2019 Core Knowledge Science Sequence

Grade 3 Unit 4: Weather and Climate

Introduction

This unit focuses on the causes and effects of weather and climate. Students work to describe patterns in atmospheric conditions across time and location, and investigate how predictions about the weather are made.

What causes changes in the weather? What is the relationship between weather and climate? These questions are central to big-picture investigations of these phenomena. This unit starts by looking at Earth's atmosphere, the mixture of gases surrounding the planet. The oxygen we need makes up only about twenty percent of the atmosphere. Another important gas in the air is water vapor, which—through evaporation, condensation, and precipitation—plays a big part in weather. Meteorologists and climatologists study patterns of weather over different scales of time.

Data on wind speed and direction are important to meteorologists because they demonstrate predictable patterns. Meteorologists also use other kinds of information to forecast the weather. Climatologists study patterns over longer time periods using much of the same data.

Students also learn that some forms of weather can be severe and hazardous, such as hurricanes, tornadoes, or lightning storms. People can design solutions to prepare for hazardous weather and to minimize risks of the effects of dangerous changes in the weather.

Note to Teachers and Curriculum Planners

This unit introduces Grade 3 students to real-world examples and fundamental concepts that will be explored in greater depth in later grades. Students will learn about observable weather patterns, factors that produce weather conditions, and long-term weather patterns that establish climate. The following are preliminary considerations for planning and instruction relative to this unit:

- While the unit engages Grade 3 students with data in tables and graphical displays, assessment of graphical displays is limited to pictographs and bar graphs.
- Students will compare and contrast different climate conditions, but assessment does not include explanations about climate change.
- For young students, the concept of air pressure is an abstract concept, best explained and understood through physical demonstrations of air as matter—for example, through discussions of how and why a balloon inflates when air is blown into it, or the experience of pressure while pushing the plunger of a sealed syringe.
- Students are asked to evaluate solutions intended to reduce the impact of weather hazards. Examples of such solutions include barriers to prevent flooding, wind-resistant roofs, and lightning rods.
- Knowledge gained during this unit will be applied during future units, such as within Grade 4 Unit 4 *Processes That Shape Earth* and Grade 5 Unit 3 *Modeling Earth's Systems*.

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2019 CORE KNOWLEDGE SCIENCE SEQUENCE	SUGGESTED LEARNING OBJECTIVES	LANGUAGE OF INSTRUCTION
The Sequence guidelines identify specific content and skills for building knowledge coherently from grade to grade.	These suggested learning objectives may be modified to meet state and local standards as well as the needs of specific schools and classrooms.	This word list provides a sampling of the vocabulary to which students should be repeatedly exposed during instruction. The list is not intended for use in isolated drill or memorization.

A. Earth's Atmosphere
 	
<u>Air and the atmosphere</u>
• Air: a mixture of gases
  ○ Air is matter (takes up space).
• The atmosphere: mixture of gases surrounding Earth
  ○ The atmosphere makes life on Earth possible.
  ○ The most common gases in the atmosphere are nitrogen and oxygen.
  ○ The atmosphere grows thinner as you move upward from Earth's surface.
• Air pressure: the weight of air in the atmosphere
  ○ Relationship between air pressure and temperature: warm air is lighter (less pressure) and cold air is heavier (more pressure)
 	
<u>Water in the atmosphere</u>
• Humidity: the amount of water vapor in the air
• Evaporation: the sun's energy changes liquid water in lakes, rivers, and oceans to gas (water vapor)
	• Use a model to demonstrate that air is matter.
	• Describe characteristics of the air and Earth's atmosphere. .
	• Identify the two most common gases in Earth's atmosphere.
	• Organize data relating to the composition of Earth's atmosphere.
	• Describe differences between evaporation and condensation.
	• Identify different forms of precipitation.
	• Explain the relationship between warmer or cooler temperature and lower or higher air pressure.
		atmosphere
		air
		mixture
		gas
		pressure
		water vapor
		humidity
		evaporation/evaporate
		condensation/condense
		weather
		cloud
		precipitation
		rain, snow, sleet, hail

• Condensation of water vapor in the atmosphere forms clouds and fog • Precipitation: water that falls from clouds (as rain, snow, sleet, or hail) NGSS References: • DCI ESS2.A • DCI ESS2.C Science and Engineering Practices • Engaging in Argument from Evidence • Analyzing and Interpreting Data • CCC Patterns		

B. Wind: The Movement of Air
• The relation between wind and air pressure
  ○ Energy from the sun warms the Earth unevenly, which creates areas of warm air (lower air pressure) and areas of cool air (higher air pressure).
  ○ Winds are the result of air moving from areas of high air pressure to areas of low air pressure.
• Changes in the wind: speed and direction
• Prevailing winds: regular patterns
NGSS References:
• DCI ESS2.A
• DCI ESS2.D
• Engaging in Argument from Evidence
• Analyzing and Interpreting Data
• CCC Patterns
	• Identify the sun as the source of energy that warms air.
	• Define wind as the movement of air
	• Create tables and graphs that represent wind data.
	• Identify and describe patterns in wind direction over time.
	• Compare wind speed data from different locations over time.
		wind
		wind vane
		air movement
		air temperature
		air mass
		speed
		direction
		change
		data/table/graph
		pattern
		prevailing winds

C. Weather and Climate <u>Weather and weather forecasting</u> • Weather: the conditions in the lowest layer of the atmosphere at a particular time and place • Weather conditions vary from place to place and change over time. • Meteorologists: scientists who use data (regarding temperature, humidity, air pressure, wind speed and direction, etc.) to understand and predict weather and climate. <u>Climate</u> • Climate: the pattern of weather conditions in an area over a long period of time • Climate varies from place to place across different regions of the Earth. • Climate in one location can vary over time. • Climatologists: scientists who use long-term weather data to understand and predict climate. NGSS References: • 3-ESS2-1 • 3-ESS2-2 • DCI ESS2.A • DCI ESS2.D • Analyzing and Interpreting Data • Obtaining, Evaluating, and Communicating Information	• Describe what a meteorologist does. • Differentiate between weather and climate. • Collect and organize weather data for a single location by season. • Use tables, graphs, and maps to describe yearly patterns of weather for a single location. • Citing evidence, predict the typical weather you might expect during an upcoming season in one location. • Compare the seasonal weather patterns of your location with the seasonal patterns of another location. • Describe the climate of the region where you live. • Gather and communicate information about a region with a different climate than your own. • Citing evidence, describe the changes in climate that have occurred in an area over time.	weather meteorologist conditions prediction data/table/graph sunlight temperature front precipitation weather map satellite season/seasonal maximum/minimum trend climate/climate zone climatologist ice age

D. Reducing the Impact of Hazardous Weather Types of severe weather • Storms: high winds, heavy rains, lightning, thunder • Extreme weather events: tornadoes, hurricanes, blizzards, drought • Flooding during and after storms Protecting people from severe weather • Extreme weather conditions can endanger people and cause destruction. • People can plan and take steps to reduce damage and avoid danger from weather hazards (for example, levies, warning systems, lightning rods, special buildings and structures, etc.) NGSS References: • 3-ESS3-1 • DCI ESS3.B • SEP Engaging in Argument from Evidence • CCC Cause and Effect	• Describe examples of extreme weather conditions. • Relate the causes of an extreme weather condition to its destructive effects. • Identify ways to avoid danger and protect yourself during weather hazards. • Plan a solution to minimize the destruction from a severe weather event. • Evaluate the effectiveness of a solution intended to reduce the effects of a weather-related hazard.	severe extreme hazard/hazardous effect destruction storm lightning thunder tornado hurricane flood blizzard drought problem solution constraint/criteria engineering design evaluate claim/evidence optimize

Possible Science Biographies

Evangelista Torricelli: physicist and mathematician who invented the barometer and studied air pressure
Blaise Pascal: formulated what came to be known as the Pascal's Law regarding pressure
Benjamin Franklin: experiments with lightning and invented a lightning rod to protect people, buildings, and other structures.
Tetsuya "Ted" Fujita: storm researcher who classified the F-scale used for rating the severity of tornadoes [also known as the FPP Scale]

As noted above, this unit references the following standards that are a part of the Next Generation Science Standards (NGSS) Grade 3 Topic *Weather and Climate*:

3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. 3-ESS2-1 **Evidence Statements**

3-ESS2-2. Obtain and combine information to describe climates in different regions of the world. 3-ESS2-2 **Evidence Statements**

3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. 3-ESS3-1 **Evidence Statements**