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| **Subject:** Science | **Grade:** 8 | **Unit ID:**  |
| **Unit 3:** Earth ScienceSub Units3A Gravity3B Earth Systems3C Weather | **Length:** 3A = 22 days3B = 8 days3C = |
| ***Stage 1: Desired Results*** |
| **Content Standards:**3A Gravity**8.MS-ESS1-2**. Explain the role of gravity in ocean tides, the orbital motions of planets, their moons, and asteroids in the solar system. State Assessment Boundary: • Kepler’s laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth are not expected in state assessment. 3B Earth Systems**8.MS-ESS2-1.** Use a model to illustrate that energy from Earth’s interior drives convection that cycles Earth’s crust, leading to melting, crystallization, weathering, and deformation of large rock formations, including generation of ocean sea floor at ridges, submergence of ocean sea floor at trenches, mountain building, and active volcanic chains. Clarification Statement: • The emphasis is on large-scale cycling resulting from plate tectonics. **8.MS-ESS3-1.** Analyze and interpret data to explain that the Earth’s mineral and fossil fuel resources are unevenly distributed as a result of geologic processes. Clarification Statement: • Examples of uneven distribution of resources can include where petroleum is generally found (locations of the burial of organic marine sediments and subsequent geologic traps), and where metal ores are generally found (locations of past volcanic and hydrothermal activity). 3C Weather**8.MS-ESS1-1b.** Develop and use a model of the Earth-Sun system to explain the cyclical pattern of seasons, which includes Earth’s tilt and differential intensity of sunlight on different areas of Earth across the year. Clarification Statement: • Examples of models can be physical or graphical. **8.MS-ESS2-5.** Interpret basic weather data to identify patterns in air mass interactions and the relationship of those patterns to local weather. Clarification Statements: • Data includes temperature, pressure, humidity, precipitation, and wind. • Examples of patterns can include air masses flow from regions of high pressure to low pressure, and how sudden changes in weather can result when different air masses collide. • Data can be provided to students (such as in weather maps, data tables, diagrams, or visualizations) or obtained through field observations or laboratory experiments. State Assessment Boundary: • Specific names of cloud types or weather symbols used on weather maps are not expected in state assessment. **8.MS-ESS2-6.** Describe how interactions involving the ocean affect weather and climate on a regional scale, including the influence of the ocean temperature as mediated by energy input from the Sun and energy loss due to evaporation or redistribution via ocean currents. Clarification Statement: • A regional scale includes a state or multi-state perspective. State Assessment Boundary: • Koppen Climate Classification names are not expected in state assessment.**8.MS-ESS3-5.** Examine and interpret data to describe the role that human activities have played in causing the rise in global temperatures over the past century. Clarification Statements: • Examples of human activities include fossil fuel combustion, deforestation, and agricultural activity. • Examples of evidence can include tables, graphs, and maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; and the rates of human activities. **Practice Standards/Concepts & Skills:**1. Asking questions (for science) and defining problems (for engineering). 2. Developing and using models. 3. Planning and carrying out investigations. 4. Analyzing and interpreting data. 5. Using mathematics and computational thinking. 6. Constructing explanations (for science) and designing solutions (for engineering). 7. Engaging in argument from evidence. 8. Obtaining, evaluating, and communicating information |
| **Overview:**This unit is broken into three sub-units: gravity, earth systems, and weather. **FOCUS LANGUAGE GOALS:**[Guide: [creating Focus Language Goals](http://www.doe.mass.edu/ell/curriculum/ResourceGuide.pdf#page=66) - delete] |
| **Understandings**3A Gravity* Gravity and inertia are the reason the planets, moon, and asteroids orbit the sun.
* The ocean tides are caused by gravity.

3B Earth Systems* The convection in the mantle causes construction and destruction of Earth’s material.
* Earth’s materials are recycled through the rock cycle.
* Mineral and fossil fuels are limited resources that are unevenly distributed around the Earth.

3C Weather* The pattern of the seasons is due to Earth’s tilt which causes the change in intensity of the sunlight during different times of the year.
* Local weather is the product of moving air masses.
* Air mass, temperature, and pressure affect the weather.
* The Coriolis effect and global ocean convection cycle affect weather and climate on a regional scale.
* Human activities are having an impact on global temperatures.
 | **Essential Questions**3A Gravity: What are the predictable patterns caused by Earth's movement in the solar system?* How does/can gravity influence the universe and its occupants?
* How does Earth’s position in the solar system affect different phenomena on Earth?
* What are the predictable patterns caused by Earth's movement in the solar system?

3B Earth Systems: How do Earth’s major systems interact? * How do the properties and movements of water shape Earth's surface and affect its systems?
* How do events in one geographic area affect events in other locations?
* How will our planet change over time?

3C Weather: What regulates weather and climate?* Is the world today a better place than the world of the past? Will our future world be better than today's world?
* How does where you live influence how you live?
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| **Knowledge:** *Students will know...***Content:**3A Gravity* review the difference between mass and weight
* the causes of tides
* the reason that planets, their moons, and asteroids orbit the sun

3B Earth Systems* an overview of the theory of plate tectonics
* Causes of plate tectonics through convection currents of the earth’s crust
* minerals and fossil fuels are the result of certain geologic processes
* human activities in certain geographic locations are shaped by the limited and uneven distribution of these resources

3C Weather* the causes of the seasons
* the properties and composition of earth’s atmosphere
* the effects of air mass, temperature, and pressure on the weather
* the causes of local and global winds
* the effects of air masses and wind patterns
* oceans transport, absorb and release energy which influences weather and climate. For example, the effects of salinity and/or water temperature on water density
* human activities have an impact on global temperatures

**Language:**Students will become familiar with a variety of different text types in the four skills (reading, writing, listening and speaking) for such purposes as:* Describe the role of gravity in the solar system
* Describe how plate tectonics relates to the distribution of the world’s resources
* Describe the factors that affect Earth’s weather
* Describe how human actions can cause irreversible damage and how to preserve resources

**Vocabulary:** [**(see definition of CCSS tiered vocabulary)**](https://drive.google.com/open?id=0B1oO5U3iU008Q1ZGaEpFeFpLVnc)

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| **Tier 1** | **Tier 2** | **Tier 3** |
| PlanetSeasonMoonStar | AxisRotationRevolutionOrbitSystemDensityFrontHumiditycurrent | AtmosphereLithosphereAsthenosphereGeosphereHydrosphereBiosphere |

 | **Skills**: *Students can ...***Content:**3A Gravity* develop a model to explain why the planets, their moons, and asteroids stay in orbit (8.MS-ESS1-2)

3B Earth Systems* model the phenomena of plate tectonics (8.MS-ESS2-1)
* investigate earthquake and volcano locations on earth’s surface (8.MS-ESS2-1)
* construct an explanation with examples of evidence for the theory of plate tectonics (8.MS-ESS2-1)
* analyze and interpret data/maps of where mineral and fossil fuel resources are found (8.MS-ESS3-1)

3C Weather* develop models to show the effects of different air masses on climate (8.MS-ESS2-5)
* analyze and interpret data tables, graphs and maps for temperature, pressure, humidity, precipitation and wind (8.MS-ESS2-5)
* analyze the relationship between ocean currents and weather patterns and their effects on regional weather (8.MS-ESS2-6)
* examine and interpret data from human effect on climate (8.MS-ESS3-5)
* develop a model to explain the reasons Earth has seasons (8.MS-ESS1-1b)
* analyze and interpret daylight hour, tidal and temperature data (8.MS-ESS1-2)

**Language:*** Construct an explanation of the effect of gravity on Earth and our solar system
* Compare and contrast the characteristics of the sun, moon, and Earth
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| ***Stage 2: Assessments*** |
| Assessments administered in this unit* Traditional computer based or paper and pencil teacher generated assessment
* Common district assessment questions (pending)
* Pearson Quick Lab: [Storm Safety](https://drive.google.com/file/d/1RyfDiOyPACa8syh2kEqS46MCxFw3Jo-k/view?usp=sharing) / [Modeling Moon’s Pull](https://drive.google.com/file/d/1ouywpcfirbAUHz_ms-0WTpgSkGpHaHzd/view?usp=sharing) / [Deep Currents](https://drive.google.com/file/d/1SLMq-b_iz3bLufwwBz2AYbQL0k0F7e7h/view?usp=sharing)
* Optional:
	+ Students will create a poster to model types of energy and renewable and non-renewable resources
	+ Students will write CER paper to answer the following question: Why is it beneficial/ necessary to pursue renewable energy resources to harness energy? Explore what factors are preventing widespread use of renewable resources to generate electricity and what could be the possible solutions to decrease the dependency on fossil fuels?
	+ [CER Greenhouse Effect](https://bpsscience.weebly.com/uploads/2/2/1/3/2213712/greenhouse_effect_cer_prompt.pdf)
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| ***Stage 3: Learning Plan*** |
| **Summary of Key Learning Events and Instructions:**This unit is divided into 3 sub-units: gravity, earth systems, and weather.  |
| **Instructional Notes:****Sociocultural implications*** Students’ prior knowledge must be tested using a pre-assessment.
* Mention contributions of astronomers from around the globe
* Weather in different regions
* Extreme weather in certain parts of nation/world
* History of calendars from different parts of the world
* Sundials - first clocks in the world
* Discuss specific climate related issues in different countries- ex. Deforestation in Brazil, pollution in India, China and waste and excessive use of resources in the USA. Compare it with environmentally friendly policies and practices in countries such as Iceland and Costa Rica.

**Connections to Prior Knowledge*** 6.MS-ESS1-1a. Develop and use a model of the Earth-Sun-Moon system to explain the causes of lunar phases and eclipses of the Sun and Moon.
* 6.MS-ESS1-4. Analyze and interpret rock layers and index fossils to determine the relative ages of rock formations that result from processes occurring over long periods of time.
* 6.MS-ESS2-3. Analyze and interpret maps showing the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence that Earth’s plates have moved great distances, collided, and spread apart.
* 7.MS-ESS2-2. Construct an explanation based on evidence for how Earth’s surface has changed over scales that range from local to global in size.
* 7.MS-ESS2-4. Develop a model to explain how the energy of the Sun and Earth’s gravity drive the cycling of water, including changes of state, as it moves through multiple pathways in Earth’s hydrosphere.
* 7.MS-ESS3-2. Obtain and communicate information on how data from past geologic events are analyzed for patterns and used to forecast the location and likelihood of future catastrophic events

**Connections to Future Knowledge*** HS-ESS1-4. Use Kepler’s laws to predict the motion of orbiting objects in the solar system. Describe how orbits may change due to the gravitational effects from or collisions with other objects in the solar system.
* HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust, the theory of plate tectonics, and relative densities of oceanic and continental rocks to explain why continental rocks are generally much older than rocks of the ocean floor
* HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth’s hydrosphere can create feedbacks that cause changes to other Earth systems.
* HS-ESS2-3. Use a model based on evidence of Earth’s interior to describe the cycling of matter due to the outward flow of energy from Earth’s interior and gravitational movement of denser materials toward the interior.
* HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth’s systems over different time scales result in changes in climate. Analyze and interpret data to explain that long-term changes in Earth’s tilt and orbit result in cycles of climate change such as Ice Ages.
* HS-ESS2-5. Describe how the chemical and physical properties of water are important in mechanical and chemical mechanisms that affect Earth materials and surface processes.
* HS-ESS2-6. Use a model to describe cycling of carbon through the ocean, atmosphere, soil, and biosphere and how increases in carbon dioxide concentrations due to human activity have resulted in atmospheric and climate changes.
* HS-ESS3-1. Construct an explanation based on evidence for how the availability of key natural resources and changes due to variations in climate have influenced human activity.
* HS-ESS3-5. Analyze results from global climate models to describe how forecasts are made of the current rate of global or regional climate change and associated future impacts to Earth systems.

**Common Misconceptions*** Minerals are important but rocks are not.
* All rocks are the same
* Summer is warmer because the Earth is closer to the Sun.
* Students don’t realize that the Earth has a consistent tilt that remains the same regardless of its position in orbit around the Sun.
* Students don’t understand the difference between what is found in a solar system vs a galaxy vs the universe
* Greenhouse Effect and Global warming are the same thing
* [Common Earth Science misconceptions](http://k12s.phast.umass.edu/~nasa/misconceptions.html)
* [More misconceptions](http://oceanmotion.org/html/teachers/misconceptions.htm)

**Instructional Strategies*** [Academic vocabulary for ELLs](https://ssec.si.edu/teaching-ell-students%E2%80%93-teaching-academic-vocabulary)
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| **Resources:****Texts:*** Pearson Interactive Science Grade 7 2017 Massachusetts Textbook Reading Chapters 1-6
* [Minerals on the Edge](https://www.geologyforinvestors.com/minerals-on-the-edge-plate-boundaries-and-minerals/)
* [NASA evidence of Global Warming](https://climate.nasa.gov/evidence/)
* [Live Science article](https://www.livescience.com/58203-how-carbon-dioxide-is-warming-earth.html)
* [Article: Global Warming](https://www.ucsusa.org/global-warming/science-and-impacts/science/scientists-agree-global-warming-happening-humans-primary-cause#.W386XegzpPY)
* [Readworks.org](https://www.readworks.org/brand-new-science-passages#!s0:373/q:/g:/t:0/s:373/pt:A/features:/)

**Websites:*** [What Causes the Earth to Experience the Seasons?](https://www.ndbc.noaa.gov/educate/seasons.shtml)
* [The Reason for the Seasons](https://ed.ted.com/lessons/reasons-for-the-seasons-rebecca-kaplan)
* [Modeling the Tides](https://docs.google.com/document/d/1mB8z2ObdgUk54N2mPMQ3t9E__32boKTMf9ixUTDHkS4/edit) / [Rubric](https://docs.google.com/document/d/1sZVFZpZW47hzQp7nP5Jxv8iOIlguLv5kDyfOwstGd50/edit)
* [Adopt a City - Mini Weather Unit](https://middleschoolscience.com/earth-science/adopt-a-city-mini-weather-unit/)
* [Ocean Tides Explained (Video)](https://www.youtube.com/watch?v=3RdkXs8BibE)
* [Phenomena](https://thewonderofscience.com/msls32#phenomena)
* CDSM Units [4](https://docs.google.com/document/d/10IYpa-z9lNrLpGGT6DhRk5e5Akaom9Mit-lGv80384Q/edit), [5](https://docs.google.com/document/d/1xjyXyzw3dSAeUIrwdHyaCHL7Oma12j0CJsfoPB3JF6Y/edit), and [6](https://docs.google.com/document/d/1yYor0IcGCAPZVBQrhvpocsQ7MGDaK9VYT2tcZbIKdg8/edit)
* <http://www.bozemanscience.com/>
* <https://betterlesson.com/browse/next_gen_science?from=mtp_overview>
* [Tides formation information](https://manoa.hawaii.edu/exploringourfluidearth/physical/tides/tide-formation-and-gravitational-pull)
* [NASA Our solar system](https://solarsystem.nasa.gov/solar-system/our-solar-system/overview/)
* [NASA Solar system and beyond](https://www.nasa.gov/topics/solarsystem/index.html)
* [PBS resources Earth science topics](https://mass.pbslearningmedia.org/subjects/8337/8338/8448?selected_facet=grades:7,8)

**Arts, Music, Media:*** list
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