Unit Title:
Grades K-2: Total Solar Eclipse Phenomena
Standard http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf
The solar eclipse phenomena finds direct correlation to 1st grade Earth Science and Physical Science standards. However, Kindergarten and Second grade teachers are encouraged to use these resources below to teach their students about the unusual phenomenon that is occurring across our state, a total solar eclipse. It is important that all students, regardless of grade, be prepared for this amazing science phenomenon preceding the event on August 21st, 2017. The information below begins with the overall learning needed for all K-2 students and then continues with deeper extension activities designed to enhance interest in, understanding of, and appreciation for this once in a lifetime event. **Kindergarten:** Standard K.P.4: The student will demonstrate an understanding of the observable properties of matter. **1st grade:** Standard 1.E.3: The student will demonstrate an understanding of the patterns of the Sun and the Moon and the Sun's effect on Earth. Standard 1.P.2: The student will demonstrate an understanding of the properties of light and how shadows are formed. **2nd grade:** Standard 2.P.4: The student will demonstrate an understanding of the effects of pushes, pulls, and friction on the motion of objects.

New Academic Vocabulary **Some students may need extra support with the following academic vocabulary in order to understand what they are being asked to understand and do. Teaching these terms in an instructional context is recommended rather than teaching the words in isolation. A great time to deliver explicit instruction for the terms would be during the modeling process. Ultimately, the student should be able to use the academic vocabulary in conversation with peers and teachers. These terms are pulled from the essential knowledge portion of the Support Doc 2.0 (http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/) and further inquiry into the terms can be found there.**					
Diagram	Eye safety	Gravity	Light	Properties	Shadow

Solar Eclipse

Prior Knowledge

- 1.E.3 - The student will demonstrate an understanding of the patterns of the Sun and the Moon and the Sun's effect on Earth.
- 1.P.2 - The student will demonstrate an understanding of the properties of light and how shadows are formed.

Subsequent Knowledge

- 4.E.3B.1 - Patterns in the location, movement, and appearance of the Moon
- 4.E.3B.3 - Shadow observations
- 8.E.4B.1 - Characteristics and movements of objects (moon) in the solar system
- 8.E.4B.5 - Describe how data from technologies provide information about objects in the solar system

Teacher Background Information on Total Solar Eclipse

- General background information for teachers on solar eclipses: http://www.mreclipse.com/Special/SEprimer.html
- An Observer's Guide to Viewing the All-American Total Solar Eclipse provided by NSTA: http://static.nsta.org/extras/solarscience/SolarScienceInsert.pdf
- An article that provides general information about eclipses and background as to why this eclipse will be known as the Great American Eclipse: http://static.nsta.org/files/sc1705_60.pdf
- A quick video that explains the three types of solar eclipses: https://www.youtube.com/watch?v=is8OLhGgLAE

Instructional Strategies/Lessons

Strategies and lessons that will enable students to understand the total eclipse phenomena.

1. Eye Safety

Essential Question: How can I safely watch the entire total solar eclipse?

- Eye safety information: All students should receive careful instruction in this area. Concerns for eye safety during a total solar eclipse provided by NASA can be found using this link: https://eclipse.gsfc.nasa.gov/SEhelp/safety.html.
- Information concerning the importance of eye safety, brands of viewers that are available for sale, and the standards they must meet: https://eclipse.aas.org/eye-safety/iso-certification
- Make a Pinhole Projector: https://www.education.com/activity/article/Pinhole_Projection/
- Cereal Box Eclipse Viewer: http://www.hilaroad.com/camp/projects/eclipse_viewer/eclipse_viewer.html

2. Exploration of a Total Solar Eclipse

A. Possible Introductory Activities Through Asking Questions and Defining Problems: *Choose from the following bulleted items to elicit student thinking about total solar eclipses through asking questions. Science begins with questions about phenomena, seeking to gather the evidence necessary to construct an explanation about the phenomena. Asking questions leads towards inquiry and drives science and engineering. It is an essential practice to developing scientific habits of mind. These questions are driven by curiosity, by the desire to understand a phenomenon, or by the need to solve a problem. In science, a question should always lead to an investigation to acquire the necessary evidence in an attempt to answer that question.*

Essential Question: Why will there be darkness during the day on August 21, 2017?

- **Weather Satellite Video of a Total Solar Eclipse:** Prompt student thinking about eclipses and what causes them by showing a time-lapse video that recorded a total solar eclipse passing over the Pacific Ocean. To enhance student discussion, the teacher should not reveal any information about the video. Before viewing, tell students that they will be asked to share one thing about the video and explain why this thing caught his/her interest. Once all students have shared, ask students to share questions that they think of while watching the clip. Encourage students to share some possible answers to the questions. Allow the discussion to be student-driven. Do not yet explain to students what they are observing at this point. Because the video is very short, the teacher may need to replay it multiple times as the discussion progresses. At the Digital Typhoon: Total Solar Eclipse of March 9, 2016 website, find the "Animation" header and click on the "RGB" link below it to view the video.
  http://agora.ex.nii.ac.jp/digital-typhoon/solar-eclipse/20160309/
- **Deep Space Climate Observatory (DSCOVR) Animation of the Moon Crossing the Face of the Earth:** After viewing the weather satellite video of a total solar eclipse and holding discussions about the phenomena, have students watch this animation of the moon crossing the face of the earth. Prompt student ideas by asking the following questions: 1. What do you notice? 2. What questions do you have? 3. What do you think is happening? 4. How are these images related to the ones we watched earlier? 5. What might be the relationship between what we have observed in the different videos? It is very important that the teacher not reveal the "right" answers during this discussion and that the students are given the opportunity to safely share their thinking and answers with each other.
  https://www.nasa.gov/feature/goddard/from-a-million-miles-away-nasa-camera-shows-moon-crossing-face-of-earth
- **Time-lapse video from Iceland:** After viewing the weather satellite and videos, have students view videos of a total

solar eclipse from the surface of the Earth. Some students may, by this time, have come to the conclusion that the phenomenon being observed in all videos and images is a total solar eclipse. If they have not, inform students that the phenomena that they have been watching is a total solar eclipse and explain briefly that the moon moves between the sun and the earth which blocks the light causing a shadow on the earth. Students observe a time-lapse video of a total solar eclipse from Iceland. Again, ask students the following questions: 1. What do you notice? 2. What questions do you have? 3. What do you think is happening? 4. How are these images related to the ones we watched earlier? 5. What might be the relationship between what we have observed in the different videos? Iceland video: https://www.youtube.com/watch?v=ZAxl0S7za8I

Literary techniques to support learning goals: *Teachers may choose from the following literary techniques below that will assist in creating the learning around asking questions about the total solar eclipse and transacting with text. These techniques can be used before, during, or after any guided content.*

1. **Interactive Read Aloud** *(Burkins, 2012): This technique can be used to engage students with text in meaningful ways. After selecting the text, construct open-ended questions that support thoughtful discussion. Some example questions that the teachers could ask while reading include:*

- *What will happen next?*
- *What are you thinking right now?*
- *This reminds me of _____. What does it remind you of?*
- *What picture do you see in your mind right now? What does this make you wonder about?*
- *How is this story like other stories we have read/heard?*

After reading, students can illustrate the main idea of the text, create their own questions about the text (to be posted and answered throughout the unit), and/or share with a partner new learning from the text and what else they may wonder.

2. **Close Reading** *(Beers and Probst, 2012): Using this technique, the teacher takes the students through reading a text multiple times for a purpose in order to get to analysis of the text.*

- *The text is read the first time to get the gist of the text. (What is the main idea and how do you know?)*
- *The text is read a second time to gain understanding. Here the text can be annotated with a "?" for words or phrases students do not know or understand, and an "!" for information students found interesting. After reading, students can share annotations with a partner to help each other identify words/phrases for meaning and share why they found the designated information interesting. Students may then share with the whole*

group.

- *The text is read a 3rd time to determine what the text is not saying (making inferences). The teacher models making inferences by:*
  - *From the text clues, I can conclude that...*
  - *Based on what the text says and what I know, I think . . .*
  - *This information makes me think . . .*
- *After last read, pull all of the information gained to revisit this question: "What is the main idea and how do we know?"*

Note: Teachers may modify for age appropriateness.

Choose from the following resources to support student engagement with the total solar eclipse and transaction with text.

Literary texts:

- Eclipse: Darkness in the Daytime by Franklin Branley: This book gives a simple description of solar eclipses. It also includes the best methods to view them and how astronomers study them.
- Where Did the Sun Go? Myths and Legends of Solar Eclipses Around the World Told with Poetry and Puppetry by Janet Cameron Hoult: This book may provide examples from which students can create their own myths.
- The Moon Book by Gail Gibbons: This book provides information about moon phases, eclipses, and lunar explorations.

Videos and other resources:

- Brainpop Jr. Videos:
  Note: Individuals may obtain a username and password by contacting their local or school library, calling the SC State Library at (803) 545-0210, or emailing Discusoffice@statelibrary.sc.gov.
  https://jr.brainpop.com/science/space/solarsystem/ (Solar System)
- You Tube Videos:
  - https://www.youtube.com/watch?v=is8OLhGgLAE (What is the solar eclipse? The three types of eclipses)
  - https://www.youtube.com/watch?v=E6OtLfszaVI (Solar eclipse explained)
- The following website contains a simplified explanation of Lunar and Solar Eclipses from NASA.
  http://spaceplace.nasa.gov/eclipses/en/
- A Promethean Planet (Class Flow) presentation titled Solar Eclipse by Amanda Neumann explains and shows what happens during a solar eclipse to help students visualize the process taking place. Use the search tool and enter Amanda Neumann. https://classflow.com/classflow/#!/product/itemId=146f7b8431f648d7ad5c3dd6e8b905ee

B. Total Solar Eclipse Exploration Through Modeling *Teachers may choose from the following bulleted options that will assist in creating the learning around modeling and the total solar eclipse. The Science and Engineering Practice of developing and using models is used to understand and represent the total solar eclipse phenomena, processes, and relationships. Models may serve as a way to answer scientific questions asked above by students. Below you will find multiple modeling strategies to choose from to engage your students in this SEP while learning about the total solar eclipse phenomena. Each student should have the opportunity to participate in at least one of these structured investigations to model a total solar eclipse.*

Essential Question: How can I model what happens during a Total Solar Eclipse?

- This lesson introduces the idea of eclipses and has students record information in journals based on several read alouds mentioned on the site. http://www.eyeonthesky.org/lessonplans/10sun_eclipse.html
- This is a whole class activity to develop a model to observe what occurs during a solar eclipse. Materials required include a globe, Styrofoam ball, string or line, lamp or light source, and some type of hook. http://www.eyeonthesky.org/lessonplans/11sun_eclipseclass.html
- Students will develop a moving model of a solar eclipse. Materials required are tape, glue, two empty toilet paper rolls, scissors, aluminum foil, sturdy wire, Styrofoam ball, ping pong ball, cardboard strip, and a stack of books or magazines. http://www.unawe.org/activity/eu-unawe1302/
- Students will create their own model of a solar eclipse. Materials required are a flashlight, an orange, a ball of clay ½ the size of the orange, and a ruler. https://www.teachervision.com/activity/make-your-own-solar-eclipse
- Students will explore how solar eclipses occur using a model. Materials required are a grape (moon), an orange (earth), toothpick, two packing 'peanuts', flashlight, and ruler. http://www.kidseclipse.com/pages/a1b3c1d1.htm
- Big Sun, Small Moon: Why do the sun and moon look like they're the same size in the sky? Students will explore the size difference between the moon and sun and participate in an activity that will explain how the sun's light can be blocked by the moon. Materials required are a large coin (quarter) or a circle of the same size and a large, round dinner plate or a circle of the same size. http://lawrencehallofscience.org/static/diy_sun_science/downloads/diy_ss_bigsun_smallmoon.pdf
- Modeling Eclipses: Students will make observations and construct explanations to explain what happens during a solar eclipse. Materials required are Styrofoam balls and a lamp. There is an extension described in the activity that would require two hula hoops. http://solar-center.stanford.edu/eclipse/model.html

C. Total Solar Eclipse Exploration Through Analyzing and Interpreting Data: *Teachers may choose from the following bulleted options that will assist in creating the learning by analyzing and interpreting data for the total solar eclipse. The Science and Engineering Practice of analyzing and interpreting data is used to understand what occurs during the total solar eclipse phenomena. Analysis and interpretation of data may serve as a way to answer scientific questions asked by students. Below you will find activities that will engage students in the collection and analysis of data while learning about the total solar eclipse phenomena. Each student should have the opportunity to participate in the collection and analysis of data while participating in a structured investigation.*

Essential Question: How does the size difference between the sun, moon, and earth result in the total solar eclipse?

- Students participate in an activity that explores the size difference between the sun, earth, and moon to compare the structures. The teacher may need to direct the discussion through questioning to discuss how distance between the three allows the moon to block out the sun during the total solar eclipse (http://www.eyeonthesky.org/lessonplans/03sun_howbig.html). This activity could be modified with the use of varying materials including markers, Avery stickers, cotton balls, etc.
- Students participate in an activity that explores how distance can affect how the size of objects are perceived. https://sunearthday.nasa.gov/2007/materials/eclipse_smallmoon_bigsun.pdf

3. Possible Culminating Activities *Teachers may choose from the following bulleted options that will focus total solar eclipse learning around constructing explanations, obtaining and evaluating data, and communicating information.*

- Students will develop and use models to communicate information learned about the solar eclipse phenomena. Students will draw a diagram for a friend who lives in another state and cannot see the eclipse. The students should show how a solar eclipse occurs by constructing a paragraph that explains their diagram, using details based on their observations.
- Students will develop and use models to construct explanations to communicate their learning. Provide students in small groups a variety of items and a flashlight. Allow them to develop their own model of a solar eclipse. Students will work in collaborative groups to create the model and then plan their presentation/explanation of their model. The presentation/explanation of the model should include how a solar eclipse occurs. Be sure to share with students the intended audience they will present to which could include (but is not limited to) another class or grade level, administrative guests, invited family members, etc.
- Students will construct explanations to communicate learning. Student products will reflect data collected and analyzed. Students will illustrate the changes that occur during a total solar eclipse by creating a “comic strip” that shows South

Carolina's exposure to the total solar eclipse. Students can be given a choice board where they can select their character (friends, animals, parents, Ancient Egyptians, etc.) and setting (chicken pen, beach, Egypt, mountains) that they will illustrate through the comic-like design. The teacher may need to investigate how to create developmentally appropriate comic strips expectations and designs.
    - Resource for creating comic strip online individually or as a class can be found at the following link: http://www.readwritethink.org/files/resources/interactives/comic/
- Students will create an informational book to communicate their learning on the total solar eclipse. Books could be created with partners or in small groups. Informational books can include the following: title page, observations, diagrams, key facts or information, data, table of contents, and/or glossary.
- Students will read or have read to them solar eclipse myths and legends. They will then construct their own explanation for how a total solar eclipse occurs to someone from the era they chose based on scientific evidence. For instance after reading the Egyptian legend, they will then construct their own explanation or draw a series of pictures with captions explaining the process behind solar eclipses to an ancient Egyptian. The explanation should include diagrams and reflect any data obtained.
    - Read Aloud of Myths, Stories, and Historical References are available at http://www.kidseclipse.com/pages/a1b3c5d0.htm .
    - Read Aloud: Where Did the Sun Go? Myths and Legends of Solar Eclipses Around the World Told with Poetry and Puppetry by Janet Cameron Hoult
    - Storytelling Videos are available at https://sunearthday.nasa.gov/2006/multimedia/storyteller.php.
    - There are numerous myth stories listed under teacher resources at http://thechallengercenter.net/?page_id=1768 .
- Students will construct and design their own "viewing device" for the solar eclipse. Students will present their own device and provide "how to" instructions. Students can then vote on the winning device and share the instructions for that device with students in the school and/or community. Some resources for basic viewing devices listed below.
    - Make a Pinhole Projector: https://www.education.com/activity/article/Pinhole_Projection/
    - Cereal Box Eclipse Viewer: http://www.hilaroad.com/camp/projects/eclipse_viewer/eclipse_viewer.html

Extension Activities

These strategies and lessons will enable students to understand the total eclipse phenomena with more direct ties to specific grade level Performance Indicators. Teachers are encouraged and have the discretion to use any resources, regardless of grade level, which may strengthen their students' needs and understanding of the total solar eclipse. These are designed to enhance interest in, understanding of, and appreciation for this once in a lifetime event. Performance Indicators are listed below in purple. The text within the Performance Indicators highlighted in *orange* and *italicized/underlined* shows connections to SEPs.

Note: Refer to the literary techniques shared in the previous section to facilitate learning with any literary/informational texts shared below.

Kindergarten Performance Indicator:
K.P.4 The student will *demonstrate an understanding* of the observable properties of matter.

Exploration of the properties of the sun, earth, and moon.
Essential Question: How do the properties of the earth, sun, and moon lead to a solar eclipse?

Vocabulary: properties, earth, sun, moon

1. Possible introductory activities:

Choose from the following resources to support student engagement with the total solar eclipse and transaction with text.

Literary texts:

- Me and My Place in Space by Joan Sweeney*:* This book provides information about space beginning with earth, our sun, and the stars.
- Rise the Moon by Eileen Spinelli: This book provides information about the moon.
- The Moon Book by Gail Gibbons: This book describes many aspects of the moon such as the moon's exploration, eclipses, and moon phases.
- Sun by Steve Tomecek: This book provides information about the sun.
- The Sun is My Favorite Star by Frank Asch: This book provides information about the sun.

2. Instructional Strategies: The properties of size, shape, and pattern of motion cause the moon to block the sun's light from the earth resulting in the phenomena known as the total solar eclipse.

- Students will create a flip book to display observable properties of the earth, moon, and sun based on the texts read by the teacher. Each flap of the flip book will represent the earth, moon, and sun. Have students write observable properties specific to the earth, moon, and sun.
- Students explore the size differences between the sun, earth, and moon; then students will compare the sizes. http://www.eyeonthesky.org/lessonplans/03sun_howbig.html
  Teachers may choose to modify this activity using cotton balls, clay, markers, etc.

First Grade Performance Indicator:
1.E.3A.3 *Obtain and communicate information* to describe how technology has enabled the study of the Sun, the Moon, planets, and stars.

Exploration of the Moon
Essential Question: How has technology enabled us to learn about the interaction between the sun and moon?

Vocabulary: technology, exploration

1. Possible introductory activities:
Choose from the following resources to support student engagement with the total solar eclipse and transaction with text.

Literary texts:
- I Took the Moon for a Walk by Carolyn Curtis and Alison Jay: This book provides a poem that teaches fun facts about the moon.
- Papa, Please Get the Moon for Me by Eric Carle: This book encourages students to observe changes in the moon.
- The Moon Over Star by Dianna Hutts Aston: This book is told by a girl who witnessed the "first moon landing." The book can be used to get the students excited about the exploration of the moon.

Videos and other resources:
- *Brainpop Jr. Videos:*
  Note: Individuals may obtain a username and password by contacting their local or school library, calling the SC State Library at (803) 545-0210, or emailing Discusoffice@statelibrary.sc.gov.
  - https://jr.brainpop.com/science/space/sun/ (Sun)
  - https://jr.brainpop.com/science/energy/light/ (Light)

2. Instructional Strategies: Information gathered by scientific technology about the solar system has resulted in a better understanding of how and why phenomena such as the total solar eclipse occurs.

- This online book provides information about different technologies that have allowed us to learn more about space. Students will obtain information and communicate their learning by explaining what these tools help astronomers to do. Students can create a flipbook to communicate about the technologies and how they are used to help us study space.
  http://spaceplace.nasa.gov/review/story-space-**tools**/supercool_space_**tools**_single_pages.pdf

- Students and teachers can visit this website to gather information about different technologies that have allowed us to learn more about the sun, moon, planets, and stars. The website has timelines and educational songs and games. Students will select an astronomy topic to research. They will communicate what they learned through illustrations and writing. http://www.kidsastronomy.com/explore_index.htm

First grade Performance Indicator:
1.E.3A.2 Use data from personal observations to describe, predict, and *develop models* to exemplify how the appearance of the moon changes over time in a predictable pattern.

Phases of the Moon
Essential Question: What do moon phases have to do with an eclipse?

Vocabulary: phases, full moon, new moon, crescent, quarter, waxing, waning, gibbous, reflect

1. **Possible introductory activities:**
Choose from the following resources to support student engagement with the total solar eclipse and transaction with text.

Literary texts:
- Faces of the Moon by Bob Crelin: This book describes the moon's phases.
- The Moon Seems to Change by Franklyn Branley: This book provides information about the phases of the moon and includes a science investigation at the end of the book to explore the moon phases.

Videos and other resources:
- BrainPop Jr Video
  Note: Individuals may obtain a username and password by contacting their local public library or school library, or by calling the SC State Library at (803) 545-0210, or emailing Discusoffice@statelibrary.sc.gov.
  - https://jr.brainpop.com/science/space/moon/ (Phases of the Moon)

2. Instructional Strategies: The phenomena of a total solar eclipse can only occur during a new moon because the moon is located between the earth and sun. This means that no light reflected by the moon can be seen on earth.

- Students will participate in several activities that provide the opportunity for them to describe, predict, and develop models to show how the moon changes in predictable patterns (moon phases).

http://spaceracers.org/pdf/moon-phases-lesson-plan.pdf

- Students will have "moon discussions," make cookie moons, make moon phases flipbooks, and conduct moon observations. http://spaceracers.org/en/parents-educators/lesson-plans/moon-phases
- Students will create their own Moon Phases Mini book. http://www.scholastic.com/parents/resources/free-printable/science-printables/minibook-moon-phases
- Students will develop a model of the moon phases using Oreo cookies. http://www.startwithabook.org/content/pdfs/Moon_Oreo_Phases.pdf
- Students will record their nightly observations of the moon to identify patterns in the different phases of the moon using a Phases of the Moon Observation Log. https://www.pinterest.com/pin/238127899025636486/

First Grade Performance Indicator:

1.P.2A.3 *Conduct structured investigations* to answer questions about how shadows change when the position of the light source changes.

Lights and Shadows

Essential Question: How does the interaction of light and shadows result in an eclipse seen on earth?

Vocabulary: light, shadow

1. **Possible introductory activities:**

Choose from the following resources to support student engagement with the total solar eclipse and transaction with text.

Literary texts:

- What Makes A Shadow? by Clyde Robert Bulla, June Otani: This book explains how shadows are made and helps students learn to make their own shadows.
- Shadow Games A Book of Hand & Puppet Shadows by Bill Mayer and Peter Foy: This book helps students learn to make shadows with their hands.
- Moonbear's Shadow by Frank Asch. This book is a fictional story about a bear who is scared away by his own shadow. The bear tries to come up with different ways to escape his shadow.
- Nothing Sticks Like A Shadow by Ann Tompert: This book is a fictional story of a rabbit that tries to escape his shadow to win a bet.

- My Shadow- a poem by Robert Louis Stevenson - A Child's Garden of Verses: This book helps students learn ways to interact with their shadows.

Videos and other resources:

- *Brainpop Jr. Videos:*
- Note: Individuals may obtain a username and password by contacting their local or school library, calling the SC State Library at (803) 545-0210, or emailing Discusoffice@statelibrary.sc.gov.
    - https://jr.brainpop.com/science/energy/light/ (Light)
    - https://jr.brainpop.com/science/space/sun/ (Sun)

2. Instructional Strategies: A total solar eclipse occurs when the moon blocks light from the sun resulting in a shadow on the surface of the earth.

- Students will conduct structured investigations to explore shadows. https://stardate.org/sites/default/files/pdfs/teachers/ShadowPlay.pdf
- Students will conduct structured investigations exploring light and shadows. http://spaceracers.org/pdf/shadow-time-lesson-plan.pdf
- Students will create solar prints. As discussions occur concerning the sun, these solar prints would support the conversation. http://www.creativefamilyfun.net/2013/06/art-science-sun-prints.html

Second Grade Performance Indicator:
2.P.4A.3 Construct explanations of the relationship between the motion of an object and the pull of gravity using observations and data collected.

Exploration of Motion
Essential Question: How does the motion of objects in our solar system result in a total solar eclipse?

Vocabulary: motion, gravity, push, pull, revolve, orbit

1. **Possible introductory activities:**

Choose from the following resources to support student engagement with the total solar eclipse and transaction with text.

Literary texts:

- Motion: Push and Pull, Fast and Slow *by* Darlene R. Stille*:* This explores the concepts of motion.
- Gravity is a Mystery *by Franklyn M. Branley:* This book explores and teaches students about gravity.

Videos and other resources:

- *Brainpop Jr. Videos:*
  Note: Individuals may obtain a username and password by contacting their local or school library, calling the SC State Library at (803) 545-0210, or emailing Discusoffice@statelibrary.sc.gov.
  - https://jr.brainpop.com/science/forces/pushesandpulls/ (Pushes and Pulls)
- You Tube: Force and Motion-Bill Nye Clip
  - https://www.youtube.com/watch?v=8iKhLGK7HGk
- Force and Motion Magic School Bus Video
  - http://www.dailymotion.com/video/x35n1nv

2. **Instructional Strategies:** Gravity holds the sun, earth, and moon in patterns of motion that sometimes results in the phenomena known as a total solar eclipse.

- Students will participate in a series of demonstrations of how gravity works. Discussion questions lead students to a better understanding of how gravity acts as a force to keep the sun, earth, and moon in the positions that sometimes result in a total solar eclipse.
  https://yurisnight.net/download/86
- The following site provides activities for elementary and middle-school students. Students participate in activities that represents the motion of jumping in relation to gravity. The activities can be adjusted to fit the needs of your students.
  http://www.rider.edu/files/tlc-HillsboroughGravityBIMRaytown.pdf

***Science and Engineering Practices**

Support for the guidance, overviews of grade level progressions, and explicit details of each SEP can found in the Science and Engineering Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf). It is important that teachers realize that the nine science and engineering practices are not intended to be used in isolation. Even if a performance indicator for a given standard only lists one of the practices as a performance expectation, scientists and engineers do not use these practices in isolation, but rather as part of an overall sequence of practice. When educators design the learning for their students, it is important that they see how a given performance expectation fits into the broader context of the other science and engineering practices. This will allow teachers to provide comprehensive, authentic learning experiences through which students will develop and demonstrate a deep understanding of scientific concepts.

The SEPs are listed within the different applications of learning in this document, but can also be accessed by clicking on the SEP support document link above.

***Cross Cutting Concepts** **(http://www.nap.edu/read/13165/chapter/8)**

The link above provides support from the Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012). The text in blue and *italicized/underlined* below provides a brief explanation of how the specific content ties to the CCC's. The concepts have applications across all domains of science. Therefore, they can be considered as a way of linking together all science domains.

1. **Patterns:** The National Research Council (2012) states that "observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *The earth and moon move in predictable patterns in relationship to the sun and each other. These patterns of motion sometimes result in shadows known as an eclipse. Light moves in a predictable pattern. If an object does not allow light to pass through it, the light is blocked producing a shadow.*

2. **Cause and effect- Mechanism and explanation:** The National Research Council (2012) states that "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84). *A solar eclipse is the result of a causal relationship between the earth, sun, and moon. The moon moves between the earth and sun resulting in light from the sun being blocked from the earth resulting in a shadow on the earth's surface. This is known as solar eclipse.*

3. **Scale, proportion, and quantity:** The National Research Council (2012) states that "in considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance" (p. 84). *During an eclipse, the light from the sun (a much larger object) can be blocked by the moon (a smaller object) due to the greater distance the sun is from the earth.*

4. **Systems and system models:** The National Research Council (2012) states that, "defining the system under study-specifying its boundaries and making explicit a model of that system-provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p.84). *Models can be used to show how motions in the Sun-Earth-Moon system cause earth phenomena such as a solar eclipse.*

**Teachers have the discretion to enhance the selected SEP's and CCC's.*

Additional Resources:

Should teachers wish to provide students with additional experiences related to the total solar eclipse, the following resources are recommended.

- This website provides a list of books, articles, and websites that can provide teachers and students with information on the total solar eclipse.
  http://www.astrosociety.org/education/astronomy-resource-guides/eclipse-resource-guide/

- This website provides information on where the total solar eclipse will be able to be seen, when it will occur, how it can be viewed safely, and what an eclipse is. This site provides related SC Curriculum Standards covered through learning about the

total solar eclipse and a list of resources for teachers about the solar eclipse.
http://thechallengercenter.net/?page_id=1768

- This is the South Carolina State Museum website and provides information on the activities the museum will offer in preparation for the viewing of the total solar eclipse.
http://scmuseum.org/eclipse/

- This teacher's resource book by Andrew Fraknoi and Dennis Schatz contains activities that help teachers prepare their students for the eclipse.
http://www.nsta.org/store/product_detail.aspx?id=10.2505/9781941316078

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