exist among force, mass, speed, and acceleration. (SC09-Gr.8-S.1-GLE.1-EO.a) How do speed and acceleration related to net force? (SC09-Gr.8-S.1-GLE.1-EO.a)	How do engineers take forces into account when designing moving objects, such as roller coasters and rockets? (SC09-Gr.8-S.1-GLE.1; RA.1, 2) How are energy and force related?
Energy can rearrange matter through chemical changes. (SC09-Gr.8-S.1-GLE.3-EO.a)	What indicates a chemical change is occurring?	How do products of chemical changes compare to reactants?
Physical and chemical changes (despite their different properties) conserve mass. (SC09-Gr.8-S.1-GLE.3-EO.a, c, d)	What indicates a physical change is occurring? (SC09-Gr.8-S.1-GLE.3-EO.a) What evidence can show whether mass has been conserved after a chemical or physical change? (SC09-Gr.8-S.1-GLE.3-EO.b,c,d; IQ.2,3)	What evidence can indicate whether a change is physical or chemical? (SC09-Gr.8-S.1-GLE.3; IQ.1) Why are physical and chemical changes necessary? (SC09-Gr.8-S.1-GLE.3-EO.a,b) What does conservation mean within the context of physical and chemical change? (SC09-Gr.8-S.1-GLE.3-EO.b,c,d; IQ.2,3)
Different ideas about how human activity changes ecosystems impacts conservation efforts within communities. (SC09-Gr.8-S.2-GLE.1-EO.a, b, c, d, e; RA 1)	What human activities impact ecosystems?	How can human activities affect local ecosystems? (SC09-Gr.8-S.2-GLE.1-EO.b, d, e; RA 1) How can bias influence explanations about human impact on ecosystems? (SC09-Gr.8-S.2-GLE.1-EO.c)

Colorado Teacher-Authored Sample Instructional Unit

Critical Content: My students will Know...	Key Skills: My students will be able to (Do)...
<ul style="list-style-type: none"> • The relationship between speed and acceleration as net forces acting on the object. (SC09-Gr.8-S.1-GLE.1-EO.a, b, c) • The current understanding of forces and how they have changed over time as we refine understanding through scientific investigations and advances in data collection. (SC09-Gr.8-S.1-GLE.1; N.1) • Similarities and distinctive characteristics of physical and chemical changes. (SC09-Gr.8-S.1-GLE.3-EO.a) • How and why mass is conserved in physical and chemical changes. (SC09-Gr.8-S.1-GLE.3-EO.c,d) • The (potential) impacts of human activity on ecosystems. (SC09-Gr.8-S.2-GLE.1-EO.a, b, d; RA.1) • Functions (as rules) assign each input exactly one output. (SC09-Gr.8-S.2-GLE.3-EO.a) • The relationships between appropriate levels of detail in research and the ability of other scientists to reproduce a result. (SC09-Gr.8-S.1-GLE.3; N.1) 	<ul style="list-style-type: none"> • Predict and evaluate movement of objects by examining forces acting on it. (SC09-Gr.8-S.1-GLE.1-EO.a) • Use mathematical expressions to describe the movement of objects. (SC09-Gr.8-S.1-GLE.1-EO.b) • Develop and design investigations to answer questions about speed, acceleration, and motion. (SC09-Gr.8-S.1-GLE.1-EO.b; N.2) • Evaluate the reproducibility of an experiment. (SC09-Gr.8-S.1-GLE.3; N.1) • Gather, analyze, and interpret data that show mass is conserved in a given chemical or physical change. (SC09-Gr.8-S.1-GLE.3-EO.c,d) • Critically evaluate scientific claims in popular media and peer-generated explanations regarding interactions in ecosystems, and determine if the evidence presented is appropriate and sufficient to support the claims. (SC09-Gr.8-S.2-GLE.1; N.1) • Recognize and infer bias in print and digital resources while researching an environmental issue. (SC09-Gr.8-S.2-GLE.1-EO.c) • Solve a function through a table, graph, or equation. (MA09-Gr.8-S.2-GLE.3-EO.a.i)

<p>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: <i>“Mark Twain exposes the hypocrisy of slavery through the use of satire.”</i></p>	
<p>A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):</p>	<p><i>Energy can move or change matter, but not create or destroy it.</i> <i>Matter can change its form or composition by physical or chemical change.</i> <i>Human activities change ecosystems in different ways.</i> <i>People disagree about evidence concerning human impacts on the environment.</i></p>
<p>Academic Vocabulary:</p>	<p>similar, different, formula, model, equation, balanced equation, scientific law, bias, inquiry, investigation, develop, communicate, infer, solve, expressions, critically, reproducibility, evaluate, experimental, examine</p>
<p>Technical Vocabulary:</p>	<p>force, balanced force, unbalanced force, net force, speed, acceleration, mass, distance, velocity, position, states of matter, phase changes, temperature, freeze, thaw, evaporate, condense, chemical bonds, atom, molecule, Law of Conservation of Mass, reactant, product, kilogram</p>

Colorado Teacher-Authored Sample Instructional Unit

Unit Description:	This unit illustrates the interconnectedness of energy concepts throughout earth, life, and physical sciences which include matter changing into different states based on energy. Beginning with the different forms of energy, across the unit students investigate how energy transfers through chemical and physical changes to generate electricity, different sources of energy have their own unique impacts on the environment, and how force and motion are impacted by the energy of an object or substance. The unit culminates in a performance assessment that asks students to develop, construct and defend a hydroelectric power plant site.
Considerations:	Energy is the overarching theme within the unit. The performance assessment addresses this theme and combines together information from the various unit generalizations. The authors of this unit decided that while connected, the generalizations needed a unifying generalization around energy. Therefore, a new generalization was written to bring together the major concepts of the unit.
Unit Generalizations	
Key Generalization:	Changes to a system (closed or open), motion, or matter is dependent upon the amount and form of energy used/transformed
Supporting Generalizations:	Energy can rearrange matter through chemical changes
	Different ideas about how human activity changes ecosystems impacts conservation efforts within communities
	Physical and chemical changes (despite their different properties) conserve mass
	Functions, words, tables, and graphs facilitate the modeling of relationships between forces and motion

Performance Assessment: <i>The capstone/summative assessment for this unit.</i>							
Claims: (Key generalization(s) to be mastered and demonstrated through the capstone assessment.)	Changes to a system (closed or open), motion, or matter is dependent upon the amount and form of energy used/transformed.						
Stimulus Material: (Engaging scenario that includes role, audience, goal/outcome and explicitly connects the key generalization)	You have been assigned to the Colorado Energy Task Force to determine which site to develop and construct a hydroelectric power plant. You must draw upon your conceptual understanding of matter and motion and how energy is used or transformed. You will create a report for your local government recommending one of the proposed sites for the development of a hydroelectric power plant. You must include evidence on energy efficiency by looking at the gravitational potential energy of both sites and how energy was transformed. The report should also include justification for your selected site based on environmental, social and economic impacts. Be sure you provide evidence supporting your selected proposed site as well as acknowledging counter claims of why it should not be the other proposed site.						
	Proposed Sites:						
	<table border="1" style="width: 100%;"> <tr> <td style="width: 15%;">State</td> <td>Colorado</td> </tr> <tr> <td>Facts</td> <td>The proposed site is located about 25 miles upstream from the nearest city, which has a population of 205,000 people. The surrounding area is predominantly farmland. Each farm occupies approximately 800 acres.</td> </tr> <tr> <td>Plant Type</td> <td>Pump Storage</td> </tr> </table>	State	Colorado	Facts	The proposed site is located about 25 miles upstream from the nearest city, which has a population of 205,000 people. The surrounding area is predominantly farmland. Each farm occupies approximately 800 acres.	Plant Type	Pump Storage
	State	Colorado					
Facts	The proposed site is located about 25 miles upstream from the nearest city, which has a population of 205,000 people. The surrounding area is predominantly farmland. Each farm occupies approximately 800 acres.						
Plant Type	Pump Storage						

Colorado Teacher-Authored Sample Instructional Unit

Estimated Power Output	200,000 kW
Waterfall Height	448 ft
Purposed Cost to Build	\$2,000 per kilowatt (kW) to construct
Recreation Use	The Forest Service plans to develop recreation facilities, which will include: campgrounds, a boat dock, trails, fishing areas and swimming beach. It is projected that 90,000 visitors per year will use the created reservoir area.
Changes in Land Use	Construction of this site would require the flooding of 2,000 acres of farmland to create the reservoir for the hydropower plant. Flooding farmland could have other impacts on the town's agricultural industry.

State	Colorado
Facts	The proposal is to dam a river about seven miles from the nearest city, which has a population of 50,000 people. The surrounding area is predominantly urban and is surrounded by mountains. The city's primary industries are tourism and recreation including whitewater rafting tours and fly fishing trips on the river.
Plant Type	Reversible Pump
Estimated Power Output	140,000 kW
Waterfall Height	305 ft
Purposed Cost to Build	\$1,000 per kilowatt (kW) to construct
Recreation Use	The Forest Service plans to develop recreation facilities, which will include: campgrounds, lure fishing areas and a small swimming beach. It is projected that 20,000 visitors per year will use the created reservoir area.
Changes in Land Use	An area of 200 acres of the natural area around the river would be flooded to create the reservoir. Damming this river could have other impacts on fish and wildlife.

These sites are not real; however they are based on real data.

Product/Evidence:
(Expected product from students)

Students will create a report to their local government (city council, county commissioner or zoning board) recommending one of the proposed sites for the development of a hydroelectric power plant. They must include evidence on energy efficiency (gravitational potential energy and kinetic energy i.e. the height of the dam) of their selected site as well as rational/justification for their site based on environmental impacts (impact on habitat, carbon footprint, etc.), social impacts (flooding, irrigation, recreation, fishing, etc.) and economic impacts (loss of recreational funds, impact on agriculture, other development opportunities). They must provide evidence supporting their proposed site as well as acknowledging counter claims (why it should not be the other proposed site).

Colorado Teacher-Authored Sample Instructional Unit

Differentiation: (Multiple modes for student expression)	<ul style="list-style-type: none"> The teacher may incorporate accommodations/modifications of 504 plans and IEP’s such as extended time, use of graphic organizers for writing assignments, oral presentations, etc. The teacher may scaffold the report using graphic organizers The teacher may provide opportunity to present report in an alternative form The teacher may vary the amount of evidence required in each type of impact <ul style="list-style-type: none"> To extend this work, students will find and propose a location on their own where they must research energy efficiency and all impacts on their own (not given).
--	--

Texts for independent reading or for class read aloud to support the content	
Informational/Non-Fiction	Fiction
<i>What Einstein Told His Barber</i> and <i>What Einstein Didn’t Know</i> – Robert L. Wolke [lexile level 1150-1220] <i>Ferguson’s Careers in Focus: Energy</i> – Ferguson [lexile level 1150-1220] <i>E=mc²</i> by David Bodanis [lexile level 1170] <i>Exploring Energy</i> – Scholastic Books, Gallimard Jeunesse (1995) [lexile level 1150-1220] <i>Out of Gas – The End of the Oil Age</i> – David Goodstein (2005) [lexile level 1150-1220]	<i>My Light</i> – Molly G. Bang [lexile level 690]

Ongoing Discipline-Specific Learning Experiences				
1.	Description:	Thinking like a Scientist: Scientific method and experimentation	Teacher Resources:	http://www.brainpopjr.com/science/scienceskills/scientificmethod/grownups.weml (Near middle of page teacher resources page with activities) http://undsci.berkeley.edu/teaching/misconceptions.php (A list of common misconceptions about the nature of science) http://undsci.berkeley.edu/teaching/ (Tips for introducing and teaching scientific method and experimentation) http://www.livescience.com/6727-invisible-gorilla-test-shows-notice.html (Video in which most people fail to observe large “gorilla” moving across room) http://www.shodor.org/succeed-1.0/forensic/teacher/lessons/observation.html (Lesson plan devoted to developing observation skills) http://blogs.loc.gov/teachers/2011/06/look-again-challenging-students-to-develop-close-observation-skills/ (Library of Congress brief of tools for helping students develop observation skills)
			Student Resources:	http://www.brainpopjr.com/science/scienceskills/scientificmethod/grownups.weml (At top of page student link for movie and activities about scientific method) http://www.glencoe.com/sites/common_assets/science/virtual_labs/E16/E16.html (Virtual lab to practice use of scientific method and experimentation) http://www.brainpop.com/science/scientificinquiry/scientificmethod/preview.weml (Movie

Colorado Teacher-Authored Sample Instructional Unit

				and quiz for scientific method/inquiry) http://lifehacker.com/5960811/how-to-develop-sherlock-holmes-like-powers-of-observation-and-deduction (Explanation of tools to increase observation skills with hook related to Sherlock Holmes)
	Skills:	Write a scientifically valid question to be answered in an experiment Design an experiment that controls for independent and dependent variables Analyze experimental results with respect to their support of the hypothesis Identify possible sources of error Design models Analyze relationships Make predictions and infer Critique research methodology of scientists or other students Make predictions based on trends	Assessment:	The student will be assessed within the learning experiences
2.	Description:	Working like a scientist: Collect, organize, and use proper units for data	Teacher Resources:	https://drive.google.com/templates# (Google Drive templates) http://www.mathgoodies.com/lessons/toc_vol11.html (Students learn how develop data collection and create graph)
			Student Resources:	https://drive.google.com/templates# (Variety of different templates to capture data and create a spreadsheet) http://nces.ed.gov/nceskids/createagraph/ (Students able to create a diverse range of graphs)
	Skills:	Identify independent and dependent variable in experiment Identify what data needs to be collected Set up appropriate data table Recognize sources of error in data collection Energy conversions	Assessment:	Students will set up their own data table in order to identify the dependent and independent variables. Students will analyze data collected and recognize outliers.
3.	Description:	Communicating like a scientist: Analytical reading and technical writing	Teacher Resources:	http://www.phschool.com/eteach/language_arts/2002_12/essay.html (Strategies to help develop reading comprehension skills) http://www.readingrockets.org/article/3479/ (7 tips with resources to help students' reading comprehension)

Colorado Teacher-Authored Sample Instructional Unit

		Student Resources:	http://www.brainpop.com/english/studyandreadingskills/readingskills/ (Reading comprehension movie and quiz) http://www.brainpop.com/english/writing/mainidea/ (Main idea movie and quiz) http://www.brainpop.com/math/dataanalysis/graphs/preview.weml (Analyzing graphs movie and quiz)
Skills:	Comprehension of academic vocabulary Identify key points and themes Identify faults in research methods, logic, and statistical findings Scrutinize credibility of sources Evaluating bias Evaluating scientific claims	Assessment:	The student will be assessed within the learning experiences

Prior Knowledge and Experiences

Students must have an understanding of basic measurement, ecosystem relationships, graphing, and the concepts of variables, compounds, and atomic structure.

Vertical Articulation: Students have last seen concepts related to this unit in 7th-PK.

Learning Experiences # 1 – 4 Instructional Timeframe: Weeks 1-3

Learning Experience # 1

The teacher may provide interactive examples of the different states of matter so that students can observe and determine how energy is involved in changing states.

Generalization Connection(s):

Physical and chemical changes (despite their different properties) conserve mass

Teacher Resources:

<http://phet.colorado.edu/en/simulation/states-of-matter-basics> (virtual simulation of particles when manipulating heat and pressure)
<http://www.goorulearning.org/#resource-search&query=states+of+matter&category=all&pageNum=1&pageSize=8> (includes brain pop worksheet, videos, Khan academy demo and video)

Student Resources:

<http://phet.colorado.edu/en/simulation/states-of-matter-basics>

Assessment:

Students will complete a ticket out the door that describes the role of energy and its effects of states of matter.

http://exitticket.org/?gclid=CMKZt6Xsir0CFQ5qfgod_YEAFw (Online exit tickets)

Colorado Teacher-Authored Sample Instructional Unit

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 real life visual examples for students to make connections. http://phet.colorado.edu/en/simulation/states-of-matter-basics (Virtual simulation of particles when manipulating heat and pressure) The teacher may provide extended time on assignments and assessments	The student may present information verbally The student may use graphic organizers or label pictures as assessment
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may allow for in-depth discovery of plasma or man-made states of matter such as Bose-Einstein Condensate	The student may generate an informative product (brochure, prezi, etc.) to present to the class or as a substitute to the assessment
Critical Content:	<ul style="list-style-type: none"> • What is energy? • What are the states of matter? • Structure of Matter • How does energy affect states of matter? 	
Key Skills:	<ul style="list-style-type: none"> • Observation and Inference Skills • Basic Laboratory Skills 	
Critical Language:	Matter, solid, liquid, gas, plasma, energy, change in state, observe, infer, describe	

Learning Experience # 2		
The teacher may model physical and chemical change so that students can explore and explain the differences between a physical and chemical change, including evidence of each type of change (e.g., change in state lab, using substances such as cornstarch, baking soda, sugar, and baking powder to see how they react with water, vinegar and iodine to determine physical and chemical changes).		
Generalization Connection(s):	Physical and chemical changes (despite their different properties) conserve mass Energy can rearrange matter through chemical changes	
Teacher Resources:	http://www.goorulearning.org/#resource-search&category=Video%252CInteractive%252CHandout&query=physical+chemical+changes&pageSize=8&pageNum=1 (Videos, interactive sites and handouts for physical and chemical changes, flashcards of physical and chemical changes) http://www.brainpop.com/educators/community/bp-jr-topic/physical-and-chemical-changes/ (Brain pop lesson ideas and handouts); www.discoveryeducation.com (full videos, video clips, hands on activities, interactive labs though Science Tech book) http://www.learner.org/courses/essential/physicalsci/about/index.html (Includes unit plan, interactive labs, videos) http://www.learningscience.org/psc2apropchangmatter.htm (Interactive web lessons)	

Colorado Teacher-Authored Sample Instructional Unit

Student Resources:	http://www.goorulearning.org/#resource-play&id=22e35e0c-1e67-4313-a320-c405e5c3c846&pn=resource (Flash cards for student review)	
Assessment:	<p>The students will explain the differences between physical and chemical changes by producing a explanatory product as determined by the teacher (i.e., iMovie, Lab Report, Graphs, Mini Quiz)</p> <p>And/or</p> <p>The student will use a graphic organizer to compare and contrast physical and chemical changes.</p> <p>http://www.eisd.net/cms/lib04/TX01001208/Centricity/Domain/599/DoubleBubbleMap.pdf (Thinking map for comparing and contrasting)</p> <p>http://www.edhelper.com/teachers/General_graphic_organizers.htm (Printable graphic organizers)</p>	
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)
	<p>The teacher may provide cloze notes, videos and or photographs that build background knowledge of change prior to introducing physical and chemical changes</p> <p>The teacher may provide extended time on assignments and assessments</p> <p>The teacher may allow students to utilize pictures and diagrams for labeling</p>	<p>The student may use graphic organizers (Venn diagrams or T charts) to organize thoughts and ideas and show similarities and differences between physical and chemical changes</p> <p>The student may create a model demonstrating the difference between physical and chemical changes (model must include labels)</p>
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may allow discovery of physical and chemical changes is inquiry based with limited process directions	The student may complete an inquiry lab write-up detailing their results
Critical Content:	<ul style="list-style-type: none"> • Signs of chemical and physical changes • Differences between chemical and physical changes 	
Key Skills:	<ul style="list-style-type: none"> • Identifying evidence of physical and chemical changes 	
Critical Language:	Physical change, chemical change, freezing, melting, boiling, evaporation, condensation, sublimation, endothermic, exothermic, composition, identify, explain, explore	

Learning Experience # 3	
The teacher may provide opportunities to discuss and investigate the Law of Conservation of Mass so that the students can recognize that mass is conserved in chemical and physical changes of matter (e.g., close reading discussion or laboratory experiment).	
Generalization Connection(s):	<p>Physical and chemical changes (despite their different properties) conserve mass</p> <p>Energy can rearrange matter through chemical changes</p> <p>Different ideas about how human activity changes ecosystems impacts conservation efforts within communities</p>

Colorado Teacher-Authored Sample Instructional Unit

Teacher Resources:	http://www.learner.org/courses/essential/physicalsci/about/index.html (Includes entire unit plan on physical and chemical changes, Session 4 includes conservation of mass/matter virtual lab) http://www.learningscience.org/psc2apropchangmatter.htm (Interactive web lessons) http://www.goorulearning.org/#resource-search&category=All&query=conservation+of+mass&pageSize=8&pageNum=1 (Videos, interactive lessons, handouts)	
Student Resources:	http://www.goorulearning.org/#resource-search&category=All&query=conservation+of+mass&pageSize=8&pageNum=1 (Videos, interactive lessons, handouts)	
Assessment:	<p>The students will explain the law of conservation of mass and its application to chemical and physical changes as well as real world impacts using the claim evidence reasoning methodology.</p> <p>http://www.docstoc.com/docs/21846889/CEI-Claim-Evidence-and-Interpretation (Claim/evidence template)</p>	
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)
	<p>The teacher may provide before and after picture or video that shows the mass before and after a physical or chemical change.</p> <p>http://www.learner.org/courses/essential/physicalsci/about/index.html (Includes entire unit plan on physical and chemical changes, Session 4 includes conservation of mass/matter virtual lab)</p> <p>The teacher may provide extended time on assignments and assessments</p>	<p>The student may utilize a virtual lab or label pictures from a lab to illustrate the conservation of mass before and after a physical or chemical change</p>
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	<p>The teacher may allow students to research and select a certain type of pollution caused by the law of conservation of mass (i.e., by products of a coal burning power plants or garbage in a land fill)</p>	<p>The student may design a plan to decrease the negative effects of that pollutant on their environment</p>
Critical Content:	<ul style="list-style-type: none"> • Law of Conservation of Mass • Matter • Physical and chemical changes 	
Key Skills:	<ul style="list-style-type: none"> • Calculate mass • Laboratory Safety • Literacy Skills 	
Critical Language:	<p>Law of conservation of mass, matter, physical and chemical change, calculate, explain, design</p>	

Learning Experiences # 4 – 6
Instructional Timeframe: Weeks 3-7

Learning Experience # 4		
The teacher may provide opportunities to investigate an object's motion so that students can explore ways to calculate speed, velocity, acceleration and momentum (e.g., Motion Lab, Calculation Practice Sheet, Inquiry Design Lab).		
Generalization Connection(s):	Functions, words, tables, and graphs facilitate the modeling of relationships between forces and motion Different ideas about how human activity changes ecosystems impacts conservation efforts within communities	
Teacher Resources:	http://phet.colorado.edu/en/simulations/category/physics/motion (Variety of motion simulations and interactive activities) http://www.goorulearning.org/#resource-search&query=motion&category=all&pageNum=1&pageSize=8 (Interactive activities, note resources and handouts) http://sciencespot.net/Pages/classphys.html (Variety of lab activities, calculation worksheets and activities) http://www.khanacademy.org/science/physics/one-dimensional-motion (Variety of videos/tutorials for classroom use)	
Student Resources:	http://phet.colorado.edu/en/simulations/category/physics/motion (Variety of motion simulations and interactive activities)	
Assessment:	The students will record evidence of correct calculations of motion and explain the relationships among the aspects of motion in their science notebooks.	
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 graphic organizer that separates the different parts of the formula for speed, velocity and acceleration (e.g., a box for distance and a box for time to put in values while completing a lab) The teacher may provide units of each measurement for each measurement and calculation The teacher may provide videos to show differences between all measurements so students are able to conceptually understand an objects motion The teacher may purposefully group students together for labs The teacher may provide extended time on assignments and assessments	The student may verbally explain the concepts of motion
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may allow students to design their own investigation given a list of supplies (hot wheels cars, ramps, etc.). The students will have to identify their variables and conduct an experiment to calculate aspects of motion	The student may create and present a formal lab report and graph showing relationships between the aspects of motion

Colorado Teacher-Authored Sample Instructional Unit

Critical Content:	<ul style="list-style-type: none"> • What is motion? • Speed, velocity, acceleration and momentum • Measurement and calculation units
Key Skills:	<ul style="list-style-type: none"> • Calculating, speed, velocity, acceleration and momentum • Identify trends and explain relationships • Use scientific tools correctly • Laboratory Safety Skills • Graphing Skills
Critical Language:	Motion, speed, velocity, acceleration, momentum, and units of measurement (meters, seconds, etc.), calculate, identify, graph, measure

Learning Experience # 5

The teacher may provide opportunities for students to explore the different types of forces so that students can identify how forces affect matter (e.g., provide demonstrations and inquiry activities to identify forces).

Generalization Connection(s):	Functions, words, tables, and graphs facilitate the modeling of relationships between forces and motion Different ideas about how human activity changes ecosystems impacts conservation efforts within communities	
Teacher Resources:	http://sciencespot.net/Pages/classphys.html (Variety of lab activities, calculation worksheets and activities) http://phet.colorado.edu/en/simulations/category/physics/motion (Variety of force simulations and interactive activities) http://www.khanacademy.org/science/physics/one-dimensional-motion (Variety of videos/tutorials for classroom use) http://www.goorulearning.org/#resource-search&query=forces&category=all&pageNum=1&pageSize=8 (Interactive activities, note resources and handouts)	
Student Resources:	http://phet.colorado.edu/en/simulations/category/physics/motion (Variety of force simulations and interactive activities)	
Assessment:	The students will demonstrate their understanding of forces by identifying and explaining the forces involved in a situation.	
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)
	<ul style="list-style-type: none"> The teacher may provide pictures of examples of different forces The teacher may provide cloze notes or graphic organizers for note taking The teacher may provide object that demonstrate different forces The teacher may provide extended time on assignments and assessments 	<ul style="list-style-type: none"> The student may label diagrams or pictures of different forces The student may verbally demonstrate their understanding of forces The student may act out the forces or use objects to demonstrate understanding while orally explaining

Colorado Teacher-Authored Sample Instructional Unit

Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may allow students to investigate how forces here on Earth differ from those throughout the Universe	The student may create an informative product (e.g., brochure, keynote, Prezi, etc.) to demonstrate a deeper understanding of forces in general
Critical Content:	<ul style="list-style-type: none"> • What are forces? • Friction • Gravity • Air Resistance • Balanced versus Unbalanced Forces 	
Key Skills:	<ul style="list-style-type: none"> • Calculating Force • Observing and Identifying Forces • Laboratory Safety Skills 	
Critical Language:	Balanced forces, unbalanced forces, friction, gravity, air resistance, force, observation, identification, matter, explanation	

Learning Experience # 6

The teacher may introduce Newton’s Laws of Motion through real life scenarios or case studies and provide concrete examples of each law so that students can apply these laws in unfamiliar situations.

Generalization Connection(s):	Functions, words, tables, and graphs facilitate the modeling of relationships between forces and motion Different ideas about how human activity changes ecosystems impacts conservation efforts within communities
Teacher Resources:	http://sciencespot.net/Pages/classphys.html (Variety of lab activities, calculation worksheets and activities) http://www.goorulearning.org/#resource-search&category=All&query=newton's+laws+of+motion&pageSize=8&pageNum=1 (Interactive activities, note resources and handouts) http://phet.colorado.edu/en/simulations/category/physics/motion (Variety of force simulations and interactive activities)
Student Resources:	http://phet.colorado.edu/en/simulations/category/physics/motion (Variety of force simulations and interactive activities)
Assessment:	The students will demonstrate their understanding of Newton’s laws of motion by creating their own scenarios or products to explain the impacts of Newton’s Laws of Motion (e.g., Storyboard, poster, comic book, board game, video, children’s book, demonstrations, etc.) http://www.postermywall.com/index.php/p/classroom-posters (Free classroom poster creator) http://www.printablepaper.net/category/storyboard (Storyboard graphic organizer) http://www.freetech4teachers.com/2013/04/the-five-best-tools-for-creating-videos.html (Free tech for teachers-creating videos) http://www.wikihow.com/Make-a-Flipbook (How to make a flip book) http://www.boardgame-online.com/creategame.php (How to create a board game)

Colorado Teacher-Authored Sample Instructional Unit

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 concrete examples by way of in class demonstrations, pictures, videos and virtual demonstrations to illustrate the different laws of motion The teacher may provide cloze notes or graphic organizers for note taking and organization of thoughts/definitions, The teacher may provide extended time on assignments and assessments	The student may draw (using picture and arrows) their explanation of Newton's laws as opposed to writing their learning The student may verbally present their learning of Newton's laws
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may allow students to research how Sir Isaac Newton developed his understanding of the Laws of Motion The teacher may allow students to investigate how the laws of motion differ on other planets	The student may answer the following prompt: If Sir Isaac Newton had the technology we have today, what discovery would he make and why? The student may create an informational product to inform classmates of the differences between Newton's Laws on Earth and on another Planet (based on mass and gravitational pull)
Critical Content:	<ul style="list-style-type: none"> • Newton's Laws of Motion • Inertia • Force=Mass x Acceleration • Balanced and Unbalanced Forces • Action and Reaction Forces 	
Key Skills:	<ul style="list-style-type: none"> • Calculating force • Identify and explain relationships and trends between force and motion 	
Critical Language:	Newton's laws of motion, inertia, balanced and unbalanced forces, action and reaction, force, mass, acceleration, calculate, identify, explain, relationships	

Learning Experiences # 7 – 10
Instructional Timeframe: Weeks 7-12

Learning Experience # 7	
The teacher may introduce and provide interactive examples of the different forms of energy so that students can explore, observe and generate their own thoughts and definitions of energy.	
Generalization Connection(s):	Energy can rearrange matter through chemical changes Different ideas about how human activity changes ecosystems impacts conservation efforts within communities

Colorado Teacher-Authored Sample Instructional Unit

Teacher Resources:	http://www.NEED.org (Energy activities) http://www.need.org/curriculum-guides (120 modules available for classroom use – notes, labs, activities) http://phet.colorado.edu/en/simulations/category/physics/work-energy-and-power (Variety of energy simulations and interactive activities)	
Student Resources:	http://phet.colorado.edu/en/simulations/category/physics/work-energy-and-power (Variety of energy simulations and interactive activities)	
Assessment:	The students will produce an exit ticket that describes the role of energy in a given interaction. http://exitticket.org/?gclid=CMKZt6Xsir0CFQ5qfgod_YEAFw (Online exit tickets)	
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 graphic organizers, pictures, videos, interactive websites and labs to illustrate the different forms of energy in multiple modes for all students The teacher may provide extended time on assignments and assessments	The student may express understanding through diagrams, pictures, or verbally The student may create a T chart to define different forms of energy The student may create an energy wheel and find pictures that define the forms of energy
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may allow students to investigate and describe how all forms of energy on Earth have originated from the nuclear reactions on the sun	The student may create a graphic organizer or visual (comic strip) in place of the ticket out the door
Critical Content:	<ul style="list-style-type: none"> • What is energy? • The different forms of energy (kinetic, potential, mechanical, nuclear, electrical, chemical, gravitational, thermal, radiant) 	
Key Skills:	<ul style="list-style-type: none"> • Identifying Energy Forms • Observation Skills 	
Critical Language:	Energy, kinetic, potential (gravitational potential), mechanical, nuclear, electrical, chemical, thermal, radiant, observe, identify, interaction	

Learning Experience # 8	
The teacher may provide interactive opportunities so that students can explore energy transformations so that they can begin to see how energy is conserved in all transformations (e.g., scenarios, laboratory experiments, NEED Project Science of Energy Kit).	
Generalization Connection(s):	Energy can rearrange matter through chemical changes Different ideas about how human activity changes ecosystems impacts conservation efforts within communities

Colorado Teacher-Authored Sample Instructional Unit

Teacher Resources:	http://www.NEED.org (Energy activities) http://www.need.org/curriculum-guides (120 modules available for classroom use – notes, labs, activities) http://phet.colorado.edu/en/simulations/category/physics/work-energy-and-power (Variety of energy simulations and interactive activities)	
Student Resources:	http://phet.colorado.edu/en/simulations/category/physics/work-energy-and-power (Variety of energy simulations and interactive activities)	
Assessment:	<p>The students will identify and explain the major energy transformations involved in a given scenario (e.g., solar panels, wind turbines, Dams, etc.)</p> <p>http://need.org/ (Energy resources)</p>	
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)
	<p>The teacher may provide real world examples of energy transfers through pictures, videos and other multimedia tools</p> <p>http://need.org/ (Energy resources)</p> <p>The teacher may provide extended time on assignments and assessments</p> <p>https://www.google.com/search?q=forms+of+energy&espv=210&es_sm=93&source=lnms&tbn=isch&sa=X&ei=ZWMHU7XRA4ff2AW7j4GwCg&ved=0CAkQ_AUoAQ&biw=1092&bih=533 (Forms of Energy images)</p>	<p>The student may express understanding through diagrams, pictures, or verbally</p> <p>The student may create a flow chart to show the change in energy forms through transformations</p> <p>The student may find pictures that define the forms of energy involved in energy transfers</p>
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	<p>The teacher may allow students to select an energy transformation and identify specific ways to decrease the amount of energy converted into thermal energy</p> <p>https://www.google.com/search?q=forms+of+energy&espv=210&es_sm=93&source=lnms&tbn=isch&sa=X&ei=ZWMHU7XRA4ff2AW7j4GwCg&ved=0CAkQ_AUoAQ&biw=1092&bih=533#q=transformations+of+energy&tbn=isch (Transformation of energy images)</p>	<p>The student may create a flow chart or design plan to increase energy efficiency within a system (i.e., light bulb, power plant, etc.)</p>
Critical Content:	<ul style="list-style-type: none"> • Forms of energy are involved in transformations • Conservation of Mass 	
Key Skills:	<ul style="list-style-type: none"> • Identify which forms of energy are involved in transformations • Explanation of Conservation of Mass • Laboratory Safety Skills 	
Critical Language:	Energy, transformation, law of conservation of energy, conservation of mass, explain, identify	

Colorado Teacher-Authored Sample Instructional Unit

Learning Experience # 9		
The teacher may provide opportunities for students to explore advantages and disadvantages of various renewable and nonrenewable resources so that students can draw conclusions and determine the best energy resources for their local area (e.g., The Great Energy Debate, Energy Enigma, Energy Resource Stations).		
Generalization Connection(s):	Energy can rearrange matter through chemical changes Different ideas about how human activity changes ecosystems impacts conservation efforts within communities	
Teacher Resources:	http://www.NEED.org (Energy activities) http://www.need.org/curriculum-guides (120 modules available for classroom use – notes, labs, activities) http://www.eia.gov (Up to date energy source data and research materials from the U.S. Energy Information Administration)	
Student Resources:	http://www.energy4me.org (Kid-friendly energy data and research information)	
Assessment:	The students will write a persuasive argument on which energy resource is most suitable to their community (area) including benefits and costs of the type of energy resource they recommend. http://www.readwritethink.org/files/resources/printouts/persuasion%20map.pdf (Persuasive template)	
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 background on renewable and nonrenewable energy resources to allow students to build background knowledge The teacher may use pictures, videos and other multimedia tools to explain the different renewable and nonrenewable resources http://need.org/ (National Energy Education Development Project with teacher and student resources around Energy) The teacher may provide extended time on assignments and assessments http://www.docstoc.com/docs/21846889/CEI-Claim-Evidence-and-Interpretation (Claim/evidence template)	The student may use a Claim Evidence Reasoning (CER) graphic organizer as an alternative to multi paragraph writing (as stated in the assessment) The student may verbally present assessment The student may create a T chart or other graphic organizer to show the benefits and costs for a specific energy resource The student may provide an informational poster on energy resources as opposed to an argumentative assessment
Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may develop and design a specific plan to implement their recommendation from the initial assessment (including: costs benefit analysis, levels of government needed for approval, site location, timeline of construction)	The student may create a project proposal plan around energy resources for their local community (e.g. formal write-up, oral presentation, etc.).

Colorado Teacher-Authored Sample Instructional Unit

Critical Content:	<ul style="list-style-type: none"> Renewable and Nonrenewable Resources Different types of energy resources (coal, wind energy, hydroelectric power, etc)
Key Skills:	<ul style="list-style-type: none"> Identify costs and benefits of energy resources Literacy Skills
Critical Language:	Fossil fuels, renewable and nonrenewable, energy resource, coal, natural gas, petroleum, wind energy, solar energy, hydroelectric power, nuclear, identify, design, inform

Learning Experience # 10

The teacher may facilitate the understanding of how humans impact their environment through the use of renewable and nonrenewable energy resources so that students can formulate their own opinions and conclusions in regards to environmental issues (e.g., argumentative paper, debate, Global Trading Game).

Generalization Connection(s):	Energy can rearrange matter through chemical changes Different ideas about how human activity changes ecosystems impacts conservation efforts within communities	
Teacher Resources:	http://www.NEED.org (Energy activities) http://www.need.org/curriculum-guides (120 modules available for classroom use – notes, labs, activities) http://channel.nationalgeographic.com/channel/human-footprint/consumption-interactive.html (Interactive calculator for determining energy usage, link to Human Footprint documentary through the main website) http://www.economist.com/node/1337251 (Nonfiction article for research/discussion purposes) http://newint.org/features/2000/11/05/facts/ (Nonfiction article for research/discussion purposes)	
Student Resources:	http://channel.nationalgeographic.com/channel/human-footprint/consumption-interactive.html (Interactive calculator for determining energy usage, link to Human Footprint documentary through the main website) http://www.economist.com/node/1337251 (Nonfiction article for research/discussion purposes) http://newint.org/features/2000/11/05/facts/ (Nonfiction article for research/discussion purposes)	
Assessment:	Students will create an informative poster explaining one impact of humans on their local environment. http://www.postermywall.com/index.php/p/classroom-posters (Free classroom poster creator)	
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 use pictures, videos and other multimedia tools to explain the how humans impact their environment through energy resources The teacher may provide cloze notes or graphic organizers for students to gather thoughts and ideas http://need.org/ (Energy activities) The teacher may provide extended time on assignments and assessments	N/A

Colorado Teacher-Authored Sample Instructional Unit

Extensions for depth and complexity:	Access (Resources and/or Process)	Expression (Products and/or Performance)
	The teacher may create and implement a specific plan based on the assessment task to decrease the impact human activity has on their environment	The student may create a specific plan on decreasing human impact on their environment
Critical Content:	<ul style="list-style-type: none"> • Renewable and nonrenewable energy resources • Personal Responsibility • Environmental Impact • Conservation of Mass • Conservation of Energy 	
Key Skills:	<ul style="list-style-type: none"> • Analyze issues from multiple perspectives • Formulate informed opinions and conclusions • Identify impacts of human on environment 	
Critical Language:	Environment, renewable and nonrenewable resources, conservation of mass, conservation of energy, identify, analyze, formulate, utilize, create	