Science Curriculum

Grade One Unit Two

Weather and Air on Earth
Course Description

In unit one, students engage in an engineering challenge to develop habits of mind and classroom practices that will be reinforced throughout the school year. In unit two, students build on the science concepts of weather and how the Sun warms Earth's surface, introduced in kindergarten. They use new tools and methods to enrich observations. Students find out about properties of air by exploring how objects interact with air. Students observe daily changes in air temperature and connect them to the daily movement of the Sun in the sky. They monitor changes in hours of daylight over the seasons and connect them to changing weather conditions. And they find the Moon in the day and night skies and monitor its movement over the month. In unit three, students learn that sound comes from vibrating objects. They explore how to change sound volume and pitch, and develop simple models for how sound travels from a source to a receiver. With light, students also work with sources and receivers. They find out what happens when materials with different properties are placed in a beam of light, and explore how to create and change shadows and reflections. Students explore how to use sound and light devices to communicate information and compare the ways that animals use their senses (ears and eyes) to gather information about their environment. In unit four, students observe firsthand the structures of plants and discover ways to propagate new plants from mature plants (from seeds, bulbs, roots, and stem cuttings). They observe and describe changes that occur as plants grow, and compare classroom plants to those in the schoolyard. They design terrariums (habitat systems) and provide for the needs of both plants and animals living together in the classroom. Students explore variation in the same kind of organism, including variation between young and adults. They learn about the behaviors of parents to help their young (offspring) survive. And they explore structure and function relationships as they sort different kinds of animal and plant structures. Throughout all units, students engage in science and engineering practices by collecting and interpreting data to build explanations and designing and using tools to answer questions. Students gain experiences that will contribute to the understanding of the crosscutting concepts of patterns; cause and effect; systems and system models; and structure and function.
Teachers may choose from a variety of instructional approaches that are aligned with 3 dimensional learning to achieve this goal. These approaches include:

<table>
<thead>
<tr>
<th>Inquiry Kit Instruction (modified)</th>
<th>Challenge Based Instruction</th>
<th>5 E Instructional Model (BSCS)</th>
<th>Culturally Relevant Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project-Based Instruction</td>
<td>Tinkering Pedagogy</td>
<td>Learning Progressions</td>
<td>Knowledge Integration</td>
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<tr>
<td>Model-based Reasoning</td>
<td>Place-based Instruction</td>
<td>Meaningful Expertise Instruction</td>
<td>Emergent Investigations (RSS)</td>
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</table>
**Pacing Chart**

*This pacing chart is based upon 160 minutes of instruction per cycle (roughly 120 days).*

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering &amp; Design</td>
<td>10 days</td>
</tr>
<tr>
<td>2</td>
<td>Weather &amp; Air on Earth</td>
<td>30 days</td>
</tr>
<tr>
<td>3</td>
<td>FOSS Sound &amp; Light</td>
<td>40 days</td>
</tr>
<tr>
<td>4</td>
<td>FOSS Plants &amp; Animals</td>
<td>40 days</td>
</tr>
</tbody>
</table>

**Unit Summary**

In this unit of study, students observe, describe, and predict some patterns in the movement of objects in the sky. The crosscutting concept of patterns is called out as an organizing concept for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations and analyzing and interpreting data. Students are also expected to use these practices to demonstrate understanding of the core ideas.

**Student Learning Objectives**

- Use observations of the sun, moon, and stars to describe patterns that can be predicted. *[Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.] [Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.](1-ESS1-1)*

- Use and share observations of local weather conditions to describe patterns over time. *[Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] [Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.](K-ESS2-1)*

- Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. *(K-2-ETS1-1)*
<table>
<thead>
<tr>
<th>NJDOE Student Learning Objective</th>
<th>Essential Questions</th>
<th>Content Related to DCI’s</th>
<th>Sample Activities</th>
<th>Resources</th>
</tr>
</thead>
</table>
| Students will gather data regarding weather conditions and use symbols to represent weather data.  
1-ESS1-2 | What is the weather today? | • Weather describes conditions in the air outside. | Students share what they know about weather and how it relates to air. Rotating class meteorologist begins recording daily weather observations on a class calendar. Students use symbols to indicate weather type and relative temperature (i.e. sunny and cold). | Suggested books:  
*Cloudy with a Chance of Meatballs* - Judi Barrett  
*Weather Words and What They Mean* - Gail Gibbons  
Weather symbols, weather calendar and graph (in resource folder) |
| Students will gather data regarding weather conditions and look for patterns related to the movement of the sun in the sky.  
1-ESS1-2 | What time of day is the air the warmest? | • Temperature describes how hot or cold the air is. Temperature is measured with thermometer.  
• The Sun rises in the east, moves across the sky and sets each day at predictable time. The Sun warms the Earth. | Students learn to use a thermometer and take turns measuring and recording the temperature. They construct a model thermometer and practice reading relative temperature. They monitor sunset and gather data about how the amount of daylight is changing over time each day. They collect data on temperature changes during the day. | Thermometer Picture (in resource folder)  
*“The Thermometer Song” YouTube video* |
| Students will gather data regarding weather conditions and look for patterns related to the types of clouds that they observe in the sky.  
1-ESS1-2 | What types of clouds are in the sky today? | • Wind moves clouds in the sky.  
• Clouds are made of liquid water drops that fall to Earth as rain; water is also in the air as a gas that we can’t see. | Students will observe and compare several types of clouds and discuss how they move across the sky. The class discusses the kinds of clouds that bring rain or snow. Students can use rain gauge to measure rain or snowfall. | Suggested books:  
*The Cloud Book* - Tomie dePaola  
[Click here for YouTube video Read Aloud](#) |
| Students will gather data regarding patterns they observe of the movement of the moon. **1-ESS1-2** | What time of day can we observe the moon? | • The Moon can be seen sometimes at night and sometimes during the day. It looks different every day, but looks the same again about every 4 weeks.  
• The Moon can be observed moving across the sky; we see it at different locations in the sky, depending on the time of day or night.  
• There are more stars in the night sky than anyone can easily count. | Students discuss their observations of the day and night sky, and begin to make systematic observations of the Moon. The observations will continue during the daytime and nighttime for 4 weeks. | **Suggested Books:**  
*When the Moon is Full* - Penny Pollock  
*The Moon Book* - Gail Gibbons  
*The Moon Seems to Change* - Franklyn Branley |
| --- | --- | --- | --- | --- |
| Students will gather data to show how the wind moves. **K-ESS2-1** | How can we observe the wind? | • Bubbles are filled with air.  
• Wind is moving air.  
• Bubbles can show the changing direction and speed of the wind. | Students use bubble wands to blow bubbles outdoors. They investigate how the air moves bubbles in a variety of locations around the school building. | **Suggested Books:**  
*Ollie and the Wind* by Ronojoy Gosh ([click here for YouTube video Read Aloud](https://www.youtube.com/watch?v=Gubo3bOvuW8))  
*The Wind Blew* by Ann Hutchins ([click here for YouTube video Read Aloud](https://www.youtube.com/watch?v=SqbTbxWT1o))  
| Students will use weather instruments to measure the strength and speed of the wind. | How strong is the wind today? | • Meteorologists use wind scales (models) to describe the strength of the wind.  
• Meteorologists use anemometers to measure the speed of the wind. | Students go outdoors to feel and observe the wind. They are introduced an anemometer, an instrument used to measure wind speed. They develop their own wind scale, using appropriate vocabulary (calm, breezy, etc.) | **Anemometer instructions (in resource folder)**  
**Weather instruments video:** [https://www.youtube.com/watch?v=SqbTbxWT1o](https://www.youtube.com/watch?v=SqbTbxWT1o)** |
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<th><strong>K-ESS2-1</strong></th>
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| Students compare the movement of a pinwheel to that of an anemometer to gather evidence about wind speed. | How can pinwheels be used to observe the wind? | ● Meteorologists use anemometers to measure the speed of the wind.  
● A pinwheel provides evidence about how fast the wind is blowing. | Students construct a pinwheel and observe how it operates when they blow on it, move it through air, and take it outdoors in the wind. They compare the pinwheel to the anemometer they saw in class. | http://kidsactivitiesblog.com/53474/giant-paper-pinwheels |
| **K-ESS2-1** | What does the wind vane tell us about the wind? | ● Meteorologists use wind vanes to observe the direction of the wind.  
● A wind vane points in the direction the wind is coming from. | Students learn about wind vanes, instruments used to indicate wind direction. Students compare the movement of the wind vanes to that of bubbles and clouds. | https://www.education.com/activity/article/wind_vane_first/ |
| **K-ESS2-1** | How can we use what we know about wind to help us fly a kite? | ● Wind lifts kites up into the sky.  
● An anemometer can give evidence that there is good wind for kite flying.  
● A wind vane points in the directions the wind is coming from. | Students construct kite. They use the weather instruments to determine the best day and location for flying kites. | Suggested Reading:  
*Kite Day* by Will Hillenbrand  
Click here for YouTube Read Aloud  
Go Fly a Kite Activity (in resource folder) |
Unit Project (Choose 1)

Building the kite meets the requirements for a unit project.

What It Looks Like in the Classroom

In this unit of study, students observe, describe, and predict some patterns of the movement of objects in the sky. Throughout the unit students look for patterns as they plan and carry out investigations and analyze and interpret data.

In this unit’s progression of learning, students develop the understanding that natural events happen today as they happened in the past, and that many events are repeated. In addition, they observe and use patterns in the natural world as evidence and to describe phenomena. First graders ask questions and use observations of the sun, moon, and stars to describe apparent patterns of change in each. These patterns are then used to answer questions and make predictions. Some examples of patterns include:

- The sun and moon appear to rise in one part of the sky, move across the sky, and set.
- The shape of the moon appears to change over a period of time in a predictable pattern.
- Stars, other than our sun, are visible at night but not during the day.

After students observe and document these types of patterns over a period of time, they need opportunities to describe the patterns and to make predictions about the changes that occur in the objects in the sky. It is important that they use observed patterns as evidence to support predictions they might make about the sun, moon, and stars. In this unit, students also learn that seasonal patterns of sunrise and sunset can be observed, described, and predicted. They relate the amount of daylight to the time of year by making observations at different times of the year. Over time, they collect and use data in order to identify the relationship between the amount of sunlight and the season. Grade 1 students are expected to make relative comparisons of the amount of daylight from one season to the next, and assessment should be limited to relative amounts of daylight, not quantifying the hours or time of daylight.

Students also build in their prior knowledge regarding weather, investigating how weather tools are used to observe and measure wind conditions. After collecting data regarding wind conditions, students engage in an engineering challenge to create a kite that can harness the wind to fly in a predetermined area.

Modifications

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations)
Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.

Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).

Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

Use project-based science learning to connect science with observable phenomena.

Structure the learning around explaining or solving a social or community-based issue.

Provide ELL students with multiple literacy strategies.

Collaborate with after-school programs or clubs to extend learning opportunities.


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Research on Student Learning

The ideas "the sun is a star" and "the earth orbits the sun" appear counter-intuitive to elementary-school students. The ideas "the sun is a star" and "the earth orbits the sun" and are not likely to be believed or even understood in elementary grades. Whether it is possible for elementary students to understand these concepts even with good teaching needs further investigation.

Explanations of the day-night cycle, the phases of the moon, and the seasons are very challenging for students. To understand these phenomena, students should first master the idea of a spherical earth, itself a challenging task. Similarly, students must understand the concept of "light reflection" and how the moon gets its light from the sun before they can understand the phases of the moon. Finally, students may not be able to understand explanations of any of these phenomena before they reasonably understand the relative size, motion, and distance of the sun, moon, and the earth (NSDL, 2015).

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Prior Learning
This is the first opportunity for students to encounter these ideas.

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<th>Future Learning</th>
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**Grade 3 Physical Science**
- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object’s speed or direction of motion. [Note: The emphasis is qualitative and conceptual understanding of forces. Quantitative understanding is at a later grade level.]

- The patterns of an object’s motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. [Note: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.]

**Grade 5 Earth Science**
- The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.

- The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

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<tr>
<th>Interdisciplinary Connections</th>
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**English Language Arts/Literacy**
In this unit of study, students need opportunities to participate in shared research and writing projects about patterns of change in the sky. For example, students can use online resources or books to research the patterns of change that are visible over time when we observe the objects in the sky. With guidance from adults, students could create books that describe and illustrate the different patterns of change observed in objects in the sky. They could also describe and illustrate the relative amount of daylight in relation to the season using a sequenced set of journal entries or in a sequence-of-events foldable.

**Mathematics**
Students need opportunities to represent and interpret data and to use addition and subtraction.
The following examples from NGSS Appendix L could provide guidance for instruction and should be done with teacher support:

**Science example 1:** There were 16 hours of daylight yesterday. On December 21, there were 8 hours of daylight. How many more hours of daylight were there yesterday than on December 21?

**Science example 2:** Based on the data collected and posted on the bulletin board so far, which day has been the longest of the year so far? Which day has been the shortest?
Technology Operations and Concepts

- Create professional documents (e.g., newsletter, personalized learning plan, business letter or flyer) using advanced features of a word processing program.

Creativity and Innovation

- Synthesize and publish information about a local or global issue or event on a collaborative, web-based service.

Communication and Collaboration

- Participate in an online learning community with learners from other countries to understand their perspectives on a global problem or issue, and propose possible solutions.

Digital Citizenship

- Model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics.

Research and Information Literacy

- Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.

Critical Thinking, Problem Solving, Decision Making

- Use an electronic authoring tool in collaboration with learners from other countries to evaluate and summarize the perspectives of other cultures about a current event or contemporary figure.

Career Ready Practices

<table>
<thead>
<tr>
<th>Career Ready Practices</th>
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<tbody>
<tr>
<td>Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.</td>
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<tr>
<td>CRP1. Act as a responsible and contributing citizen and employee</td>
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<tr>
<td>Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.</td>
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<tr>
<td>CRP2. Apply appropriate academic and technical skills.</td>
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<tr>
<td>Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic</td>
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</table>
skill in a workplace situation.

**CRP4. Communicate clearly and effectively and with reason.**
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others’ time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

**CRP6. Demonstrate creativity and innovation.**
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

**CRP10. Plan education and career paths aligned to personal goals.**
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

**CRP11. Use technology to enhance productivity.**
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks of technology applications, and they take actions to prevent or mitigate these risks.

**CRP12. Work productively in teams while using cultural global competence.**
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team
Appendix A: NGSS and Foundations for the Unit

Use observations of the sun, moon, and stars to describe patterns that can be predicted. [Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.] [Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.] (1-ESS1-1)

Use and share observations of local weather conditions to describe patterns over time. [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] [Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.] (K-ESS2-1)

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

<table>
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<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
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<tbody>
<tr>
<td><strong>Planning and Carrying Out Investigations</strong></td>
<td><strong>ESS1.A: The Universe and its Stars</strong></td>
<td><strong>Patterns</strong></td>
</tr>
<tr>
<td>• Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(1-PS4-3)</td>
<td>• Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (1-ESS1-1)</td>
<td>• Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (1-ESS1-1),(1-ESS1-2)</td>
</tr>
<tr>
<td><strong>Planning and Carrying Out Investigations</strong></td>
<td><strong>ESS1.B: Earth and the Solar System</strong></td>
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<tr>
<td>• Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1-ESS1-2)</td>
<td>• Seasonal patterns of sunrise and sunset can be observed, described, and predicted. (1-ESS1-2)</td>
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<tr>
<td><strong>Analyzing and Interpreting Data</strong></td>
<td></td>
<td>Connections to Nature of Science</td>
</tr>
<tr>
<td>• Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1-ESS1-1)</td>
<td></td>
<td>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</td>
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<td>• Science assumes natural events happen today as they happened in the past. (1-ESS1-1)</td>
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<td>• Many events are repeated. (1-ESS1-1)</td>
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<tr>
<td>English Language Arts</td>
<td>Mathematics</td>
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<td>Participate in shared research and writing projects (e.g., explore a number of</td>
<td>Reason abstractly and quantitatively. (1-ESS1-2) MP.2</td>
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<tr>
<td>“how-to” books on a given topic and use them to write a sequence of instructions).</td>
<td>Model with mathematics. (1-ESS1-2) MP.4</td>
<td></td>
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<tr>
<td>(1-ESS1-1),(1-ESS1-2) W.1.7</td>
<td>Use appropriate tools strategically. (1-ESS1-2) MP.5</td>
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<td>With guidance and support from adults, recall information from experiences or gather</td>
<td>Use addition and subtraction within 20 to solve word problems involving</td>
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<tr>
<td>information from provided sources to answer a question. (1-ESS1-1),(1-ESS1-2) W.1.8</td>
<td>situations of adding to, taking from, putting together, taking apart, and</td>
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<td></td>
<td>comparing, with unknowns in all positions, e.g., by using objects, drawings,</td>
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<td></td>
<td>and equations to represent the problem. (1-ESS1-2) 1.OA.A.1</td>
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<td>Organize, represent, and interpret data with up to three categories; ask and</td>
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<td>answer questions about the total number of data points, how many in each</td>
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<td>category, and how many more or less are in one category than in another. (1-</td>
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<td></td>
<td>ESS1-2) 1.MD.C.4</td>
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**Rubric:** See Resource Folder

**Field Trip Ideas:** PANTHER planetarium, Liberty Science Center, American Museum of Natural History