6.3 Weather and Climate

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **6 weeks**
Status: **Published**

Course Pacing Guide

Unit	MP	Weeks
Intro to MS Science and Light	1	5
Thermal Energy	1	8
Weather and Climate	2	9
Plate Tectonics	2, 3	6
Natural Hazards	3, 4	6
Cells and Systems	4	8

Unit Overview

This unit starts with students exploring a series of hailstorm events from different locations across the country at different times of the year. These cases spark questions and ideas for investigations around trying to figure out how ice can be falling from the sky on a warm summer day, how clouds form, why some clouds produce storms with large amounts of precipitation and others don't, and how all that water gets into the air in the first place.The second half of the unit focuses on the exploration of a weather report of a winter storm that affected large portions of the midwestern United States. Students analyze maps, transcripts and video that show the storm was forecasted to then produce heavy amounts of snow and ice in large portions of the northeastern part of the country. This sparks questions and ideas for investigations around trying to figure out what could be causing such a large-scale storm and why it would end up affecting a different part of the country a day later.

Enduring Understandings

- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not

change relative locations.
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.
- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.
- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.
- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.
- Because these patterns are so complex, weather can only be predicted probabilistically.

Essential Questions

- What causes precipitation events like hail to occur?
- What are conditions like on days when it hails?
- How does the air up high compare to the air near the ground?
- Why is the air near the ground warmer than the air higher up?
- What happens to the air near the ground when it is warmed up?
- How can we explain the movement of air in a hailstorm cloud?
- Where did all that water in the air come from, and how did it get into the air?
- What happens to water vapor in the air if we cool the air down, and why?
- Why don't we see clouds everywhere in the air, and what is a cloud made of?
- Why do clouds or storms form at some times but not others?
- Why don't water droplets or ice crystals fall from the clouds all the time?
- What causes more lift in one cloud versus another?
- Why do some storms produce really big hail and others don't?
- What causes a large-scale precipitation event like this to occur?
- What happens with temperature and humidity of air in large storms?
- How do warm air masses and cold air masses interact along the boundaries between them?
- Is there a relationship betwen where the air is rising and where precipitation falls?
- How can we explain what is happening across this storm (and other large-scale storms)?
- Are there patterns to how air masses move that can help predict where large storms will form?
- How do oceans affect whether a place gets a lot or a little precipitation?
- Why is there less precipitation further inland in the Pacific Northwest than further inland from the Gulf Coast?
- How can we explain differences in climate in different parts of the world?

New Jersey Student Learning Standards (No CCS)

SCI.MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air

	masses result in changes in weather conditions.
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-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
SCI.MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Interdisciplinary Connections

LA.RI.6.1	Cite textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
MA.6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
LA.RI.6.9	Compare, contrast and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) one author's presentation of events with that of another (e.g., a memoir written by and a biography on the same person).
LA.W.6.8	Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

Technology Standards

TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

21st Century Themes/Careers

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

Instructional Strategies & Learning Activities

Throughout this unit, students will:

- Develop a model for how light interacts with matter and use it to explain why surfaces on Earth warm up over the course of a sunny day and why different types of surfaces warm up more than others
- Develop a model for how the composition and spacing of molecules in gases are affected by temperature changes and use it to explain why parcels of air rise or sink in the surrounding air after those parcels are warmed or cooled

- Develop a model for how the motion and interactions of the molecules of a substance change when thermal energy is transferred to it or from it and use it to explain what is happening when water evaporates, boils, condenses and freezes and what causes clouds to form
- Plan and carry out experiments to determine how convection currents are driven by temperature differences in a fluid and use those results to explain what causes increased lift forces and wind speeds in and under a storm cloud
- Develop a model for how differential heating of gases and liquids results in convection and use it to explain why precipitation doesn't fall from every cloud and why some storms produce hail and others do not

Learning Activities include:

- Exploring an anchoring phenomenon and developing questions
- Creating a Driving Question Board and Ideas for Investigations
- Analyzing and interpreting data from various storm events
- Analyzing and interpreting weather balloon data
- Planning and carrying out an investigation - collecting temperature and light data above various ground surfaces
- Planning and carrying out an investigation - air in a closed system
- Observing cloud movement
- Reading a text excerpt about composition of air
- Planning and carrying out an investigation - cooling warm, humid air
- Modeling with magnetic marbles
- Reading a text excerpt about cloud formation and cloud condensation nuclei
- Using a digital simulation to create a thunderstorm
- Planning and carrying out an investigation - convection currents

Differentiated Instruction

Examples may include:

- Inquiry/Problem-Based Learning
- Learning preferences integration (visual, auditory, kinesthetic)
- Sentence & Discussion Stems
- Tiered Learning Targets
- Meaningful Student Voice & Choice
- Relationship-Building & Team-Building
- Self-Directed Learning
- Mastery Learning (feedback toward goal)
- Grouping
- Rubrics
- Jigsaws
- Learning Through Workstations

- Assessment Design & Backwards Planning

Formative Assessments

- Exit Tickets/Google Form reflections
- Scientist Circle discussions
- Soap Bubble investigation model
- Student Science notebooks

Summative Assessment

This unit contains several summative assessments that address different science and engineering practices. In the first summative assessment (at the unit mid-point), students will complete a transfer task to apply what they have figured out thus far in the unit to a hurricane scenario.

In the second summative assessment, students will record patterns they notice and then use these patterns to analyze data in an assigned map. They will work to write scientific explanations and then improve their explanations using peer feedback.

In the end-of-unit summative assessment, students apply their understanding to explain the phenomena in a different context. This is a transfer task.

Benchmark Assessments

- Fall/Winter LinkIt Assessments

Resources & Technology

- Storyline and lessons adapted from OpenSciEd Weather and Climate Unit
- Digital simulations of storm conditions
- Use of light meters, digital thermometers, humidity probes

BOE Approved Texts

N/A

Closure

Individual classes and lessons will end with a closure activity that reinforces what students figured out during class, and helps navigate toward next steps.
Closure activities may include:

- Scientists' Circle
- Post-it reflection
- Google form exit ticket
- Group performance reflection
- Science notebook jot

ELL

- Alternate Responses
- Advance Notes
- Extended Time
- Teacher Modeling
- Simplified Written and Verbal Instructions
- Frequent Breaks
- Google Translate

Special Education

Accomodations will be made in accordance with students' IEPs. The following list provides examples:

- Shorten assignments to focus on mastery of key concepts.
- Substitute alternatives for written assignments (clay models, posters, panoramas, collections, etc.)
- Keep workspaces clear of unrelated materials.
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Maintain adequate space between desks.

- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Allow the student to complete an independent project as an alternative test.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.
- Mark the correct answers rather than the incorrect ones.
- Use a pass-fail or an alternative grading system when the student is assessed on his or her own growth.

504

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits

At Risk

Examples may include:

- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Assistance in maintaining uncluttered space
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Peer or scribe note-taking
- Use of manipulatives
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Adjusted assignment timelines
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects

- Film or video supplements in place of reading text
- Cue/model expected behavior
- Use de-escalating strategies
- Use peer supports and mentoring
- Have parent sign homework/behavior chart
- Chart progress and maintain data

Gifted and Talented

Examples may include:

- Offer choice
- Speak to Student Interests
- Allow G/T students to work together
- Tiered learning
- Focus on effort and practice
- Encourage risk taking