

Unit: Weather and Climate

Content Area: **Science**
Course(s): **Integrated Science 7**
Time Period: **Week**
Length: **10 weeks**
Status: **Published**

Unit Overview

Students investigate the atmosphere and energy transfer, the water cycle, air pressure and air masses, weather prediction, climate factors and patterns, and Earth's changing climates.

Transfer

Students will be able to independently use their learning to...

- Become better prepared for catastrophic weather events.
- Understand the dangers of catastrophic events and use proper safety precautions.
- Forecast local weather and explain how weather conditions inform design decisions.
- Investigate a career in meteorology.
- Understand how heat in a home is dispersed.
- Argue from evidence the reason for refrigeration of food.
- Make decisions about protection in extreme weather.
- Make decisions regarding use of alternate energy sources.
- Develop action plans to mitigate problems associated with rapid climate change.
- Investigate the role of resource management planning in storm surge protection in NJ.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand ...

- Importance and key features of Earth's atmospheric layers.
- Multiple factors make up Earth's weather systems.
- The role of the sun in affecting temperature changes around the Earth.
- How heat moves through different substances.
- How the greenhouse effect works.
- How differences in air pressure cause wind.
- The role of the water cycle in shaping the weather.
- How interaction of air masses change the weather.
- How scientists predict weather and create weather maps from data.
- How global wind patterns are caused by uneven heating of Earth's surfaces.
- How global winds affect climates around the world.
- Which factors affect climate at a local level (microclimates).
- Earth's climate is changing throughout time.
- Changing climate causes changes in sea level, ecosystems, and weather patterns.

Essential Questions

Students will keep considering...

- What is the difference between heat and temperature?
- How do air and water move on Earth?
- What makes weather wet and wild?
- What kind of detrimental weather could occur where I live? Are we ready? What should we do?
- How do constructive and destructive forces shape and reshape the earth's surface?
- Why are climates around the earth so different?
- How is latitude related to climate?

Application of Knowledge and Skill

Students will know...

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- Weather is the result of short-term variations in temperature, humidity, and air pressure.
- Climate is the result of long-term patterns of temperature and precipitation.
- Global patterns of atmospheric movement influence local weather.
- Climate is influenced locally and globally by atmospheric interactions with land masses and bodies of water.
- Weather (in the short term) and climate (in the long term) involve the transfer of energy and water in and out of the atmosphere.
- How cause and effect relationships can be used to predict weather phenomena.
- How global patterns are related to local weather.
- How data is used to inform meteorologic predictions.
- Data provides evidence that a changing climate is causing a rise in sea level.
- How advances in technology integration has improved our ability to predict the weather and measure climate change.

Students will be skilled at...

Students will be skilled at...

- Explain the interrelationships between daily temperature, air pressure, and relative humidity data.
- Determine the origin of local weather by exploring national and international maps.
- Create climatographs for various locations around Earth and categorize the climate based on the yearly patterns of temperature and precipitation.
- Explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country.
- Explain how local weather conditions impact design decisions.
- Designing devices for surviving in extreme weather environments.
- Create a model of the hydrologic cycle that focuses on the transfer of water in and out of the atmosphere. Apply the model to different climates around the world.
- Developing an action plan for a severe weather event, including advance planning and mitigation of its effects.
- Making claims and predictions based on evidence from their investigations.
- Using models to describe weather phenomena.
- Interpreting data represented in graphs, charts, and tables and use the data to identify patterns.
- Analyzing data to uncover similarities and differences.

Academic Vocabulary

absolute humidity

aerosol

air mass

albedo

anemometer

atmosphere

atmospheric pressure

barometer

biosphere

blizzard

California Current

climate

climate change

climate change adaptation

climate change mitigation

climate zone

cold front

condensation

conduction

constraints

convection

convection cell

Coriolis effect

criteria

crystallization

deforestation

density

density currents

dew

dew point

El Niño

enhanced greenhouse effect

evaporation

geosphere

global ocean convection cycle

global warming

global winds

greenhouse effect

greenhouse gases

groundwater

Gulf Stream

heat

heat index

heat wave

high pressure system

hurricane

hydrosphere

ice age

ice sheet

isobar jet stream

kinetic energy

latitude

local climate

low pressure system

microclimate

occluded front

ocean current

permafrost

polar

precipitation

proportional

prototype

radiation

relative humidity

renewable energy

sea level

sea level rise

severe thunderstorm

severe weather

stationary front

stratosphere

surface current

surface winds

sustainable

system

temperate

temperature

topography

tornado

transpiration

tropical

troposphere

urban heat island

warm front

water cycle

weather

weather front

wind

Learning Goal 1

Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

SCI.MS-ESS2-6

Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

SCI.MS-ETS1-1

Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Target 1 (Lesson 1, 3, 10)

Students can relate ocean temperatures to global circulation and flow of energy of the ocean.

Target 2 (Lesson 1, 3, 4)

Students will identify the layers of the atmosphere and its composition; including density, temperature, and height.

Target 3 (Lesson 9)

Use a model of the Coriolis Effect to predict global wind patterns to make decisions about shipping routes.

Target 4 (Lesson 8, 11)

Explore and use the effects of albedo, climographs and maps to explain climate differences in similar latitudes.

Learning Goal 2

Develop and use a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

SCI.MS-ESS2-4	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Target 1 (Lesson 5)

Create a psychrometer and use it to measure humidity, analyze dew point data.

Target 2 (Lesson 5)

Create a model of the water cycle that includes the influence of sunlight and gravity.

Learning Goal 3

Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions

SCI.MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Target 1 (Lesson 4, 5, 6)

Use models to understand pressure and then build your own barometer. Analyze air pressure data to predict weather patterns across the United States.

Target 2 (Lesson 5, 6, 7)

Students collect local weather data, model four different fronts using cold and warm water, and interpret a series of weather maps to make predictions.

Learning Goal 4

Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

SCI.MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Target 1 (Lesson 7)

Students analyze weather maps to predict severe weather.

Learning Goal 5

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

SCI.MS-ESS3-3

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Target 1 (Lesson 2)

Identify and clarify evidence for how a changing climate is causing rising sea levels and changes in ecosystems and weather patterns.

Target 2 (Lesson 12)

Work in a team of scientists to describe a city's regional climate and the threats it faces from climate change. Analyze plans to mitigate or adapt to climate change.

Learning Goal 6

Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century

SCI.MS-ESS3-5

Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Target 1 (Lesson 12)

Explore how different forms of light interact with the atmosphere through building a model of the layers of the atmosphere and simulations that demonstrate the greenhouse effect, apply what you've learned as you predict the temperatures of planets.

Target 2 (Lesson 13)

Create a timeline of Earth's climate history, Make a list of questions about climate change and categorize

them. Create an explanation for changes in the average global temperature over the past 100 years

Learning Goal 7

Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

SCI.MS-PS3-3

Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Target 1 (Lesson 13)

Generate and use temperature data to test a variety of items to determine which are insulators and which are conductors.

Learning Goal 8

Plan an investigation to determine the relationship among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

SCI.MS-ETS1-3

Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

SCI.MS-ETS1-1

Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

SCI.MS-PS3-4

Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

Target 1 (Lesson 3)

Draw conclusions from modes about how the atmosphere blocks certain wavelengths of light.

Target 2 (Lesson 2, 3)

Analyze data to discover how the greenhouse effect works.

Learning Goal 9

Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Target 1 (Lesson 2)

Construct arguments based on scientific evidence to explain how heat moves through different substances.

Formative Assessment and Performance Opportunities

- Anchoring phenomena checkpoints
- Constructed response
- Exit tickets
- Group work
- Interactive science notebook
- KWL charts
- Misconception check
- Performance assessments
- Quizzes
- Rubrics
- Teacher observation

Summative Assessment

Common Assessment in Linkit

Unit 1 Performance Assessment - Apply what you have learned about maximizing and minimizing the flow of heat to explain how local weather conditions impact design decisions.

Unit 2 Performance Assessment - Develop an action plan for a severe weather event, including providing advanced warning, preparation plans, and the mitigation of its effects.

Unit 3 Performance Assessment - Work with a team to develop a device or an action plan designed to mitigate a specific problem associated with rapid climate change.

Accommodations/Modifications

- Carefully review the safe handling of all materials and tools
- Evaluate and modify student teams for successful collaboration
- Flexible grouping
- For conservation of energy of a system; have student explore the idea of systems
- Guided reading; read aloud
- Learning stations provide opportunity to teach small groups
- Pre-teach vocab using context clues
- Pre-teach vocab using vocab cards feature
- Provide physical paper copies of maps as needed
- Replace numbered steps of investigation with labeled pictures
- Re-word, Re-teach and Clarify
- Scaffold learning
- Use chart paper or white boards to provide pacing and visual cues to stay organized during group activities
- Use graphic organizers such as t-charts when evaluating cause and effect relationships for climate change
- Use of collaboration during various activities
- Use of games and tournaments
- Use of models
- Use Quizlet for vocabulary review
- Use scale when teaching relative layers of the atmosphere
- Use single sentence summaries of main ideas for each lesson to model note-taking

- Varied supplemental materials

Unit Resources

TCI on-line	Chromebooks	Science World Magazines
TCI kits	Supplemental textbooks	Review Games
Bill Nye Series	Digital Resources	Google Hangouts
Document Camera	Interactive Science Notebook	Blackline Masters

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Interdisciplinary Connections

MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
LA.RL.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
LA.RL.7.4	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of rhymes and other repetitions of sounds (e.g., alliteration) on a specific verse or stanza of a poem or section of a story or drama.
MA.6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
LA.RL.7.7	Compare and contrast a written story, drama, or poem to its audio, filmed, staged, or multimedia version, analyzing the effects of techniques unique to each medium (e.g., lighting, sound, color, or camera focus and angles in a film).

LA.RL.7.8	(Not applicable to literature)
LA.RL.7.9	Compare, contrast and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) a fictional portrayal of a time, place, or character and a historical account of the same period as a means of understanding how authors of fiction use or alter history.
MA.7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
MA.7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
LA.W.7.1.A	Introduce claim(s), acknowledge alternate or opposing claims, and organize the reasons and evidence logically.
LA.W.7.1.B	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
LA.W.7.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
LA.W.7.2.A	Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).
LA.W.7.2.B	Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.
LA.W.7.2.F	Provide a concluding statement or section that follows from and supports the information or explanation presented.
LA.W.7.7	Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
LA.W.7.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
LA.W.7.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.SL.7.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.
LA.SL.7.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
MA.6.SP.B.5c	Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
LA.L.7.4.A	Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
LA.L.7.4.B	Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., belligerent, bellicose, rebel).
LA.L.7.4.C	Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and

digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.

LA.L.7.4.D

Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).