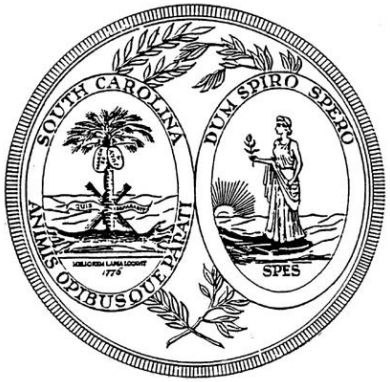
South Carolina Academic Standards and Performance Indicators for Science 2014



Instructional Unit Resource

4th Grade

South Carolina Academic Standards and Performance Indicators for Science 2014
Fourth Grade Science Instructional Unit Resource

As support for implementing the *South Carolina Academic Standards and Performance Indicators for Science 2014*, the standards for Fourth Grade have been grouped into possible units. In the Overview of Units below, the titles for those possible units are listed in columns. Refer to the Overview document to note these unit titles and how Standards, Conceptual Understandings, Performance Indicators, Science and Engineering Practices, and Crosscutting Concepts align. Following the Overview of Units, an Instructional Unit document is provided that delivers guidance and possible resources in teaching our new *South Carolina Academic Standards and Performance Indicators for Science 2014*. The purpose of this document is to provide guidance as to how all the standards in this grade may be grouped into units and how those units might look. Since this document is merely guidance, districts should implement the standards in a manner that addresses the district curriculum and the needs of students. This document is a living document and instructional leaders from around the state will continuously update and expand these resource documents. These documents will be released throughout the 2016-2017 school year with the intentionality of staying ahead of instruction. Teachers should also note that links to the Standards document, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, the SEP Support Document, and the Support Document 2.0 are embedded throughout the Instructional Unit format for reference.

Acknowledgments

Jean Baptiste Massieu, famous deaf educator, made a statement that is now considered a French proverb. “Gratitude is the memory of the heart. Indeed, appreciation comes when you feel grateful from the depths of your heart. The head keeps an account of all the benefits you received and gave. But the heart records the feelings of appreciation, humility, and generosity that one feels when someone showers you with kindness.” It is with sincere appreciation that we humbly acknowledge the dedication, hard work and generosity of time provided by teachers and instructional leaders across the state that have made and are continuing to make the Instructional Unit Resources possible.

Grade 4 Overview of Units

Unit 1		Unit 2		Unit 3		Unit 4	
EARTH SCIENCE: WEATHER AND CLIMATE		EARTH SCIENCE: STARS AND THE SOLAR SYSTEM		PHYSICAL SCIENCE: FORMS OF ENERGY – LIGHT AND SOUND		LIFE SCIENCE: CHARACTERISTICS AND GROWTH OF ORGANISMS	
Standard		**Standard**		**Standard**		**Standard**	
4.E.2		4.E.3		4.P.4		4.L.5	
Conceptual Understanding		**Conceptual Understanding**		**Conceptual Understanding**		**Conceptual Understanding**	
4.E.2A	4.E.2B	4.E.3A	4.E.3B	4.P.4A	4.P.4B	4.L.5A	4.L.5B
Performance Indicators		**Performance Indicators**		**Performance Indicators**		**Performance Indicators**	
4.E.2A.1 4.E.2A.2	4.E.2B.1 4.E.2B.2 4.E.2B.3	4.E.3A.1 4.E.3A.2 4.E.3A.3	4.E.3B.1 4.E.3B.2 4.E.3B.3 4.E.3B.4	4.P.4A.1 4.P.4A.2 4.P.4A.3 4.P.4A.4 4.P.4A.5	4.P.4B.1 4.P.4B.2 4.P.4B.3	4.L.5A.1 4.L.5A.2 4.L.5A.3 4.L.5A.4	4.L.5B.1 4.L.5B.2 4.L.5B.3
***Science and Engineering Practices**		***Science and Engineering Practices**		***Science and Engineering Practices**		***Science and Engineering Practices**	
4.S.1A.2 4.S.1A.4 A.S.1A.6 A.S.1A.8		4.S.1A.2 A.S.1A.4 A.S.1A.6 4.S.1A.7 4.S.1A.8		4.S.1A.2 4.S.1A.3 4.S.1A.4 4.S.1A.7 4.S.1A.8 4.S.1B.1		4.S.1A.2 4.S.1A.4 4.S.1A.6 4.S.1A.7 4.S.1A.8	
***Crosscutting Concepts**		***Crosscutting Concepts**		***Crosscutting Concepts**		***Crosscutting Concepts**	
1,2,3,4,5,7		1,2,4,7		1,2,3,4,5		1,2,5,6	

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

Unit Title
Earth Science: Weather and Climate
Standard http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf
4.E.2 The student will demonstrate an understanding of the water cycle and weather and climate patterns.

Conceptual Understanding
4.E.2A. Conceptual Understanding: Earth's atmosphere is a mixture of gases, including water vapor and oxygen. The movement of water, which is found almost everywhere on Earth including the atmosphere, changes form and cycles between Earth's surface and the air and back again. This cycling of water is driven by energy from the Sun. The movement of water in the water cycle is a major pattern that influences weather conditions. Clouds form during this cycle and various types of precipitation result.
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.**
Gases, Cycle, Atmosphere, Troposphere, Oxygen, Nitrogen Carbon dioxide, Water vapor, Water cycle, Evaporation, Condensation, Precipitation Run off
Performance Indicators Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's.
4.E.2A.1 *Obtain and communicate* information about some of the gases in the atmosphere (including oxygen, nitrogen, and water vapor) to develop models that exemplify the composition of Earth's atmosphere where weather takes place. 4.E.2A.2 *Develop and use models* to explain how water changes as it moves between the atmosphere and Earth's surface during each phase of the water cycle (including evaporation, condensation, precipitation, and runoff).

***Science and Engineering Practices** **Support for the guidance, overviews of learning progressions, and explicit details of each SEP can be 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.**
4.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others. 4.S.1A.8 Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.
***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.
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). *The water cycle will show how one part of the cycle affects how the water gets back to the Earth.* 3. Scale, Proportion, and Quantity: The National Research Council (2012) states "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). *The atmosphere is made up of different percentages of gases which make it possible to sustain life.* 4. Systems and System Models: The National Research Council (2012) states "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 are used to show how the water cycle works to keep renewing our water sources.* 5. Energy and Matter: The National Research Council (2012) states "tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations" (p. 84). *The water cycle shows how energy is used to move different forms of matter through a system.*

7. Stability and change: The National Research Council states" For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of system are critical elements of study" (p.84). *The water cycle is a natural system which occurs on Earth to keep our ecosystems stable.*

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

Prior Knowledge
• N/A
Subsequent Knowledge
• 6.E.2A.1; H.E.5A.1 – Properties of the Atmosphere • 6.E.2A.3 – Water cycle parts and properties • H.E.6A.2 – Water cycle as a form of energy transfer

Possible Instructional Strategies/Lessons **Strategies and lessons that will enable students to master the standard and/or indicator.**

• 4.E.2A.1
  ○ Creating a Model of the Atmosphere: This lesson allows students to make a model of the atmosphere with the following materials: dry black beans (Nitrogen), red beans (other gases), white beans (Oxygen) and a small glass jar. Introduce the atmosphere with the following video: https://www.youtube.com/watch?v=fyfN9t_E0w8 Show students a pie graph of the gasses in the atmosphere depicting the approximate percentages of 78% Nitrogen, 21% Oxygen, and 1% other. Have students fill the jar with the appropriate color beans for the approximate percentage.
 	
• 4.E.2A.2
  ○ Exploring the Water Cycle: This lesson allows students to explore the water cycle. This resource can be found at: https://pmm.nasa.gov/education/sites/default/files/lesson_plan_files/exploring-water-cycle/Exploring%20the%20Water%20Cycle%20TG%20v2.pdf
 	
  ○ The Water Cycle Game: This lesson allows students to follow the process of the water cycle. This resource can be found at: http://www.arcticclimatemodeling.org/lessons/acmp/acmp_k4_WaterCycle_WaterCycleGame.pdf

Resources

- 4.E.2A.1
  - The Earth's Atmosphere: This website gives information about the atmosphere layers and gases. This resource can be found at: http://www.ducksters.com/science/atmosphere.php
  - Layers of the Atmosphere: This is a video showing the layers of the atmosphere. This resource can be found at: https://www.youtube.com/watch?v=qW5xp64AiRs
- 4.E.2A.2
  - A trip through the water cycle: This activity is a simulation of a drop of water moving through the water cycle. This resource can be found at: http://www.discoverwater.org/blue-traveler/
  - The Water Cycle Song: This is a song students can learn to help remember the water cycle. This resource can be found at: https://www.youtube.com/watch?v=T05djitkEFI

Sample Formative Assessment Tasks/Questions

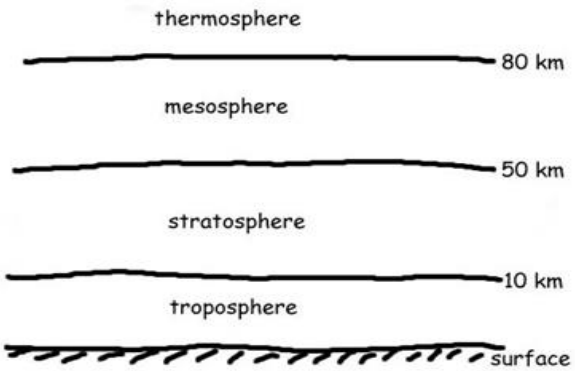
Additional sample formative assessment tasks/questions for grade bands are located at the end of each of the SEP Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)

- Use the information in the table of Gases of the Atmosphere and complete the model below by adding the correct amount and name of these three gases (nitrogen, oxygen, and water vapor) in the layer of the atmosphere where weather takes place.

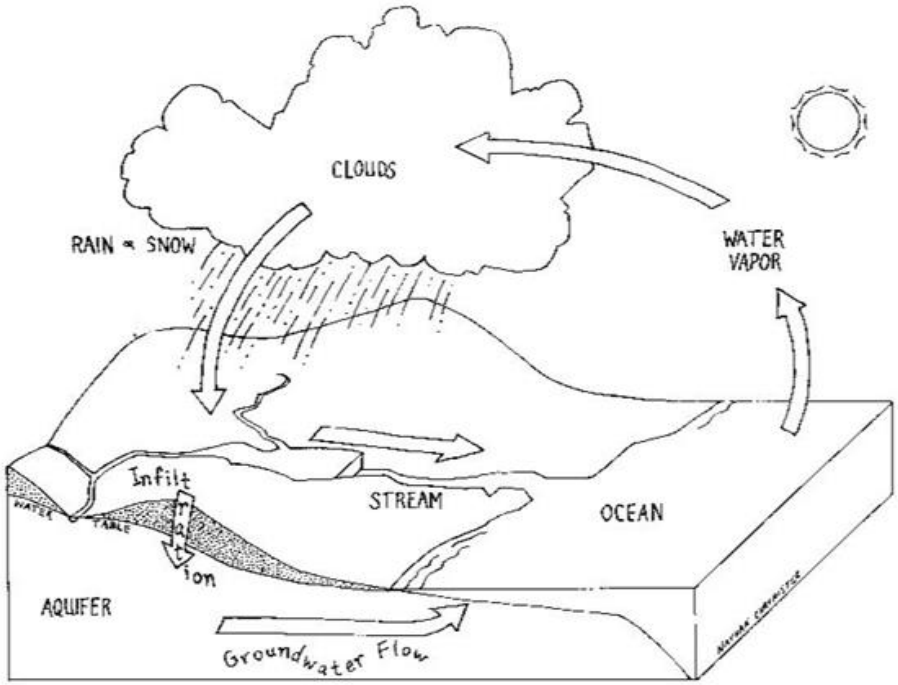
Gases of the Atmosphere

Gas	Percentage by Volume
Nitrogen	78%
Oxygen	20%
Carbon Dioxide	>1%
Water Vapor	>1%
Other gases	>1%

Model of the Layers of the Atmosphere



- Label the model of the water cycle to include evaporation, condensation, precipitation, and runoff to illustrate how water changes as it moves between the atmosphere and Earth's surface during each phase of the water cycle including condensation, evaporation, precipitation, and runoff.



- Fill in the table to explain what happens to water as it moves through the water cycle including details about condensation, evaporation, precipitation and runoff.

Water Cycle Process	What Happens During the Process and Why	What it becomes (types)
Condensation		
Evaporation		
Precipitation		
Runoff		

Unit Title
Earth Science: Weather and Climate
Standard http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf
4.E.2 The student will demonstrate an understanding of the water cycle and weather and climate patterns.

Conceptual Understanding
4.E.2B. Scientists record patterns in weather conditions across time and place to make predictions about what kind of weather might occur next. Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over long periods of time. Some weather conditions lead to severe weather phenomena that have different effects and safety concerns.

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.

Weather maps	Temperature	Precipitation	Snow	Sleet	Hail
Rain	Cloud	Weather phenomena	Thunderstorms	Hurricanes	Climate
Relative humidity	Weather vane	Thermometer	Anemometer	Rain gauge	Fahrenheit
Celsius	Qualitative	Quantitative	Meteorologist	Radar	Satellites

Performance Indicators

Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's.

4.E.2B.1 *Analyze and interpret data* from observations, measurements, and weather maps to describe patterns in local weather conditions (including temperature, precipitation, wind speed/direction, relative humidity, and cloud types) and predict changes in weather over time.

4.E.2B.2 *Obtain and communicate* information about severe weather phenomena (including thunderstorms, hurricanes, and tornadoes) to explain steps humans can take to reduce the impact of severe weather phenomena.

4.E.2B.3 *Construct explanations* about regional climate differences using data from the long term weather conditions of the region.

*Science and Engineering Practices

Support for the guidance, overviews of grade level progressions, and explicit details of each SEP can be 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.

4.S.1A.4 Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation or graphing) to (1) reveal patterns and construct meaning or (2) support explanations, claims, or designs.

4.S.1A.6 Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.

4.S.1A.8 Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.

***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.

1. Patterns- The National Research Council states "Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *Patterns can be found in the temperature, wind speed and direction in local weather.*

2. Cause and Effect: Mechanism and explanation: The National Research Council (2012) states "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). *Severe weather phenomenon will cause humans to take steps to help reduce the impact on their lives.*

3. Scale, Proportion, and Quantity: The National Research Council (2012) states "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). *By measuring temperature, humidity, wind speed, and wind direction, local weather predictions can be made.*

7. Stability and change: The National Research Council states" For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of system are critical elements of study" (p.84). *By studying local weather patterns, regional climate can be determined.*

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

Prior Knowledge

- K.E.3A.2; 2.E.2A.2 – Seasonal weather patterns over time
- K.E.3A.1 – Describe local weather conditions to see patterns in weather
- K.E.3A.4 – Weather impacts humans
- 2.E.2A.1 – Describe local weather conditions based on data
- 2.E.2A.4 – Explain severe weather phenomenon and why safety precautions are necessary

Subsequent Knowledge
• 6.E.2B.1 – Predict local weather conditions based on data • 6.E.2B.3 – Solar energy affects climate • 6.E.2B.4 – Explain how climate is determined • H.E.5A.6 – Climate is caused by global circulation • H.E.5A.7; H.E.5A.8 – Climate change & human responsibility • H.E.5A.3 – Predict local weather conditions based on data regarding air masses, pressure systems and frontal boundaries • H.E.5A.5 – Explain severe weather formation based on evidence of meteorological conditions.

Possible Instructional Strategies/Lessons **Strategies and lessons that will enable students to master the standard and/or indicator.**
• 4.E.2B.1 o Global Precipitation Measurement Mission: This lesson allows students to use the engineering model to create a rain gauge. This resource can be found at: https://pmm.nasa.gov/education/sites/default/files/lesson_plan_files/rain%20gauge%20activity/Rain%20Gauge%20Lesson%20Plan%20v2.pdf o Measuring Wind with Your Own Wind Meter: This activity allows students to make their own anemometers. This resource can be found at: http://www.sciencebuddies.org/science-fair-projects/Classroom_Activity_Teacher_WindMeters.shtml o Learn About Weather Using a Homemade Weather Vane: This activity allows students to make their own weather vane. This resource can be found at: http://www.pbs.org/parents/adventures-in-learning/2014/03/learn-about-the-weather-with-a-homemade-weather-vane o Build Your Own Sling Psychrometer: This activity allows students to make a sling psychrometer to measure humidity. This resource can be found at: http://www.flinnsci.com/documents/demopdfs/earthsci/es10301.pdf o Clouds Lots and Lots of Clouds: This activity allows students to make a flipbook of the different types of clouds. This resource can be found at: http://www.dragonfliesinfirst.com/2012/04/clouds-lots-and-lots-of-clouds.html

- 4.E.2B.2
  - Severe Storms: What to Do?: This activity allows students to obtain information about severe weather phenomena. This resource can be found at: http://www.getprepared.gc.ca/cnt/rsrcs/pblctns/svrstrms-wtd/index-en.aspx

- 4.E.2B.3
  - Designing a Levee: This activity allows students to use the engineering design process to create a levee that will withstand weather phenomenon over a period of time. This resource can be found at: http://studylib.net/doc/6766350/pendleton-elementary

  - TRB 4:2 Investigation 6: Collecting Weather Data: In this investigation students will collect data for two weeks. They will start seeing patterns and be able to make predictions. This resource can be found at: http://www.uen.org/Lessonplan/preview.cgi?LPid=10092

Resources

- 4.E.2B.1
  - Observe: Track clouds in the Sky :This resource gives information about the cloud types. This resource can be found at: http://teacher.scholastic.com/activities/wwatch/observe_step1.htm

- 4.E.2B.2
  - Hurricanes, Thunderstorms, and Tornadoes: This PowerPoint gives extensive information about hurricanes, thunderstorms and tornadoes. This resource can be found at: http://www.thomas.k12.ga.us/userfiles/687/Classes/41096/Hurricanes%20Thunderstorms%20and%20Tornadoes.ppt

- 4.E.2B.3
  - Weather and Climate: What's the Difference?: This resource enables students to learn the differences between weather and climate. This resource can be found at: https://www3.epa.gov/climatechange/kids/documents/weather-climate.pdf

- 4.E.2B.1 and 4.E.2B.3
  - Hands-On Science and Literacy Lessons About Weather and Climate: These lessons and activities could be used to help your students develop an understanding of weather and climate in their hometown. The resource can be found at: http://beyondpenguins.ehe.osu.edu/issue/weather-and-climate-from-home-to-the-poles/hands-on-science-and-literacy-lessons-about-weather-and-climate

Sample Formative Assessment Tasks/Questions

Additional sample formative assessment tasks/questions for grade bands are located at the end of each of the SEP Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)

- Use the Five Day Forecast for Charleston, SC to complete the below data table.

Five Day Forecast for Charleston, SC

	6/12	6/13	6/14	6/15	6/16
Wind speed	8 mph	9 mph	3 mph	2 mph	2 mph
Wind direction					
Relative Humidity	53%	53%	70%	100%	85%
	Thu	Fri	Sat	Sun	Mon
Precipitation					
Hi/Low Temperature	83° 66°	84° 67°	81° 68°	79° 68°	85° 69°

Make sure you complete the following:

a. Enter the wind speed.
b. Use the arrows and compass rose to determine the wind direction.
c. Enter the relative humidity
d. Use the weather icons to determine the precipitation.
e. Enter the high temperature
f. Enter the low temperature.

Five Day Forecast for Charleston, SC

Weather Condition	6/12	6/13	6/14	6/15	6/16
Wind Speed					
Wind direction					
Relative humidity					
Precipitation					
High Temperature					
Low Temperature					

- Thunderstorms often occur in Charleston. Often there is lightning, thunder, heavy rain, and strong winds. Describe one safety concern people might have when a thunderstorm is approaching and what people can do to ensure they are safe during the thunderstorm.

Safety concern:
Safety precaution:

- The picture below shows a tornado. Describe one way that the tornado might affect the habitat of humans living in the area.

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