Colorado Teacher-Authored Instructional Unit Sample

Science
8th Grade

Unit Title: Our Place in Space

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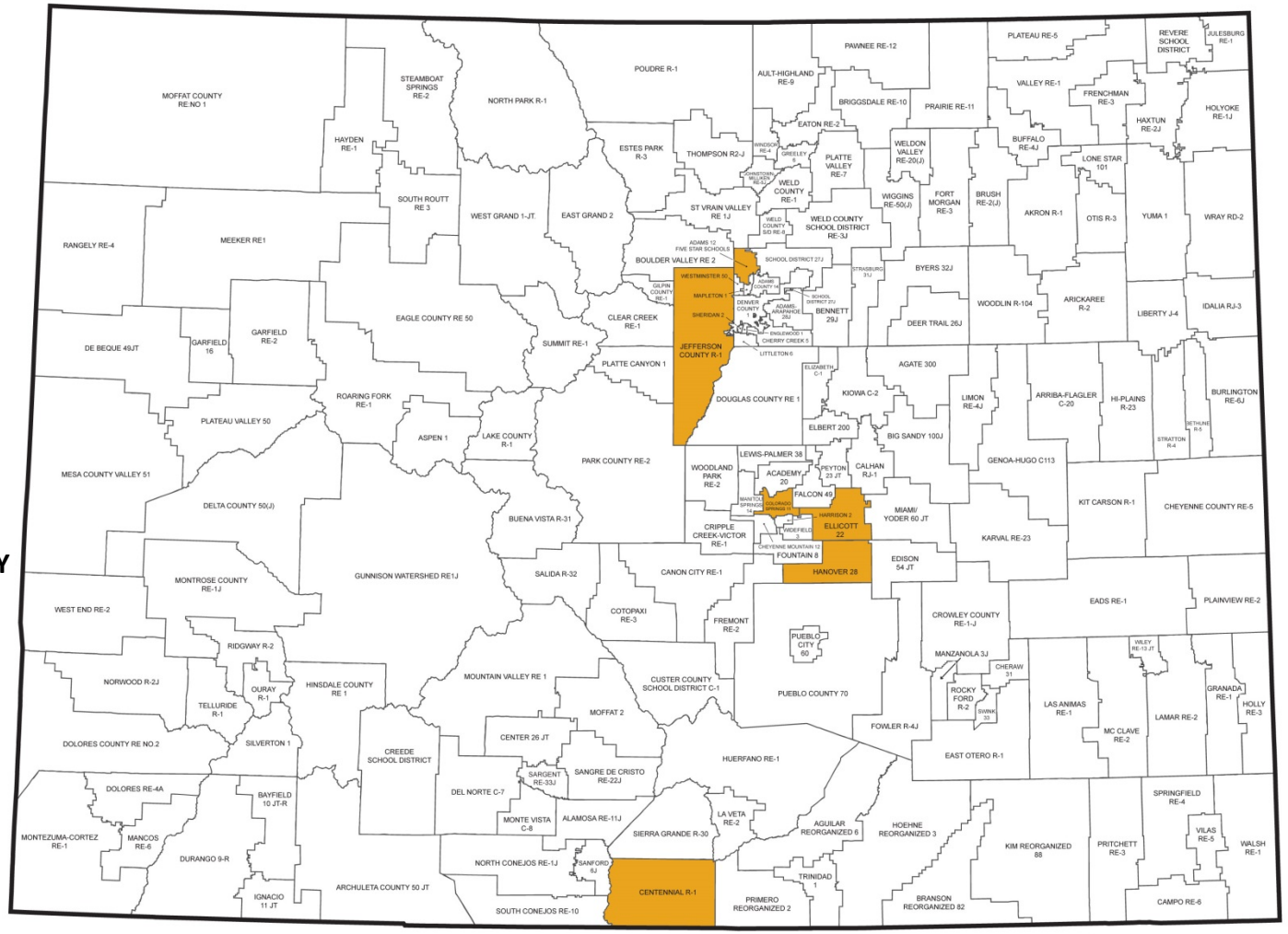

This unit was authored by a team of Colorado educators. The template provided one example of unit design that enabled teacher-authors to organize possible learning experiences, resources, differentiation, and assessments. The unit is intended to support teachers, schools, and districts as they make their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

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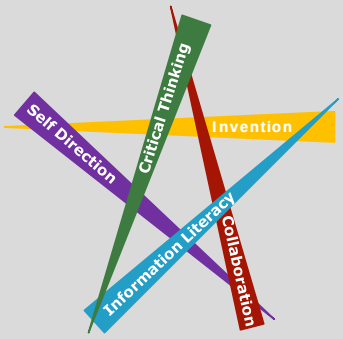
Colorado Teacher-Authored Sample Instructional Unit

Content Area	Science	Grade Level	8th 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
Our Place in Space	9-10 weeks	2

Unit Title	Our Place in Space		**Length of Unit**	9-10 weeks
Focusing Lens(es)	Systems	**Standards and Grade Level Expectations Addressed in this Unit**	SC09-GR.8-S.1-GLE.1 SC09-GR.8-S.1-GLE.2 SC09-GR.8-S.1-GLE.4 SC09-GR.8-S.3-GLE.2 SC09-GR.8-S.3-GLE.3 SC09-GR.8-S.3-GLE.4	
Inquiry Questions (Engaging-Debatable):	• How would multiple visible moons in the night sky affect the solar system? • Should more money be allocated for space exploration? • How would a different tilt of the earth affect energy consumption in Colorado?			
Unit Strands	Physical Science, Earth Science			
Concepts	Change, Scale, Organization, Energy/Matter, Models, Patterns, Motion, Cycle, Systems, Inquiry, Investigation, Force, Transformation, gravity			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
The Earth and the pattern of its moon within the solar system create cycles of tides, eclipses, and phases of the moon which impact where and how people live. (SC09-GR.8-S.3-GLE.4-EO.b)	What are three ways the position of the moon affects seasons. (SC09-GR.8-S.3-GLE.4-EO.a,b; IQ.1)	How would tides be different if the Earth had no moons? Two moons? (SC09-GR.8-S.3-GLE.4-EO.a,b; IQ.1)
Earth's shape and tilt determine the amount of solar energy that reaches different latitudes which affects length of day, climate, and seasonal patterns. (SC09-GR.8-S.3-GLE.2-EO.b,c)	How does the shape and tilt of the earth influence climate in Colorado? (SC09-GR.8-S.3-GLE.2-EO.b) What are the energy transformations involved in the solar energy impacting the planet? (SC09-GR.8-S.1-GLE.2-EO.c) What are the main climates on Earth and how are they defined by temperature and precipitation? (SC09-GR.8-S.3-GLE.2; IQ.2)	How would different tilts of the Earth impact seasonal changes? (SC09-GR.8-S.3-GLE.2-EO.b) How does energy transform from one form to another? (SC09-GR.8-S.1-GLE.2-EO.c) How do electromagnetic waves transfer energy that affects climate and life? (SC09-GR.8-S.1-GLE.4-EO.a; RA.3)
Gravitational force accounts for patterns of motion of objects within the solar system and tides. (SC09-GR.8-S.3-GLE.3-EO.f)	What major forces maintain the orbit of objects in the solar system? (SC09-GR.8-S.1-GLE.1-EO.a) What makes pathways predictable for orbit? (SC09-GR.8-S.3-GLE.4-EO.a) and (SC09-GR.8-S.3-GLE.3-EO.f) How does gravity affect tides? (SC09-GR.8-S.3-GLE.4-EO.a; IQ.2)	What evidence indicates a force has acted on a system? (SC09-GR.8-S.1-GLE.1-EO.a) Is it possible for a force to act on a system without having an effect? (SC09-GR.8-S.1-GLE.1-EO.a)

Changing models reflect changing ideas of the organization and scale of the solar system. (SC09-GR.8-S.3-GLE.4-EO.a,f; N.3)	What are historic and current models of the Earths place in the solar system? (SC09-GR.8-S.3-GLE.3-EO.d; RA.1; N.2) What are the different objects that comprise the solar system? (SC09-GR.8-S.3-GLE.3-EO.a; IQ.1)	How does understanding our place in the solar system help predict future events? (SC09-GR.8-S.3-GLE.3-EO.d; RA.1; N.2) How is the solar system changing over time? (SC09-GR.8-S.3-GLE.3-EO.d;N.2)

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• Different forms of energy and how they can transfer or transform from one form to another. (SC09-GR.8-S.1-GLE.1-EO.a,b,c) • Electromagnetic energy that provides energy for climate and life. • Earth's variety of climates defined primarily by precipitation and temperature (SC09-GR.8-S.3-GLE.2-EO.b,c) • The solar system and its numerous objects including planets, sun, moons, asteroids, comets, and dwarf planets (SC09-GR.8-S.3-GLE.3-EO.a) • The predictable orbits of objects in the solar system. (SC09-GR.8-S.3-GLE.4-EO.f) • Relative positions of the Earth, moon and sun and how they help explain natural phenomena such as tides, eclipses (moon and sun) and moon phases. (SC09-GR.8-S.3-GLE.4-EO.b) • Earth's tilt and the ways in which it accounts for variations in amounts of direct light and its relationship to the seasons (SC09-GR.8-S.3-GLE.2-EO.b,c) • The continual changes to our understanding of the solar system due to scientific investigations and advances in data collection (SC09-GR.8-S.3-GLE.3; N.2)	• Gather, analyze, and interpret data to describe the different forms of energy (SC09-GR.8-S.1-GLE.1-EO.a) • Construct a scale model of the solar system and use it to explain the motion of objects (SC09-GR.8-S.3-GLE.3-EO.a) • Describe methods and equipment used to explore the solar system and beyond. (SC09-GR.8-S.3-GLE.3-EO.b) • Design an investigation that involves direct observation, models, data sets, and/or simulations to study objects in the sky (SC09-GR.8-S.3-GLE.3-EO.c,e,f) • Analyze and interpret data to explain why we have seasons (SC09-GR.8-S.3-GLE.4-EO.b) • Use models to explain the relative motions of the Earth, moon, and sun over time (SC09-GR.8-S.3-GLE.4-EO.c) • Research, critique, and communicate scientific theories that explain how the solar system formed (SC09-GR.8-S.3-GLE.3-EO.d)

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):	*A model can be interpreted to explain the phases of the moon. Through analyzing data, I can determine the relationship between latitude and climate and can predict the degree of seasonal variation.*
Academic Vocabulary:	Interpret, compare and contrast, identify, critique, evaluate, analyze, models, evidence, distinguishing characteristics, scientific investigation, net
Technical Vocabulary:	Climate, revolution, rotate, season, tide, eclipse, scale model, gibbous, waxing/waning, dwarf planet, gravity, star, axis, relative, latitude, longitude, absorption, reflection, heliocentric, satellite, orbit, force, motion, inertia, radiation, hemisphere, electromagnetic, angle of insolation, neap tide, spring tide, tidal force, precipitation

Unit Description:	This unit focuses on exploring patterns of motion in our solar system as they relate to the positions of the Earth, Moon, and Sun. Students will be introduced to models of the solar system and how the movement/position of celestial objects effects tides, creates eclipses, day cycles, year cycles, seasons, and moon phases. The unit culminates in a presentation interpreting data about an imaginary planet/solar system and what solar system/planetary conditions might explain the given observations.
Considerations:	The moon phase requires a North-facing orientation. Precipitation and electromagnetic forces may be left out of this unit. MISCONCEPTIONS: The moon is only out at night. The sky is blue because of the ocean. All high tides are the same height, as are all low tides.
Unit Generalizations	
Key Generalization:	Gravitational force accounts for patterns of motion of objects within the solar system and tides.
Supporting Generalizations:	The Earth and the pattern of its moon within the solar system create cycles of tides, eclipses, and phases of the moon which impact where and how people live.
	Earth's shape and tilt determine the amount of solar energy that reaches different latitudes which affects length of daylight, climate, and seasonal patterns.
	Changing models reflect changing ideas of the organization and scale of the solar system.

Performance Assessment: *The capstone/summative assessment for this unit.*	
Claims: (Key generalization(s) to be mastered and demonstrated through the capstone assessment.)	Gravitational force accounts for patterns of motion of objects within the solar system and tides.
Stimulus Material: (Engaging scenario that includes role, audience, goal/outcome and explicitly connects the key generalization)	The Voyager 1 space probe has located a spiral galaxy similar to ours. Within this galaxy, the probe has identified a solar system that includes a planet much like the Earth. You are a NASA astronomical analyst asked to interpret observable data recorded by Voyager 1. Using your knowledge of the motion of objects within a solar system, make inferences about the solar system/planetary conditions and possible seasonal changes on this new planet. Observations that have been recorded include: • massive tidal surges that cover large amounts of land • the planet's day/night cycle is 36 hours • tilt of the planet is 90 degrees • the length of the year is 200 days

Product/Evidence: (Expected product from students)	Students will take the role of a NASA astronomical analyst asked to create a presentation (Prezi, PowerPoint, speech, etc.) which interprets and infers planetary conditions based on predetermined data/observations. They must describe: ● the moon's gravitational effects on tidal surge ● the rotation of the planet as the cause of its day cycle ● the seasonal effects due to the planetary tilt ● the revolution/orbit of the planet as the cause of its year length
Differentiation: (Multiple modes for student expression)	The teacher may limit/vary the amount of information about the new planet.

Texts for independent reading or for class read aloud to support the content

Informational/Non-Fiction	Fiction
The Moon – Paulette Bourgeois [lexile level 760] *So That's How the Moon Changes Shape!* - Allan Fowler [lexile level 720] *Earth, Sun, Moon* - Glen Phelan [lexile level 590]	*When is a Planet not a Planet?: The Story of Pluto*–Scott, E. [lexile level 980] *The Hazards of Space Travel* - Comins, N. [lexile level 1380]

Ongoing Discipline-Specific Learning Experiences

1.	Description:	Working like a scientist: Using the scientific method	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) http://www.vrml.k12.la.us/cc/tools/tools.htm (interactives, electronic templates, blackline, and printables) http://www.nsta.org/publications/freebies.aspx (multiple free resources)
			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

				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:	Collect and analyze data Compare and contrast ideas	Assessment:	The student will be assessed within the learning experiences
2.	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)
			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 should have a basic understanding of seasons, the solar system, gravity, motion and force, climate, and know that the sun is a star.

Vertical Articulation: The last time students would have engaged with these concepts was in 4th grade.

Learning Experiences # 1 – 4
Instructional Timeframe: Weeks 1-5

Learning Experience # 1		
The teacher may show the development of different solar system models from historically significant figures so that students can describe the evolution of these models due to the advancement of technology.		
Generalization Connection(s):	Changing models reflect changing ideas of the organization and scale of the solar system.	
Teacher Resources:	http://www.livebinders.com/play/play_or_edit?id=125653 (History of Early Astronomy reading component) http://tinyurl.com/neftdpa (image of Ptolemy's model) http://www.tiki-toki.com/timeline/entry/76343/Astronomy-Model-Timeline/#vars!date=0140-01-01_00:00:00! (solar system model timeline) http://astro.unl.edu/naap/ssm/heliocentric.html (Heliocentric animation) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://idialab.org/virtual-hadrians-villa/ (Hadrian's Villa virtual lab showing architecture solstices and equinox) https://www.cfa.harvard.edu/news/2014-10 (realistic virtual universe) https://www.youtube.com/watch?v=KESAUT6_iYM (Heliocentric vs Geocentric video)	
Student Resources:	http://astro.unl.edu/naap/ssm/heliocentric.html (Heliocentric animation) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://www.softschools.com/teacher_resources/timeline_maker/ (online timeline generator) http://www.dipity.com/ (online timeline generator with multimedia resources) https://prezi.com/nh0zsra-kal5/historical-models-of-solar-system-timeline/ (Solar system timeline) http://csep10.phys.utk.edu/astr161/lect/retrograde/aristotle.html (model of the Ptolemy solar system)	
Assessment:	Students will compare and contrast aspects of the different models of the solar system (geocentric versus heliocentric) OR students will create a timeline outlining the important discoveries, contributions, and claims regarding the solar system model.	
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 Cloze timeline. The teacher may create a matching activity with all required historical information.	The student may match ideas/concepts to the correct person/order. The student may verbally express the differences in the solar system models.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide Internet resources giving more historical background.	The student may include additional information that they discovered in their timeline.

Critical Content:	• Heliocentric • Geocentric • Ptolemy • Copernicus • Galileo • Newton • Orbit
Key Skills:	• Compare and contrast historical solar system models
Critical Language:	Heliocentric, geocentric, critique, model, compare and contrast,

Learning Experience # 2	
The teacher may differentiate between the different types of telescopes so that students can describe the uses, general structures, and method of magnification of each type.	
Generalization Connection(s):	Changing models reflect changing ideas of the organization and scale of the solar system.
Teacher Resources:	http://www.skyandtelescope.com/astronomy-equipment/how-to-choose-a-telescope/ (how to choose a telescope) http://www.tiki-toki.com/timeline/entry/76343/Astronomy-Model-Timeline/#vars!date=0140-01-01_00:00:00! (solar system model timeline) http://www.glencoe.com/sites/common_assets/science/virtual_labs/ES21/ES21.swf (Experimental Space Processing Satellite) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://www.exploratorium.edu/hubble/tools/types.html (explains the 3 types of optical telescopes) https://davidleesummers.wordpress.com/2014/11/01/making-a-telescope/ (How to make a telescope) http://www.slideshare.net/allsaintsscience/8th-gradech-4-sec-1-telescopes (telescope slideshow) http://ngm.nationalgeographic.com/2009/07/telescopes/telescopes-interactive (Timeline: A History of Telescopes) http://jwst.nasa.gov/3dflyby (3-D Webb Space Telescope) http://www.worldwidetelescope.org/ (enables your computer to function as a virtual telescope) http://hubblesite.org/explore_astronomy/ (Hubble telescope) http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/ (free ebook astrophotography) http://chandra.harvard.edu/resources/flash/telescopes_light.html (Chandra X-Ray Observatory)
Student Resources:	http://piktochart.com (infographic maker) https://www.canva.com/create/infographics/ (infographic maker) cooltoolsforschools.wikispaces.com (collection of websites for access to different types of presentations) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://ngm.nationalgeographic.com/2009/07/telescopes/telescopes-interactive (Timeline: A History of Telescopes) http://jwst.nasa.gov/3dflyby (3-D Webb Space Telescope) http://www.worldwidetelescope.org/ (enables your computer to function as a virtual telescope)

	http://hubblesite.org/explore_astronomy/ (Hubble telescope) http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/ (free ebook astrophotography) http://chandra.harvard.edu/resources/flash/telescopes_light.html (Chandra X-Ray Observatory)	
Assessment:	The student will create an infographic describing the different telescopes in chronological order.	
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 allow students to work in groups.	The student may produce an infographic without using digital access, i.e. a poster, a cartoon.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	The student may illustrate the required information by creating a video presentation.
Critical Content:	● Optical (refractive/reflective), infrared, ultraviolet, radio, telescope, magnification, lens, aperture.	
Key Skills:	● Differentiate amongst telescope types. ● Organize the technological development allowing the observation of celestial objects. ● Determine which telescope is most appropriate to use to find a specific type of data.	
Critical Language:	Differentiate, organize, determine, lens, refractive, reflective, infrared, ultraviolet, radio, telescope, magnification	

Learning Experience # 3	
The teacher may provide resources showing the arrangement of the Earth, Moon, and Sun so that students can accurately represent the relative position of the Earth within the system.	
Generalization Connection(s):	Gravitational force accounts for patterns of motion of objects within the solar system and tides. The Earth and the pattern of its moon within the solar system create cycles of tides, eclipses, and phases of the moon which impact where and how people live. Earth's shape and tilt determine the amount of solar energy that reaches different latitudes which affects length of daylight, climate, and seasonal patterns.
Teacher Resources:	http://issuu.com/burki12/docs/stars_and_planets__dk_eyewitness_workbooks_ (DK" Stars and Planets" scroll for many other books and magazines to read on-line) http://getsmarts.weebly.com/space.html (solar system worksheets, webquest, facts, interactives, etc.,) http://space.jpl.nasa.gov/ ("Solar System Simulator" can choose target, date, field of view) http://depts.washington.edu/naivpl/content/welcome-virtual-planetary-laboratory (The Virtual Planetary Library) http://onlinelabs.in/astronomy (multiple virtual labs for solar system) http://www.classzone.com/books/earth_science/terc/content/visualizations/es2701/es2701page01.cfm (Simulation "Examine the Vast Distances of Planets in Our Solar System") https://drive.google.com/file/d/0B8WUo3lSMNqBN2tqdWJVTndEUlU/edit (Use for Graphing AU's) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)

	https://www.youtube.com/watch?v=lltkAduGVSg (video showing retrograde) https://www.youtube.com/watch?v=piBBQTkoQ9c (video to explain retrograde)	
Student Resources:	http://mrnussbaum.com/space-2/ (scroll down to "Make Your Own Solar System includes tutorial) http://flyrussell.com/reviews/ (Scroll for choices of games and simulations) http://space.jpl.nasa.gov/ ("Solar System Simulator" can choose target, date, field of view) http://www.classzone.com/books/earth_science/terc/content/visualizations/es2701/es2701page01.cfm (Simulation "Examine the Vast Distances of Planets in Our Solar System") http://www.seasky.org/solar-system/solar-system.html (Virtual tour) http://www.earthsunmoon.co.uk/ (Earth, moon and sun interactive) https://youtu.be/1Eh5BpSnBBw (shows the Earth's position - to scale - within the Universe) https://phet.colorado.edu/sims/my-solar-system/my-solar-system_en.html (solar system simulation)	
Assessment:	The student will create a model of the orbits of Earth and moon around the sun and include a discussion of revolution and rotation.	
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 diagram of the Earth, moon, and sun in space. The teacher may allow the student to work independently.	The student may label a model of the Earth, Moon, and Sun. The student may verbally describe a diagram of the Earth, Moon, and Sun.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may explain how to find the scale factor and proportions of real life objects to their models. The teacher may explore the concept of extrasolar planetary systems.	The student may calculate and mathematically justify the size and scale of their models. The student may examine extrasolar planets.
Critical Content:	• Retrograde, revolution, rotation, planets, astronomical unit, scale model, radiation.	
Key Skills:	• Differentiate between revolution and rotation. • Infer the reasoning of the use of a scale model.	
Critical Language:	Retrograde, revolution, rotation, planets, astronomical unit, scale model, radiation, differentiate, infer, scale, analyze	

Learning Experience # 4	
The teacher may model the physical characteristics and behaviors of the sun and other stars so that students can describe the Sun's effects on Earth.	
Generalization Connection(s):	Earth's shape and tilt determine the amount of solar energy that reaches different latitudes which affects length of daylight, climate, and seasonal patterns.
Teacher Resources:	https://youtu.be/9ijxEsarKkU (YouTube video featuring details about the sun) http://climate.nasa.gov/interactives/sun (interactive virtual tour of the sun) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://space-facts.com/the-sun/ (general information about the sun)

Student Resources:	https://voicethread.com (presentation possibility) http://www.screencast-o-matic.com (presentation possibility) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)	
Assessment:	Students will create a presentation that represents the relationship between the Earth and the sun.	
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 examples of different types of presentations. The teacher may provide a graphic organizer of the information. The teacher may allow the students to work in groups.	The student may give a live speech/presentation. The student may present with a partner or in a small group.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may allow students to investigate and research specific behaviors of the sun as observed from Earth (solar flares, Aurora Borealis, etc.) The teacher may present the information in a jigsaw activity.	The student may present a symbolic/analogical relationship between the sun and the Earth and provide a written justification of the comparison.
Critical Content:	● Corona, chromosphere, photosphere, solar flare, radiation, star, fusion, energy	
Key Skills:	● Accurately describe the structure of the sun and its behavior ● Explain the effects of the sun's activity on the Earth.	
Critical Language:	Gas, energy, radiation, corona, chromosphere, photosphere, solar flare, fusion, molecule, atom	

Learning Experiences # 5 – 7
Instructional Timeframe: Weeks 6-9

Learning Experience # 5	
The teacher may brainstorm with the class to review Newton's Laws of Motion so that students can apply that knowledge to how the gravity of objects in space creates movement/interactions between those objects.	
Generalization Connection(s):	Gravitational force accounts for patterns of motion of objects within the solar system and tides.
Teacher Resources:	http://users.clas.ufl.edu/ufhatch/NSF-PLANS/2-2_NEWTON.htm (Teacher lesson plans/resource: Demonstration of Newton's Three Laws of Motion and the Law of Gravitation) https://phet.colorado.edu/sims/my-solar-system/my-solar-system_en.html (Simulation for mass, position, and velocity of 2 bodies) https://www.youtube.com/watch?v=okCCGxWs_L8 (You Tube video song- "What's Newton's Laws say? (What does a fox say) https://www.youtube.com/watch?v=PkAO8F-Tm-w (You Tube video song-"Newton's Laws of Motion" (music by Chris Brown – "International Love") http://www.scholastic.com/teachers/activity/force-and-motion-6-studyjams-interactive-science-activities (Student Resource: study

<table>
<tr><td></td><td colspan="2">jam videos & quiz/test on Newton's Three Laws of Motion & Gravity & Inertia)
http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)</td></tr>
<tr><td>Student Resources:</td><td colspan="2">http://www.scholastic.com/teachers/activity/force-and-motion-6-studyjams-interactive-science-activities (Student Resource: study jam videos & quiz/test on Newton's Three Laws of Motion & Gravity & Inertia)
https://phet.colorado.edu/sims/my-solar-system/my-solar-system_en.html (Simulation for mass, position, and velocity of 2 bodies)
http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)
http://www.sciencechannel.com/games-and-interactives/newtons-laws-of-motion-interactive/ (tutorial on Newton's 3 laws of motion with an optional review quiz)</td></tr>
<tr><td>Assessment:</td><td colspan="2">The student will identify each of Newton's Laws of Motion and provide examples of each during an exit ticket exercise.</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>N/A</td><td>The student may provide written responses.</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>N/A</td><td>N/A</td></tr>
<tr><td>Critical Content:</td><td colspan="2">● Gravity
● Celestial objects
● Motion
● At rest
● Uniform motion
● External force
● Inertia
● Mass
● Force
● Acceleration
● Velocity
● Vector sum
● Magnitude</td></tr>
<tr><td>Key Skills:</td><td colspan="2">● Recognize which of Newton's Laws is in effect.
● Provide examples of each of Newton's Laws of Motion.</td></tr>
<tr><td>Critical Language:</td><td colspan="2">Recognize, gravity, celestial objects, motion, at rest, uniform motion, external force, inertia, mass, velocity, vector sum, magnitude, acceleration</td></tr>
</table>

Learning Experience # 6
The teacher may utilize digital resources as well as hands on activities illustrating gravity on other celestial objects so the

student can connect that the mass of an object will determine its gravity.		
Generalization Connection(s):	Gravitational force accounts for patterns of motion of objects within the solar system and tides.	
Teacher Resources:	http://www.scholastic.com/teachers/activity/force-and-motion-6-studyjams-interactive-science-activities (Student Resource: study jam videos & quiz/test on Newton's Three Laws of Motion & Gravity & Inertia) https://phet.colorado.edu/sims/my-solar-system/my-solar-system_en.html (Simulation for mass, position, and velocity of 2 bodies) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)	
Student Resources:	http://www.scholastic.com/teachers/activity/force-and-motion-6-studyjams-interactive-science-activities (Student Resource: study jam videos & quiz/test on Newton's Three Laws of Motion & Gravity & Inertia) https://phet.colorado.edu/sims/my-solar-system/my-solar-system_en.html (Simulation for mass, position, and velocity of 2 bodies) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)	
Assessment:	The student will model and calculate gravity, mass, and acceleration of two celestial objects.	
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 mass and gravity of objects	The student may verbally explain mass and gravity of two objects
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	N/A
Critical Content:	• Mass • Gravity • Volume • Acceleration • Compare • Contrast	
Key Skills:	• Understand that the size of an object (mass) determines it gravity. • Compare and contrast the behavior of gravity on several celestial objects.	
Critical Language:	Mass, gravity, volume, acceleration, compare, contrast, model	

Learning Experience # 7	
The teacher may provide simulations, illustrations, or hands-on activities to demonstrate how the tilt of the Earth determines seasons so the student can synthesize why seasons occur and how they vary at different locations on Earth.	
Generalization Connection(s):	Earth's shape and tilt determine the amount of solar energy that reaches different latitudes which affects length of daylight, climate, and seasonal patterns.

<table>
<tr><td>Teacher Resources:</td><td colspan="2">https://www.khanacademy.org/science/cosmology-and-astronomy/earth-history-topic/earth-title-topic/p/season-simulator (interactive simulator demonstrating the seasons)
http://tinyurl.com/owawzpk (The Seasons Teacher Guide)
http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)
http://phl.upr.edu/hec (“Planetary Habitability Laboratory”)
http://scied.ucar.edu/games-sims-weather-climate-atmosphere (Games and Simulations for weather, climate, and atmosphere)
http://idialab.org/virtual-hadrians-villa/ (Hadrian’s Villa virtual lab showing architecture solstices and equinox)
http://astro.unl.edu/naap/motion1/motion1.html (“Basic Coordinates and Seasons Lab”)
http://msp.ehe.osu.edu/wiki/index.php/MSP:MiddleSchoolPortal/The_Reasons_for_the_Seasons (multiple resources-Science and myth, misconceptions, sources for real date, etc.,)
http://aspire.cosmic-ray.org/ (Multiple simulations and lessons)
http://scienceofeverydaylife.discoveryeducation.com/teachers/videos.cfm?grade=grades35 (resources for differentiation for seasons and weather)</td></tr>
<tr><td>Student Resources:</td><td colspan="2">http://highered.mheducation.com/sites/007299181x/student_view0/chapter2/seasons_interactive.html (Seasons interactive)
http://flyrussell.com/reviews/ (Scroll for choices of games and simulations)
http://scied.ucar.edu/games-sims-weather-climate-atmosphere (Games and Simulations for weather, climate, and atmosphere)
http://aspire.cosmic-ray.org/ (Multiple simulations and lessons)
http://astro.unl.edu/naap/motion1/motion1.html (“Basic Coordinates and Seasons Lab”)
http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)
http://phl.upr.edu/hec (“Planetary Habitability Laboratory”)</td></tr>
<tr><td>Assessment:</td><td colspan="2">The student will compare and contrast two climates at different parallels in a short constructed response. Information to include:
• temperature of each location
• day length at each location</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 may provide a map showing cities and parallels</td><td>The student may create a labeled illustration demonstrating the required knowledge.</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 provide additional readings or videos that illuminate how seasonal changes affect the behavior of humans or animals in various locations.</td><td>The student may describe how the differences at each location affect the people or animals living there.</td></tr>
<tr><td>Critical Content:</td><td colspan="2">• Tilt
• Axis
• Season
• Absorption
• Hemisphere
• Climate</td></tr>
</table>

Key Skills:	• Identify the season based of the Sun's position and a given Earth location. • Describe the distinguishing features of each season. • Analyze and interpret data on season, temperature, day length in various locations.
Critical Language:	Model, diagram, simulation, identify, analyze, interpret, tilt, axis, season, absorption, hemisphere.

Learning Experiences # 8 - 9
Instructional Timeframe: Weeks 9-10

Learning Experience # 8	
The teacher may diagram and describe the relative movements of the Moon, Earth, and Sun so the student can explain how the relative position of the Moon to the Earth effects observations.	
Generalization Connection(s):	The Earth and the pattern of its moon within the solar system create cycles of tides, eclipses, and phases of the moon which impact where and how people live. Gravitational force accounts for patterns of motion of objects within the solar system and tides.
Teacher Resources:	http://www.science-class.net/archive/science-class/Astronomy/MoonPhases.htm (Teacher Resource with activities, labs, slide-shows, interactive & resource websites) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://www.universetoday.com/92148/what-if-the-earth-had-two-moons/ (Article with added links) http://www.lpi.usra.edu/education/resources/s_system/moon.shtml (Lunar and Planetary Institute) http://www.moonphases.info/moon_phases.html (may be used as a reading component) http://tycho.usno.navy.mil/vphase.html (moon phase images from 1800-2199) http://aspire.cosmic-ray.org/ (Multiple simulations and lessons)
Student Resources:	http://flyrussell.com/reviews/ (Scroll for choices of games and simulations) http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://aspire.cosmic-ray.org/ (Multiple simulations and lessons) http://www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.mphase/phases-of-the-moon/ (tutorial) http://www.lpi.usra.edu/education/resources/s_system/moon.shtml (Lunar and Planetary Institute) http://www.moonphases.info/moon_phases.html (may be used as a reading component) http://tycho.usno.navy.mil/vphase.html (moon phase images from 1800-2199)
Assessment:	Students will complete an astronomy log making observations of the phase and position of the moon in the sky at a given time for a period of 30 days. (NOTE: This assessment needs to begin at the start of the unit). Students will then make predictions based on the patterns they recognize in their observations.

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 can review the phases of the moon and how to draw them.	Students may complete a partially completed data chart
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher can review the phases of the moon and how to draw them.	Students may diagram the relative position of the Earth, moon, and sun with each phase of the moon observed. Students may predict the phase of the moon based on the relative position of the Earth, moon, and sun.
Critical Content:	• Solar eclipse • Lunar eclipse • Moon phases • Full moon • New moon • Waning crescent • Waxing crescent • Waning gibbous • Waxing gibbous • 1st quarter • 3rd quarter	
Key Skills:	• Modeling the moon cycles with Earth, moon, and sun • Direct observations of objects • Design an investigation that involves direct observations of objects in the sky • Compile gathered data into a correctly labeled chart/graph	
Critical Language:	Reflection, satellite, relative (perspective), eclipse, solar eclipse, lunar eclipse, reflection.	

Learning Experience # 9	
The teacher may provide simulations, videos, and models of the Earth's tides in relation to the lunar cycle so the student can understand how the Moon's gravity directly influences the tides on Earth.	
Generalization Connection(s):	The Earth and the pattern of its moon within the solar system create cycles of tides, eclipses, and phases of the moon which impact where and how people live. Gravitational force accounts for patterns of motion of objects within the solar system and tides.
Teacher Resources:	http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations) http://www.schoolsobservatory.org.uk/astro/esm/tidesim (tide simulator) http://csep10.phys.utk.edu/astr161/lect/time/tides.html (explanation of lunar tides)

<table>
<tr><td></td><td colspan="2">http://oceanservice.noaa.gov/facts/tidefrequency.html (tidal frequencies with a diagram of lunar tides)
http://oceanservice.noaa.gov/education/kits/tides/lessons/tides_tutorial.pdf (NOAA tutorial on tides)
http://www.argo.ucsd.edu/OceansRisingYr8-12PartB.pdf (activities and lessons to teach kids about tides)</td></tr>
<tr><td>Student Resources:</td><td colspan="2">http://flyrussell.com/reviews/ (Scroll for choices of games and simulations)
http://astro.unl.edu/animationsLinks.html (Astronomy simulations and animations)
http://www.ducksters.com/science/earth_science/ocean_tides.php (kid-friendly explanation of tides)
http://tinyurl.com/pdzqqh4 (web quest on tides using the NOAA website -- answers are provided on the document and will need to be deleted prior to assigning to students)</td></tr>
<tr><td>Assessment:</td><td colspan="2">The student will complete a web quest, including research of scientific data on water levels, lunar phase, and location. It will culminate in a short constructed response explaining why unusually high/low tides may occur.</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 may allow the students to work in groups.
The teacher may reduce the assignment as needed.</td><td>The student may verbally present a determination of why unusually high or low tides occur.</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 offer additional resources (such as videos and simulations) about human coastal development and coastal topography.</td><td>The student may include information about how topography and man-made features affect the impact of tides on humans.</td></tr>
<tr><td>Critical Content:</td><td colspan="2">● High tide
● Low tide
● Neap
● Spring tide
● Tidal force
● Lunar</td></tr>
<tr><td>Key Skills:</td><td colspan="2">● Research digital content.
● Evaluate data in a chart.
● Analyze graphs of tidal data.
● Identify patterns within scientific data.</td></tr>
<tr><td>Critical Language:</td><td colspan="2">Model, diagram, high/low tide, neap, spring tide, tidal force, pattern, topography, simulation, lunar</td></tr>
</table>