

# ***The Sun and The Water Cycle Educator Guide***

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### ***The Sun and The Water Cycle Teacher Book Walk Cue Chart***

Use this tool to help guide the discussion between you and your students throughout the story.

<b>Page #</b>	<b>Description</b>	<b>Suggestions</b>	<b>Extensions, Resources, Science Standards*</b>
Before reading	<i>Review vocabulary.</i> Have students say each word and review the definitions. Ask them what they already know about the words.	Use the glossary and diagram on pages 24-25 of the book to review vocabulary with students.	<u>Resource:</u> A graphic organizer is located on pages 12-15 of this educator guide. It can be used to help students comprehend vocabulary words and concepts from the story.
Before reading	<i>Picture Walk.</i> Browse the illustrations on the cover through page 15 of the book with students. Have them identify the types of characters and settings they see, and examine diagrams that are labeled with vocabulary words.	Remind students to read labels on pictures in addition to making observations about what they see in the pictures.	
Before reading	<i>Predictions.</i> Have students use the book's vocabulary, title, and illustrations to make predictions about what they will learn from the story.	Have students record their ideas so they can refer back to them after reading the book.	
Pg. 1	<p><i>a) Assess &amp; Activate Prior Knowledge.</i> Have students discuss what they already know about the water cycle, and what role the Sun plays in it.</p> <p><i>b) Check for Understanding.</i> Check to see if students understand what Marisol means when she says she hopes the Sun will come out and “dry everything up”.</p>	<p>a) The labeled diagram on page 2 of the book may help students if they have trouble recalling this information.</p> <p>b) Ask students if they have seen the Sun dry things after it rains (i.e. puddles dry up). You can explain that this is due to evaporation if they are familiar with the concept to link to their prior knowledge. (Evaporation is introduced on pages 10-11 of the story.)</p>	<u>Extension:</u> Camilla Corona (the “Space Chicken”) is shown on Marisol’s backpack and hidden throughout the book. She promotes STEM subjects in a fun way for kids. Students can read about her and the NASA Solar Dynamics Observatory (SDO) mission on page 26 of the book.

\*Refer to the ***Science Standards Alignment*** section of this educator guide (pages 22-23) for more details on the standards that are addressed on each page.

Pg. 2	<p>a) <i>Check for Understanding.</i> Check to see if students understand what Sofia means when she says water travels “on, above, and below the Earth’s surface”.</p> <p>b) <i>Check for Understanding.</i> Ask students why the oceans would be frozen if there were no Sun, as Marisol points out.</p>	<p>a) Ask students to share examples of water that is located on, above, and below the surface of Earth (i.e. a puddle is on the surface, rain is above it, and groundwater is below it). They can refer to the diagram on page 2 of the book to help them.</p> <p>b) The point can be made that melting and freezing are also processes that are part of the water cycle, although they are not discussed in the story. Students can come up with ways that these processes occur in the water cycle (i.e. heat causes snow and ice to melt, water freezes to make ice).</p>	<p>Resource: A glossary is located on pages 24-25 of the book. Bolded words in the story are listed in the glossary.</p> <p><i>*Standards addressed on page 2:</i> <b>Next Generation Science Standards (NGSS) addressed:</b> <i>Disciplinary Core Ideas (DCI):</i> 4-PS3.B(1), MS-ESS2.A(1); <i>Crosscutting Concepts (CC):</i> Energy and Matter, Cause and Effect</p> <p><b>National Science Education Standards (NSES) addressed:</b> <i>Grades K-4:</i> B.1.3; <i>Grades 5-8:</i> D.1.5</p>
Pg. 3	<p>a) <i>Assess &amp; Activate Prior Knowledge.</i> Have students discuss what they know about <b>heat energy</b> and <b>water vapor</b>. (Note: Bolded words in the story are listed in the book’s glossary).</p> <p>b) <i>Assess &amp; Activate Prior Knowledge.</i> Have students discuss what they already know about the three states of matter that Marisol mentions (<b>solid</b>, <b>liquid</b>, and <b>gas</b>).</p>	<p>a) Have students identify different sources of heat energy (i.e. Sun, campfire, oven). They can also describe different types of energy that exist in their every day lives (i.e. heat, light, electric energy).</p> <p>b) Have students come up with examples of solids, liquids, and gases that are in the classroom or that exist in their everyday lives. (Many examples are provided on pages 3-4 of the book.)</p>	<p><u>Extension:</u> Plasma is the fourth state of matter and makes up over 99% of our universe; the Sun is made entirely of plasma! Plasma is ionized gas that can be found in many every day items, like plasma TVs and neon signs. Learn more about plasma here: <a href="http://www-spof.gsfc.nasa.gov/Education/wplasma.html">http://www-spof.gsfc.nasa.gov/Education/wplasma.html</a></p> <p><i>*Standards addressed on page 3:</i> <b>NGSS:</b> <i>DCI:</i> 4-PS3.B(1), MS-ESS2.A; <i>CC:</i> Energy and Matter, Cause and Effect <b>NSES:</b> <i>Grades K-4:</i> B.1.3</p>

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Pg. 5	<p><i>a) Address a Common Misconception.</i> Before reading this page, ask students to look at the illustration. Ask them where they think the water in the puddles will go after the Sun comes out. After taking some responses, read page 5 and then discuss how their answers compared to what Sofia explained in the story.</p> <p><i>b) Assess &amp; Activate Prior Knowledge.</i> Discuss other examples of cycles students may be familiar with (i.e. life cycle, rock cycle, recycling, the repeating pattern of the seasons) to help them understand the term <b>cycle</b>.</p>	<p>a) A common misconception students have is that water leaves the Earth's atmosphere when it evaporates. It is important for them to understand that the same water has been cycling around the Earth for billions of years and that it will continue to. (This point is reinforced on page 6 of the book.)</p> <p>b) Have students look up the term <b>cycle</b> (and other bolded vocabulary words found throughout the story) in the glossary on page 24.</p>	<p><u>Extension to NASA:</u> Another example of a cycle is the sunspot cycle. The Solar Dynamics Observatory (SDO) mission studies solar activity, which drastically changes over the course of the 11-year sunspot cycle. (<i>Note: The sunspot cycle and water cycle are not related.</i>)</p> <p>Learn more about the sunspot cycle from the National Earth Science Teachers Association: <a href="http://www.windows2universe.org/sun/activity/sunspot_cycle.html">http://www.windows2universe.org/sun/activity/sunspot_cycle.html</a></p> <p><u>*Standards addressed on page 5:</u>  <b>NGSS:</b> DCI: 5-ESS2.A, MS-ESS2.C(1);  <b>CC:</b> Energy and Matter  <b>NSES:</b> Grades K-4: B.1.3</p>
Pg. 6	<p><i>a) Assess &amp; Activate Prior Knowledge.</i> Discuss the many ways that the Sun provides the Earth with energy (i.e. heat and light energy).</p> <p><i>b) Relating Concepts to Real Life.</i> Ask students what the Earth would be like without the Sun. How would it affect their lives? How would it affect the food chain or the weather?</p>	<p>a) Students can read the first book of this series, <i>The Day Joshua Jumped Too Much</i>, to gain background knowledge on how the Sun provides energy to Earth (see resource information listed in the right column).</p> <p>b) Example answers: (1) If there was no light energy from the Sun, plants could not grow. Without plants, there would be no food chain. (2) The weather would always be cold without the Sun's heat; lakes and oceans would be frozen.</p>	<p><u>Resource:</u> The first book of this series, <i>The Day Joshua Jumped Too Much</i>, discusses the various types of energy that the Sun provides the Earth, and shows what the Earth would be like without the Sun. The book and accompanying educator guide can be downloaded for free here: <a href="http://sdo.gsfc.nasa.gov/epo/educators/thinkscientifically.php">http://sdo.gsfc.nasa.gov/epo/educators/thinkscientifically.php</a></p> <p><u>*Standards addressed on page 6:</u>  <b>NGSS:</b> DCI: MS-ESS2.A(1);  <b>CC:</b> Energy and Matter  <b>NSES:</b> Grades 5-8: D.3.4</p>

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Pg. 8	<p>Introduce Precipitation.</p> <p><i>Assess &amp; Activate Prior Knowledge.</i> Ask students what they know about <b>precipitation</b>, and if they recognize any other vocabulary terms on this page (<b>sleet</b>, <b>hail</b>).</p>	<ul style="list-style-type: none"> <li>- Have students look up vocabulary words they may not understand in the glossary on pages 24-25.</li> <li>- Showing students pictures of sleet and hail will help them visualize what they are, especially if they have not seen them before.</li> </ul>	<p>Extension to NASA: NASA has two precipitation measurement missions currently in orbit, GPM and TRMM. You can find precipitation-related educational resources and the latest rainfall data here: <a href="http://pmm.nasa.gov">http://pmm.nasa.gov</a></p> <p>Resource: For more information on precipitation, visit the USGS Precipitation webpage: <a href="http://ga.water.usgs.gov/edu/watercycleprecipitation.html">http://ga.water.usgs.gov/edu/watercycleprecipitation.html</a></p> <p>*Standards addressed on page 8:  <b>NGSS:</b> DCI: 5-ESS2.A, MS-ESS2.C(1)  <b>NSES:</b> Grades K-4: D.3.2; Grades 5-8: D.1.5</p>
Pg. 9	<p>Introduce Surface Runoff &amp; Groundwater.</p> <p><i>Assess &amp; Activate Prior Knowledge.</i> Before reading, ask students if they are familiar with the bolded terms <b>surface runoff</b> and <b>groundwater</b>. If so, ask them to explain what they know. If not, have them predict what the words mean using illustrations on the page.</p>	<ul style="list-style-type: none"> <li>- Explain to students that breaking these terms into parts may help them figure out what they mean (i.e. groundwater = ground + water).</li> <li>- Groundwater may be a difficult concept for students to grasp since they cannot see it outside. To help them understand, you can explain that people who drink from wells are drinking groundwater and show them pictures.</li> <li>- Make sure students are familiar with the terms “bodies of water” and “creek”, as they are repeated later in the book.</li> </ul>	<p>Resources: For information on groundwater, visit the USGS Groundwater webpage: <a href="http://ga.water.usgs.gov/edu/watercyclegwstorage.html">http://ga.water.usgs.gov/edu/watercyclegwstorage.html</a></p> <p>For information on surface runoff, visit the USGS Surface Runoff webpage: <a href="http://ga.water.usgs.gov/edu/watercyclerunoff.html">http://ga.water.usgs.gov/edu/watercyclerunoff.html</a></p> <p>*Standards addressed on page 9:  <b>NGSS:</b> DCI: 5-ESS2.A, MS-ESS2.C(1);  <b>CC:</b> Scientific Knowledge Assumes an Order and Consistency in Natural Systems  <b>NSES:</b> Grades K-4: B.1.3; Grades 5-8: D.1.5</p>

\*Refer to the *Science Standards Alignment* section of this educator guide (pages 22-23) for more details on the standards that are addressed on each page.

<p>Pgs. 10-11</p>	<p><b>Introduce Evaporation.</b></p> <p><i>a) Assess &amp; Activate Prior Knowledge; Relate Concepts to Real Life.</i> Ask students what they know about <b>evaporation</b>, and if they can think of any examples of evaporation from their every day lives.</p> <p><i>b) Check for Understanding.</i> Refer to the evaporation illustration on page 11 of the book to help students review the concept. Ask them to explain what the arrows mean—what is going into the sky from the puddle? What is the water changing into? (Answer: Water is changing into water vapor and going into the sky. Liquid is changing into gas due to evaporation.)</p>	<p>a) Example answers: Wet clothes dry outside in heat, wet hair dries from a blow dryer’s heat, a glass of water left outside can become less full or dry up in the Sun’s heat. (Note: Steam and fog are examples of condensation, not evaporation. This will be discussed on the next page.)</p> <p>b) Stress that without the Sun’s heat there would be no evaporation, which means there would be no water cycle.</p> <p>(Note: If students have learned about plant growth or photosynthesis before, this may be a good opportunity to tie into what they know.)</p>	<p><u>Extension (evaporation):</u> Evaporation occurs because of vapor pressure differences; this means that water does not necessarily need to be heated for it to evaporate, as in a puddle. By warming the air above the puddle, the Sun induces evaporation by reducing the relative humidity of the air, and increases the capacity of the air to hold more water vapor. This would be a difficult concept for younger students to grasp, but may be appropriate for readers with background knowledge of vapor pressure and humidity.</p> <p><u>Extension (transpiration):</u> Transpiration can be introduced here, as it relates to the process of evaporation. Transpiration is the process by which plants release water into the air as water vapor. After plants soak up water from the ground, some of it is released onto the plants’ leaves, which then evaporates into water vapor. You can refer to the plants pictured on the page and point out that they are transpiring. Make sure to stress that this process could not happen without the Sun’s heat energy.</p>
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Pgs. 10-11 cont.			<p>Resources: For information on evaporation, visit the USGS Evaporation webpage:  <a href="http://ga.water.usgs.gov/edu/watercycleevaporation.html">http://ga.water.usgs.gov/edu/watercycleevaporation.html</a></p> <p>For information on transpiration, visit the USGS Evapotranspiration webpage:  <a href="http://ga.water.usgs.gov/edu/watercycleevapotranspiration.html">http://ga.water.usgs.gov/edu/watercycleevapotranspiration.html</a></p> <p>*Standards addressed on pages 10-11:  <b>NGSS:</b> <i>DCI:</i> 5-LS1.C, 5-ESS2.A, MS-ESS2.A, MS-ESS2.C(1), MS-ESS2.C(3);  <i>CC:</i> Energy and Matter, Cause and Effect, Scientific Knowledge Assumes an Order and Consistency in Natural Systems  <b>NSES:</b> <i>Grades K-4:</i> B.1.3, C.1.1, D.1.2;  <i>Grades 5-8:</i> D.1.5</p>
Pg. 12	<p>Introduce Condensation.</p> <p><i>a) Assess &amp; Activate Prior Knowledge; Relate Concepts to Real Life.</i>  Ask students what they know about <b>condensation</b>, and if they can think of any examples of condensation from their every day lives. (Have they ever seen their breath on a cold day before like shown in the story?)</p>	<p>a) Examples answers: Dew on grass in the morning, ground-level fog, steam, condensation on windows and a cold glass. (Clouds are also formed by condensation, which is discussed on the next page.)</p>	<p><u>Extension (condensation):</u>  Condensation occurs when the air is cooled down to its dew point. Explain this concept to students, and point out that they would most likely only be able to see their breath on very cold days.</p> <p><u>Resource:</u> For information on condensation, visit the USGS Condensation webpage:  <a href="http://ga.water.usgs.gov/edu/watercyclecondensation.html">http://ga.water.usgs.gov/edu/watercyclecondensation.html</a></p>

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Pgs. 16-17	<p><i>Students Create Their Own Story.</i></p> <p>Students can play Marisol’s game too and come up with a story about the journey a water drop travels through the water cycle.</p>	<p>Students can start their story out where they live and point it out on the map on page 17 of the book. They can also use a globe to locate where they live and to form their story.</p>	<p><u>Resource:</u> Refer to the Language Arts Activities section on page 16 of this educator guide for more activity ideas.</p> <p><u>Extension to NASA:</u> The NASA Earth Observatory mission has an animated map showing the average amount of water vapor in the atmosphere over the past 11 years. Access it here: <a href="http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MYDAL2_M_SKY_WV">http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MYDAL2_M_SKY_WV</a></p> <p><u>*Standards addressed on pages 16-17:</u>  <b>NGSS:</b> <i>DCI:</i> 5-ESS2.A, MS-ESS2.C(1);  <i>CC:</i> Energy and Matter, Cause and Effect, Scientific Knowledge Assumes an Order and Consistency in Natural Systems; <b>NSES:</b> <i>Grades K-4:</i> B.1.3; <i>Grades 5-8:</i> D.1.5, D.1.8</p>
Pg. 18	<p><i>Examine NASA Solar Data.</i></p> <p>Point out to students that the images Marisol is looking at are both of the Sun. The NASA Solar Dynamics Observatory (SDO) took the images at the same time. You can explain that NASA scientists study images like this every day to learn more about activity that happens on the Sun.</p> <p>(The yellow image is of the Sun’s atmosphere and the gray image is a magnetic map of the Sun’s surface.)</p>	<p>The two SDO images on this page are taken from an activity called <i>Matching Pairs</i>, which you can have students do to analyze and compare solar data, just like scientists do. There is also a thorough explanation of what these images represent. (See information to the right about how to download this free resource.)</p>	<p><u>Resource:</u> You can download the free <i>Matching Pairs</i> lesson plan here: <a href="http://nasawavelength.org/resource/nw-000-000-003-224">http://nasawavelength.org/resource/nw-000-000-003-224</a></p> <p><u>Extension to NASA:</u> Show students what the Sun looks like today by visiting the SDO data page: <a href="http://sdo.gsfc.nasa.gov/data">http://sdo.gsfc.nasa.gov/data</a></p> <p><u>Standards addressed on page 18:</u>  <b>NGSS:</b> <i>CC:</i> Science as Human Endeavor  <b>NSES:</b> <i>Grades K-4:</i> G.1.4; <i>Grades 5-8:</i> D.1.5, G.1.1</p>

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Pg. 19	<i>Check for Understanding.</i> Before turning to page 20, ask students what they would tell Marisol's mother about what they learned.	Students can work in pairs or small groups to develop an answer before sharing with the class. They can write down their answer in the form of dialogue that Marisol would say to her mother, or in paragraph form.	
Pg. 20	<i>Check for Understanding.</i> Before turning to page 22, ask students if they see examples of condensation and evaporation in the kitchen.	Marisol gives the answers on page 22, so pause to give students a chance to identify examples before turning the page.	<p><u>Extension:</u> Others processes in the water cycle that are not mentioned in the book include melting and freezing. You can point out examples of these processes on this page:</p> <ul style="list-style-type: none"> <li>- <b>Melting example:</b> Marisol's mother replaced the ice in her glass because the ice from page 3 melted over the course of the day. This relates to how the Sun melts ice and snow (solids), and changes them to water (a liquid).</li> <li>- <b>Freezing example:</b> The ice (a solid) in Marisol's glass was formed in the freezer from water (a liquid). This relates to how, when the Sun's energy is less intense in winter months, water is more likely to freeze and form snow and ice in many areas. This concept is discussed in depth in the resource listed below.</li> </ul> <p><u>Resource:</u> The second book of this series, <i>Adventures in the Attic</i>, discusses how the seasons are caused by the change in intensity of the Sun's energy over the year. The book and accompanying educator guide can be downloaded for free here:  <a href="http://sdo.gsfc.nasa.gov/epo/educators/thinkscientifically.php">http://sdo.gsfc.nasa.gov/epo/educators/thinkscientifically.php</a></p>

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Pg. 20 cont.			<p>*Standards addressed on page 20:</p> <p><b>NGSS:</b> <i>DCI:</i> 5-ESS2.A, MS-ESS2.A, MS-ESS2.C(1), MS-ESS2.C(3);</p> <p><i>CC:</i> Cause and Effect, Energy and Matter, Systems and System Models</p> <p><b>NSES:</b> <i>Grades K-4:</i> B.1.3; <i>Grades 5-8:</i> D.1.5, D.1.8, D.3.4</p>
Pg. 22	<p><i>Review Major Concepts &amp; Check for Understanding.</i></p> <p>a) In their own words, have students explain why these are examples of evaporation and condensation.</p> <p>b) Have students give examples of condensation that they learned about other than those listed on this page.</p> <p>c) Ask students why they do not see an example of precipitation in the kitchen. Review what precipitation is.</p>	<p>a) Remind students that without the Sun's energy there would be no evaporation and, consequently, no water cycle.</p> <p>b) Example answers: fog, dew on grass, condensation on windows. The steam pictured at the top of page 22 is also condensation. (The heating of the water in the pot causes evaporation, but this process is invisible.)</p> <p>c) Example answer: Precipitation is water falling from the sky, but the scene takes place indoors.</p>	<p>*Standards addressed on page 22:</p> <p><b>NGSS:</b> <i>DCI:</i> 5-ESS2.A, MS-ESS2.A, MS-ESS2.C(1), MS-ESS2.C(3);</p> <p><i>CC:</i> Cause and Effect, Energy and Matter, Systems and System Models</p> <p><b>NSES:</b> <i>Grades K-4:</i> B.1.3; <i>Grades 5-8:</i> D.1.5, D.1.8, D.3.4</p>

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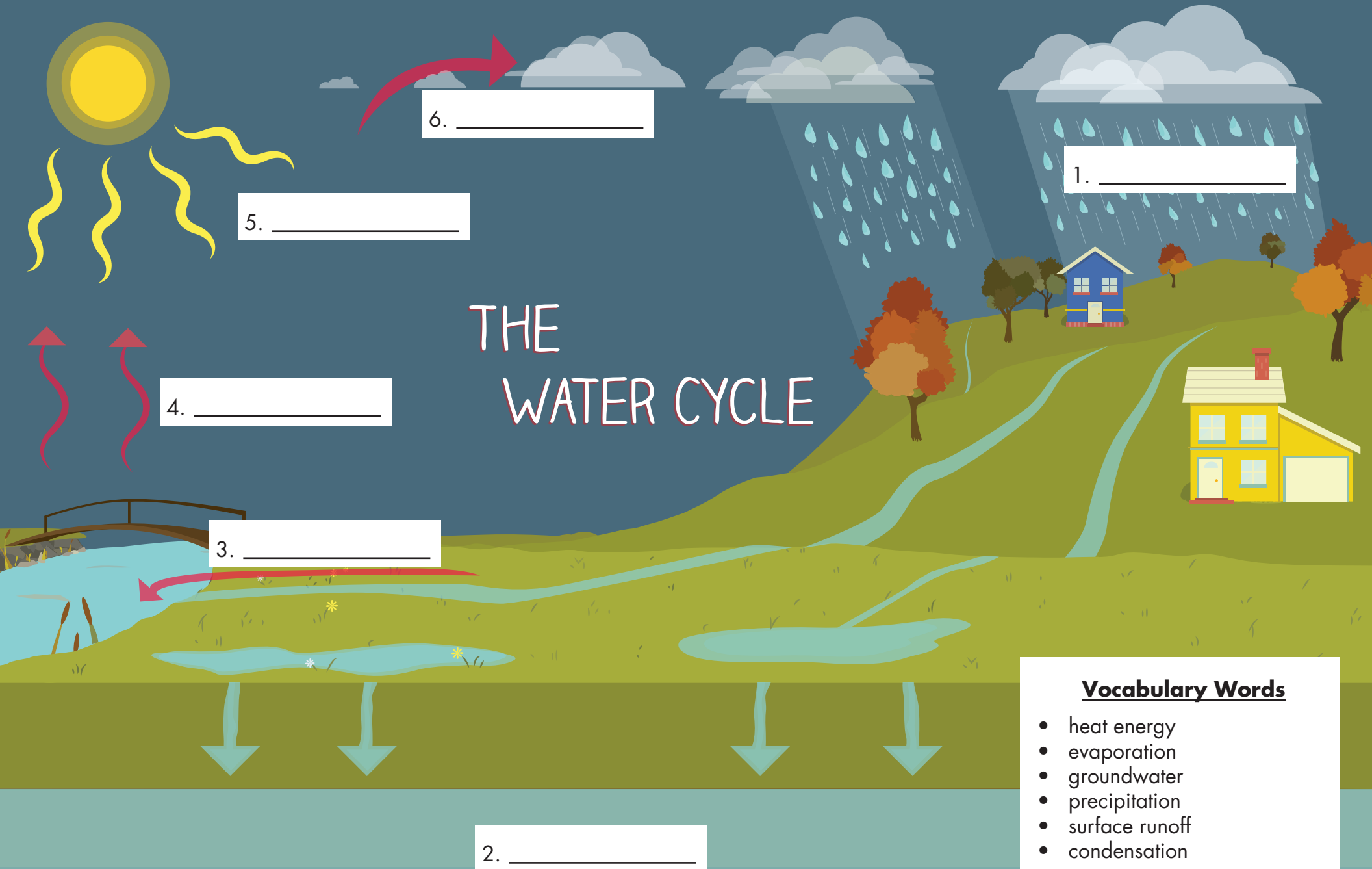
Pg. 23	<p><i>Check for Understanding.</i> Ask students what Marisol means when she says that we are a part of the water cycle. Ask students in what ways they are part of the water cycle.</p>	<p>- Example answers: They drink water, water evaporates off their skin when they sweat (perspiration), they go to the bathroom (elimination).</p> <p>Facts you may want to point out:</p> <ul style="list-style-type: none"> <li>- Our bodies are about 60% water!</li> <li>- Even animals, like the cat pictured on page 23 and the other animals pictured throughout the book, are a part of the water cycle. (You can scan back through the book to see animals drinking water and fish swimming in the creek.)</li> </ul>	
After The Story	<p><i>Checking Predictions.</i> Ask students if the predictions they made about the story before they started reading were correct or not. Have them explain how they were similar or different.</p>	Refer back to the predictions students wrote down prior to reading the book (see page 1 of this document).	
After The Story	<p><i>Summarizing the Book.</i> Ask students how the water cycle depends on the Sun. Have them give examples from the book to support their answers.</p>	Students can use the information they collected on the graphic organizer to help them with their summary.	<p><u>Resource:</u> The graphic organizer is located on pages 12-15 of this educator guide.</p>

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Name: \_\_\_\_\_

## The Sun and The Water Cycle Graphic Organizer

Fill in the blanks with the vocabulary words from the box!



### ***The Sun and The Water Cycle Graphic Organizer***

1) After filling out the blanks on the back of this page, describe what each vocabulary word means in the boxes below.

<b>condensation:</b>	<b>heat energy:</b>
<b>evaporation:</b>	<b>precipitation:</b>
<b>groundwater:</b>	<b>surface runoff:</b>

2) Describe what the **water cycle** is using the vocabulary words above.

Fill in the blanks with the vocabulary words from the box!

2. \_\_\_\_\_

- heat energy
- evaporation
- groundwater
- precipitation
- surface runoff
- condensation

### ***The Sun and The Water Cycle Graphic Organizer***

1) After filling out the blanks on the back of this page, describe what each vocabulary word means in the boxes below.

<b>condensation:</b>	<b>heat energy:</b>
<b>evaporation:</b>	<b>precipitation:</b>
<b>groundwater:</b>	<b>surface runoff:</b>

2) Describe what the **water cycle** is using the vocabulary words above.



### ***The Sun and The Water Cycle Language Arts Activities***

1. *Visual Glossary*: Students use the glossary on pages 24-25 of the book to create an illustrated version of their own.
2. *Readers' Theater*: Students create skits based on scenes or concepts from the book, and act them out for the class.
3. *Water Cycle Story*: Students write a story about the journey a drop of water makes through the water cycle. To give them an example, have them reread pages 16-17 where Marisol tells a story about the travels of a water drop. They can also illustrate their story.
4. *Water Cycle Song*: Students write a song about the water cycle and set it to a familiar melody (i.e. Yankee Doodle).
5. *\*Character Map*: Students describe characters by how they act, and write their opinions about them on this graphic organizer.
6. *\*Concept Wheel*: This concept map enables students to further explore a concept by writing a definition, summary, examples and non-examples, and identifying relationships to other concepts.
7. *\*Event Map*: Students can use this graphic organizer to investigate how a certain event in the story evolved; they identify what happened and how, who was involved, where and when it occurred, and why it was important.
8. *\*Sequence Chain*: A graphic organizer that students can use to map out the sequence of events that took place in the story. They also record the setting, place, time, and characters involved.
9. *\*Setting Map*: Students draw a map of the setting where the story took place, and include all of the important places in the story.
10. *Research Project*: Students use books and/or websites to research how different forms of pollution exist in the water cycle (i.e. toxic pollution gets carried into waterways via surface runoff). They can present their findings in various ways; for example, they can create an informational brochure or poster, compose a news report and orally present it to the class, or write a report.

\*These graphic organizers can be found for free at:

<http://www.dailyteachingtools.com/language-arts-graphic-organizers.html>

***The Sun and The Water Cycle***  
**Learning Objectives & Assessment Questions**

**Learning Objectives**

**Science Objectives:** Students will be able to...

- Describe the importance of the Sun to the water cycle.
- Explain evaporation, condensation, and precipitation, and the relationship between them.
- Create a story about a water droplet's journey through the water cycle.

**Reading Comprehension Objectives:**

- Students will be able to answer questions about the story by referring to key details in the text.
- Students will be able to summarize the story.

**Assessment Questions**

**Science Comprehension Questions:**

*Knowledge*

- How is the Sun important to the water cycle?
- What are precipitation, condensation, and evaporation? How do they relate to one another?

*Synthesis*

- Create a story about a water droplet's journey through the water cycle. (For an example, students can refer to the story Marisol came up with on pages 16-17.)
- Draw a labeled diagram of how the water cycle works where you live. (For an example, students can refer to pages 14-15 to see the labeled diagram of how the water cycle works where Marisol and Sofia live).

*Evaluation*

- Explain how your life would be different if there were no water cycle.
- What process do you think is the most important in the water cycle? Why?

**Reading Comprehension Questions:**

*Knowledge*

- Name two vocabulary words that you learned and describe what they mean.
- Identify places in the book where Marisol and Sofia discuss the importance of the Sun. What do they say is important about the Sun?
- What is the setting of the story? Give details from the story to support your answer.

*Synthesis*

- Write a diary entry for one of the characters that describes what happened during the story, and how they felt about the events that took place.
- Retell the story in your own words.

*Evaluation*

- Where in the story would you have acted differently than Marisol or Sofia? What would you have done instead?
- How do you think Marisol felt about her day exploring the water cycle? Refer to details in the story to support your answer.
- What questions would you have asked Sofia if you were Marisol?

### *The Sun and The Water Cycle Lesson Plans & Activities*

Name & Summary	Key Words	Math Connection	Science Standards Addressed*	Source
<b><i>Cyclical Cycles</i></b>  Students build a model of the water cycle.	condensation, evaporation, gas, liquid, precipitation	no	<u>National Science Education Standards (NSES):</u> <i>Grades K-4:</i> B.1.3; <i>Grades 5-8:</i> D.1.5  <u>Next Generation Science Standards (NGSS):</u> <i>Disciplinary Core Ideas (DCI):</i> MS-ESS2.C(1); <i>Crosscutting Concepts (CC):</i> Cause and Effect, Systems and System Models; <i>Engineering Practices (EP):</i> Developing and Using Models, Planning and Carrying Out Investigations	NASA <a href="http://nasawavelength.org/resource/nw-000-000-002-626/">http://nasawavelength.org/resource/nw-000-000-002-626/</a> (see page 20 in guide)
<b><i>Earth System in a Bottle</i></b>  Students build terrariums to observe the water cycle.	atmosphere, condensation, evaporation, gas, photosynthesis, soil, sunlight, transpiration, water vapor	no	<u>NSES: Grades K-4:</u> B.1.3, C.1.1, D.1.2; <i>Grades 5-8:</i> D.1.5, D.3.4  <u>NGSS: DCI:</u> 5-ESS2.A, 5-LS1.C, MS-ESS2.C(1), MS-ESS2.C(3), MS-LS1.C; <i>CC:</i> Cause and Effect, Energy and Matter, Systems and System Models; <i>EP:</i> Developing and Using Models, Planning and Carrying Out Investigations	University Corporation for Atmospheric Research <a href="http://nasawavelength.org/resource/nw-000-000-001-696/">http://nasawavelength.org/resource/nw-000-000-001-696/</a>
<b><i>The Water Cycle: A StudyJams Activity &amp; Video</i></b>  Students watch an animated video on the water cycle then take a quiz on what they learned.	condensation, evaporation, gas, liquid, precipitation, Sun's heat energy, transpiration, water vapor	no	<u>NSES: Grades K-4:</u> B.1.3, C.1.1, D.3.2; <i>Grades 5-8:</i> D.1.5, D.1.8, D.3.4  <u>NGSS: DCI:</u> MS-ESS2.C(1), MS-ESS2.C(3); <i>CC:</i> Cause and Effect, Energy and Matter, Science is a Human Endeavor	Scholastic <a href="http://www.scholastic.com/teachers/activity/water-cycle-studyjams-activity">http://www.scholastic.com/teachers/activity/water-cycle-studyjams-activity</a>

\*For details on how these activities align to national science standards, refer to the **Science Standards Alignment** section of this educator guide on pages 22-23.

<b><i>Where Did the Water Go?</i></b>  A laboratory activity where students investigate the process of evaporation.	atmosphere, evaporation, gas, liquid	data collection	<u>NSES: Grades K-4:</u> B.1.3; <i>Grades 5-8:</i> D.1.5, D.3.4  <u>NGSS: DCI:</u> MS-ESS2.C(1), MS-ESS2.C(3); <i>CC:</i> Cause and Effect; <i>EP:</i> Analyzing and Interpreting Data, Planning and Carrying Out Investigations	Houghton Mifflin Harcourt Education Place <a href="http://www.eduplace.com/kids/sla/3/dripdrop_act.html">http://www.eduplace.com/kids/sla/3/dripdrop_act.html</a>
<b><i>The Incredible Journey</i></b>  Kinesthetic activity where students act out the water cycle.	cloud, condensation, evaporation, gas, glacier, groundwater, liquid, plants, precipitation, soil, solid, Sun's energy, transpiration	no	<u>NSES: Grades K-4:</u> B.1.3; <i>Grades 5-8:</i> D.1.5, D.1.8, D.3.4  <u>NGSS: DCI:</u> MS-ESS2.C(1), MS-ESS2.C(3); <i>CC:</i> Cause and Effect, Energy and Matter	Museum of Science and Industry, Chicago <a href="http://www.msichicago.org/fileadmin/Education/learninglabs/lab_downloads/TTW_in_cjourney_act.pdf">http://www.msichicago.org/fileadmin/Education/learninglabs/lab_downloads/TTW_in_cjourney_act.pdf</a>
<b><i>Heat Energy and Water</i></b>  Students investigate how heat affects solid and liquid water in this hands-on activity.	heat energy, liquid, melting, solid	data collection	<u>NSES: Grades K-4:</u> B.1.3  <u>NGSS: DCI:</u> 4-PS3.B(1); <i>CC:</i> Cause and Effect, Energy and Matter; <i>EP:</i> Analyzing and Interpreting Data, Asking Questions and Defining Problems, Planning and Carrying Out Investigations	Utah Education Network <a href="http://www.uen.org/Lessonplan/preview.cgi?LPid=9830">http://www.uen.org/Lessonplan/preview.cgi?LPid=9830</a>
<b><i>Why Does A Puddle Shrink?</i></b>  A laboratory activity where students investigate the process of evaporation.	evaporation, gas, liquid, Sun's heat energy	data collection, graphing, calculating rate of evaporation	<u>NSES: Grades K-4:</u> B.1.3; <i>Grades 5-8:</i> D.1.5, D.3.4  <u>NGSS:</u> MS-ESS2.C(1), MS-ESS2.C(3); <i>CC:</i> Cause and Effect, Energy and Matter; <i>EP:</i> Analyzing and Interpreting Data, Constructing Explanations and Designing Solutions, Planning and Carrying Out Investigations, Using Mathematics and Computational Thinking	Utah Education Network <a href="http://www.uen.org/Lessonplan/preview.cgi?LPid=9823">http://www.uen.org/Lessonplan/preview.cgi?LPid=9823</a>

<p><b><i>Where Is Water Found?</i></b></p> <p>Students discover where Earth's water is distributed in this hands-on, math-related activity.</p>	<p>distribution of Earth's water, freshwater, glacier, ocean, water vapor</p>	<p>percentages</p>	<p><u>NSES</u>: <i>Grades 5-8</i>: D.1.5</p> <p><u>NGSS</u>: <i>DCI</i>: MS-ESS2.C(1); <i>CC</i>: Cause and Effect, Energy and Matter</p>	<p>Utah Education Network  <a href="http://www.uen.org/Lessonplan/preview.cgi?LPid=9820">http://www.uen.org/Lessonplan/preview.cgi?LPid=9820</a></p>
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### ***The Sun and The Water Cycle Additional Resources***

Links to general water cycle information and recommended educational resources.\*

- Beyond Penguins and Polar Bears—*Common Misconception about the States of Matter & Water Cycle*: <http://beyondpenguins.ehe.osu.edu/issue/water-ice-and-snow/common-misconceptions-about-states-and-changes-of-matter-and-the-water-cycle>
- GLOBE Program—*Earth Science Storybooks & Classroom Activities (grades K-4)*: <http://www.globe.gov/web/elementary-globe>
- NASA—*The Earth's Water Cycle (video)*: <http://youtu.be/oaDkph9yQB8>
- NASA Earth Observatory—*How NASA is Observing the Water Cycle*: <http://earthobservatory.nasa.gov/Features/Water/page4.php>
- NASA Earth Observatory—*Water Vapor Global Map*: [http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MYDAL2\\_M\\_SKY\\_WV](http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MYDAL2_M_SKY_WV)
- NASA GPM mission—*Water Cycle Educational Resources*: <http://pmm.nasa.gov/education/water-cycle>
- Science Education Resource Center—*Earth Labs: Solar Energy and the Water Cycle*: <http://serc.carleton.edu/eslabs/weather/2a.html>
- The Water Project—*Teaching Tools & Resources*: <http://thewaterproject.org/resources>
- US EPA—*Climate Change Kids' Site (interactive water cycle movie)*: [http://www.kidsnewsroom.org/climatechange/water\\_cycle\\_version2.html](http://www.kidsnewsroom.org/climatechange/water_cycle_version2.html)
- USGS—*Free Kids' Water Cycle Poster*: <http://ga.water.usgs.gov/edu/watercycle-kids.html>
- USGS—*Water Cycle Information (in 60 different languages)*: <http://ga.water.usgs.gov/edu/watercycle.html#langs>

\*For lesson plans and activities, please see pages 18-20 of this educator guide.

## ***The Sun and The Water Cycle Science Standards Alignment***

An outline of the Next Generation Science Standards & National Education Science Standards that align with the story content.

**Reading level:** Grades 3-6

**A. Next Generation Science Standards (NGSS)** - please refer to <http://www.nextgenscience.org> for more information

### Disciplinary Core Ideas

#### *Grade 4:*

- 4-PS3.B(1): Energy is present whenever there are moving objects, sound, light, or heat...

#### *Grade 5:*

- 5-ESS2.A: Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect the Earth's surface materials and processes... Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
- 5-LS1.C: Plants acquire their material for growth chiefly from air and water.

#### *Middle School (Grades 6-8):*

- MS-ESS2.A(1): All Earth's processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the Sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.
- MS-ESS2.C(1): Water continually cycles among the land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- MS-ESS2.C(3): Global movements of water and its changes in form are propelled by sunlight and gravity.

### Crosscutting Concepts

#### *Grade 3:*

- **Cause and Effect:** Cause and effect relationships are routinely identified and used to explain change.
- **Scientific Knowledge Assumes an Order and Consistency in Natural Systems:** Science assumes consistent patterns in natural systems.

#### *Grade 4:*

- **Energy and Matter:** Energy can be transferred in various ways and between objects.
- **Science is a Human Endeavor:** Science affects everyday life.

#### *Grade 5:*

- **Systems and System Models:** A system can be described in terms of its components and their interactions.

#### *Middle School (Grades 6-8):*

- **Cause and Effect:** Cause and effect relationships may be used to predict phenomena in natural or designed systems.
- **Energy and Matter:** Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

**B. National Science Education Standards (NSES)** - please refer to [http://books.nap.edu/catalog.php?record\\_id=4962#toc](http://books.nap.edu/catalog.php?record_id=4962#toc) for more information

*Grades K-4:*

- B.1.3. Materials can exist in different states—solid, liquid, and gas. Some common materials, such as water, can be changed from one state to another by heating or cooling.
- C.1.1. Organisms have basic needs. For example, animals need air, water, and food; plants require air, water, nutrients, and light...
- D.1.2. Soils have properties of color and texture, capacity to retain water, and ability to support the growth of many kinds of plants, including those in our food supply.
- D.3.2. Weather changes from day to day and over the seasons. Weather can be described by measurable quantities, such as temperature, wind direction and speed, and precipitation.
- G.1.4. Many people choose science as a career and devote their entire lives to studying it. Many people derive great pleasure from doing science.

*Grades 5-8:*

- D.1.5. Water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle". Water evaporates from the Earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.
- D.1.8. Clouds, formed by the condensation of water vapor, affect weather and climate.
- D.3.4. The Sun is the major source of energy for phenomena on the Earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.
- G.1.1. Women and men of various social and ethnic backgrounds...engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.