SUBJECT: SCIENCE/Life Science

BOE APPROVAL: August 2016

Cliffside Park Public Schools

GRADE: 6

Unit 7: Weather and Climate

CONTENT AREA: General Physical Science	GRADES: 6	UNIT: 7 of 7
Pacing: Approx. 1 Month		
Science and Engineering Practices **Developing and Using Models** **• Develop and use a model to describe phenomena. (MS-ESS2-6)** **• Develop a model to describe unobservable mechanisms. (MS-ESS2-4) Planning and Carrying Out Investigations** **• Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)**	**Disciplinary Core Ideas** **ESS2.C: The Roles of Water in Earth's Surface Processes** **• Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)** **• The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)** **• Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)** **• Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) ESS2.D: Weather and Climate • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)** **• Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)** **• The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)**	**Crosscutting Concepts** Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5) Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6) Energy and Matter • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)
Performance Expectations: MS.PS1.A ; MS.PS2.A ; MS.PS3.A ; MS.PS3.B		
Evidence Statement(s): MS.PS1.A ; MS.PS2.A ; MS.PS3.A ; MS.PS3.B		
Essential Question: What factors interact and influence weather and climate?		

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21st Century Skills: 8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.2, 8.1.8.D.3, 8.1.8.D.4, 8.1.8.D.5, 8.2.8.A.5
Career Ready Practices: CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12

Technical Terms (Suggested)	Core Instructional Materials	Assessment Statement
The terms are located in the corresponding chapter of the students text. All terms will be addressed before the beginning of the unit. ** All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.**	MS-ESS2-4, MS-ESS2-5, and MS-ESS2-6- Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard.	Students who understand the concepts are able to: • Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. • Model the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. • Collect data to serve as the basis for evidence for how the motions and complex interactions of air masses result in changes in weather conditions. • Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Modifications

English Language Learners	Special Education	At Risk	Gifted & Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair-share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

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5E Model	
Performance Expectation: MS-ESS2-4 **MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.**	
Engage: Anticipatory Set	Amazon Water Cycle Role Play http://www.calacademy.org/educators/lesson-plans/amazon-water-cycle-role-play
Exploration: Student Inquiry	Modeling Watershed In this activity, students use models to demonstrate how energy from the sun and the force of gravity impacts how groundwater moves. http://betterlesson.com/lesson/638308/modeling-watersheds
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): ESS2.C: The Roles of Water in Earth's Surface Processes Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity.
Elaboration: Extension Activity	Hands-on Activity: Natural and Urban "Stormwater" Water Cycle Models https://www.teacHands-on Activity: Natural and Urban "Stormwater" Water Cycle Modelshengineering.org/view_activity.php?url=collection/usf_/activities/usf_stormwater/usf_stormwater_lesson01_activity1.xml Monthly Climate Tables/Precipitation Charts http://climate.rutgers.edu/stateclim_v1/data/index.html Discussion Questions: How does duration and intensity of precipitation impact the water cycle? Compare the precipitation totals of different regions of NJ How would storms affect the movement of water through the water cycle? Related Activities: Earth Science Week

	http://www.earthsciweek.org/ngss-performance-expectations/ms-ess2-4
Evaluation: Assessment	Assessment Task A: Ground Water Simulator =HYPERLINK("https://docs.google.com/document/d/1QdkThOnTe3vFFRxodlnFHiWuIKnQCF7o7NwAM2UgT0g/edit","Model Rubric")

5E Model	
Performance Expectation: MS-ES2-5 **MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.**	
Engage: Anticipatory Set	Begin lesson by showing a short video clip of a broadcast weather forecast by going to following website: Weather Channel Select the Forecast tab. Choose the national forecast and play this for the class. You can also try any of the major network station websites either in your area or nationally for their videos. After showing the video, ask the class how daily information is presented? What units are given? Where is evidence of fronts, high/low pressure, temperature, precipitation, cloud cover, humidity or wind speeds? Much of what they will be studying is captured in a few minutes of video and now it's their turn to try their hand at predicting the weather.
Exploration: Student Inquiry	Weather Forecasting Online Activity In this lesson, students will analyze weather maps as they develop their own understanding of the relationships between air pressure and clouds, factors that influence climate, weather fonts and the jet stream. http://betterlesson.com/lesson/638300/weather-forecasting-online-activity
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): ESS2.C: The Roles of Water in Earth's Surface Processes The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.

	ESS2.D: Weather and Climate Because these patterns are so complex, weather can only be predicted probabilistically.
Elaboration: Extension Activity	Once students have made their predictions and reviewed them with the teacher, ask them to reflect on the accuracy of their model. Ask them to write a paragraph that compares their prediction to the actual forecast for day 4. What was similar? What was different? Were they surprised by the outcome? Did it bring up any questions? Ask students to hold a discussion with their partner before drafting the final paragraph.
Evaluation: Assessment	Assessment Task A: Weather Forecasting Packets http://betterlesson.com/lesson/resource/3250148/weather-forecasting-internet-packet?from=resource_title Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. Assessment Task B: Weather Forecasting Discussion Questions http://betterlesson.com/lesson/resource/3250150/weather-forecasting-discussion-questions Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

5E Model	
Performance Expectation: MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	
Engage: Anticipatory Set	Begin with a question-answer activity- Have you ever been to the beach on a hot day? Where is it cooler, on the water or on the sand? Demonstration- using two lamps. One lamp should be over a tray of water, one lamp should be over a tray of sand. Students will be able to touch the water and the sand and compare and contrast the difference in the temperature. Thermometers can also be used to determine the temperature of the sand and water. Ask students, If sand and water both absorb energy from the sun why do they feel so different?
Exploration: Student Inquiry	Day 1: Group students into pairs. Conduct the following experiment using these resources:

	Before conducting experiment have students make predictions about the rate of heating for each material. During experiment, students will collect data and make inferences based on their observations. Students will record information in data tables and later analyze their data. 1. Fill one cup with water. 2. Fill one cup with soil. 3. Stand one thermometer in the water and one in the soil. 4. Read and record the temperatures of each cup at room temperature. 5. Place both cups under the lamp. Wait several minutes for cups to absorb the lamp's heat. 6. Read and record the temperatures of each cup a second time. 7. Were there any changes in temperature? The temperature of the soil should rise (heat up) first, as the soil absorbs heat faster than water. 8. Remove the cans from under the lamp and leave at room temperature for several minutes. 9. Read and record the temperatures of each cup. <u>Day 2:</u> Students will create a graph based on the data they collected. They will graph the temperature increase and decrease over a period of minutes. Students will use the data collected to draw a model (line graph) of the land and water and predict how temperature will change during the course of 24 hours (the model should show that the land heats up and cools down faster than the water). Students will present their graphs and models. <u>Day 3:</u> *Exploration Questions* *Hold a class discussion. Ask students to describe the heating and cooling rates of land and water in this investigation. Have students record their findings and answers to the following questions:* *Which material held its heat longer?* *What factors may have influenced your results?* *Why did the land change temperature the faster than the water?* *Next, students will observe animations of land and sea breezes.* *Animation of land and sea breezes:* *http://www.classzone.com/books/earth_science/terc/content/visualizations/es1903/es1903page01.cfm* *They will compare the animation to their model and prediction. Students will have to explain their models.* *- Is the pattern in your model similar or different to those shown in the animation? Explain your findings.*

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Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): ESS2.C: The Roles of Water in Earth's Surface Processes Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. ESS2.D: Weather and Climate Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.
Elaboration: Extension Activity	Students will work in groups to choose a geographical area (with teacher approval) and will develop and present a weather report for this region. Some presentation options include: posters, PowerPoint Presentations and videos. Teachers will identify the components which are to be included in the presentation through the use of a rubric. Additional Resource: http://www.nea.org/tools/lessons/hurricane-season-grades-6-8.html
Evaluation: Assessment	Assessment Task A: Line Graph Model Develop and use a model to describe phenomena. Students will be assessed on accuracy of line graph and their ability to describe phenomena based upon data collected. Use the discussion questions as a guide. Assessment Task B: Model Reflection Questions Students will compare their models to the animation. Students must be able to answer the following question: Is the pattern in your model similar or different to those shown in the animation? Explain your findings.

What factors interact and influence weather and climate?

This unit is broken down into three sub-ideas: Earth's large-scale systems interactions, the roles of water in Earth's surface processes, and weather and climate. Students make sense of how Earth's geo-systems operate by modeling the flow of energy and cycling of matter within and among different systems. A systems approach is also important here, examining the feedbacks between systems as energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of cause and effect, systems and system models, and energy and matter are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in developing and using models and planning and carrying out investigations as they make sense of the disciplinary core ideas. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on MS-ESS2-4, MS-ESS2-5, and MS-ESS2-6.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
1	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple	ESS2-4

	pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.] (MS-ESS2-4)	
2	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.] (MS-ESS2-5)	ESS2-5
3	Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents. [Note: This SLO is based on a disciplinary core idea found in the Framework. It is included as a scaffold to the following SLO.] (ESS2.C)	ESS2,C
4	Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country. [Note: This SLO is based disciplinary core ideas found in the Framework. It is included as a scaffold to the following SLO.] (ESS2.C; ESS2.D)	ESS2.C, ESS2.D
5	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.] (MS-ESS2-6)	ESS2-6

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science & Engineering Practices **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems	**Disciplinary Core Ideas** **PS2.B: Types of Interactions** Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend	**Cross-Cutting Concepts** **Cause and Effect**

in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. **Asking Questions and Defining Problems** Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. **Engaging in Argument from Evidence** Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.	through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). **ETS1.B: Developing Possible Solutions** There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary) **PS2.B: Types of Interactions** Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. **PS2.B: Types of Interactions** Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. **ESS2.C: The Roles of Water in Earth's Surface Processes** The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. **ESS2.D: Weather and Climate**	Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Systems and System Models** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. **Cause and Effect** Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. **Connections to Nature of Science** **Scientific Knowledge is Based on Empirical Evidence** **Science knowledge is based upon logical and conceptual connections between evidence and explanations.**	**Because these patterns are so complex, weather can only be predicted probabilistically.**	

Connections to other DCIs in this grade-band: *MS.PS1.A ; MS.PS2.A ; MS.PS3.A ; MS.PS3.B*

Articulation of DCIs across grade-bands:
3.ESS2.D ; 5.ESS2.A ; HS.ESS2.C ; HS.ESS2.D

Common Core State Standards Connections:
ELA/Literacy - *ELA: RST.6-8.3, WHST.6-8.7*

Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5),(MS-ESS3-5) RST.6-8.1 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-5) RST.6-8.9 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS2-5) WHST.6-8.8 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-6) SL.8.5

Mathematics -

Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5) MP.2 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5) 6.NS.C.5 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-5) 6.EE.B.6