Unit 1:
Earth's Systems, Human Activity, and Engineering

Science Grade 3

This unit focuses on weather and climate at the third grade level. Students will learn that weather is the temperature, precipitation, air pressure, and wind speed and direction of a place at any given time. They will learn to differentiate between weather and climate, as they learn that climate is the pattern of weather in a place over a period of time. They will also learn about the different climate zones on the earth, and man-made objects used to prevent weather-related problems. At the end of the unit students will use their knowledge to analyze the efficiency of certain weather-related tools and make determinations about how they could be improved.

A collaboration with Cape Cod Regional STEM Network, D. Fratus and L. Kraus (Dennis-Yarmouth Public Schools) & K. Piknick (Monomoy Public Schools). This material is based upon work supported by the National Science Foundation under Grant No. 1347610. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Stage 1 Desired Results

MA STE Standards

3-ESS2-1. Use graphs and tables of local weather data to describe and predict typical weather during a particular season in an area.

3-ESS2-2. Obtain and summarize information about the climate of different regions of the world to illustrate that typical weather conditions over a year vary by region.

3-ESS3-1. Evaluate the merit of a design solution that reduces the damage caused by weather.*

3.3-5-ETS1-1. Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.*

3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.*

3.3-5-ETS1-4 (MA). Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution.*

ESSENTIAL QUESTIONS

Q1. What is weather?

Q2. How does weather affect our lives?

Q3. What is climate?

Q4. What are the regions of the world?

Q5. How does weather impact the lives of the people who live in those different regions?

Q6. How can people help protect themselves from weather-related hazards?

UNDERSTANDINGS

Students will understand that…

- bar graphs and pictographs can be used to show data about weather patterns over time (climate).
- weather over time makes up the climate of a region.
- different regions of the world have different climates.
- different design solutions can be used to prevent weather-related damage.

Students will be skilled at…..

- making predictions based on data interpreted from bar graphs and pictographs.
- summarizing the changes in the climate of a region over the course of a year.
- supporting their claims with evidence.

TRANSFER

Students will be able to independently use their learning to…

analyze a design solution used to prevent a weather-related problem , and describe how effective the design solution would be in a particular climate.

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	Cross-Curricular Connections English Language Arts ● Opinion writing ● Expository writing ● Reading informational text ● Speaking and Listening ● Comparing and Contrasting ● Using supporting details Mathematics ● Reading and interpreting graphs Social Studies ● Regions of the world ● Geography ● How climate affects the different regions economically

Stage 2 Evidence

Formative Assessment Ideas:

- Students make reasonable predictions based on local weather data.
- Students demonstrate understanding of the six climate zones/regions.
- Students support their claims about a design solution to a weather-related problem.

Will be assessed through teacher-observation, tickets-to-leave, quick writes, Partner Shares, etc.

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Summative Assessment Ideas: Written Summative Assessment includes:

- Students label the six climate zones of the world.
- Students illustrate the yearly climate of 2 given regions, and compare the climate zones in writing.
- Students predict impending weather based on provided weather graphs.
- Students analyze a design intended to reduce weather-related problems, and support their opinion about the merit of the design in writing.

Stage 3 Learning Plan

Lesson 1 (Days 1-2): Introduction to Weather

Day 1: Students engage in a range of collaborative discussion with partners, and within a whole group, in order to build some background knowledge about the question "What is weather?" Students will participate in a read-aloud, discussions, and begin a word wall, in order to activate their prior knowledge and help the classroom teacher determine any misconceptions the students may have at the onset of this unit.

Day 2: Students participate in a weather scavenger hunt to continue to enhance their background knowledge about the topic of weather. The students will also continue to work on a KWL chart to continue to increase their vocabulary, and as a way for them to keep track of their learning.

Lesson 2 (Days 3-7): Track Weather Like a Meteorologist

Day 1 (3): Students begin tracking weather through use of a teacher-created table, in conjunction with use of the online Weather Underground website. They will continue to use this table and Weather Underground each day for the remainder of the week. In addition to beginning to track the weather in their area, they also begin to use thermometers to measure daily temperature, which is a third grade math standard.

Day 2 (4): Through demonstration, as well as video support, students will learn that temperature of the air causes wind, and can change air pressure.

Day 3 (5): Students will continue to learn about wind in this lesson, with a focus on wind speed and direction. They will use the Beaufort Wind Scale in order to help them realize they can approximate wind speed using observation of the things around them.

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Day 4 (6): The focus of this day is to help the students understand the basics of the Water Cycle. Through a demonstration, use of BrainPop, and an activity the students conduct with a partner, they should understand the concepts of evaporation, condensation, and precipitation.

Day 5 (7): Students will participate in a read-aloud story discussion, and and activity in which they will make their own cloud in a jar, in order to enhance their knowledge of types of clouds in connection with weather and sky cover. They will also participate in an art activity to make different types of clouds. This will be the final day of learning about specifics in regards to weather, and next the students will move onto recognizing that patterns in weather make up the climate of a place.

Lesson 3 (Day 8): Time for a Forecast

Day 1 (8): Students use their knowledge of weather, and the information from their Weather Data Charts to make predictions about upcoming weather. They will present these predictions to the class in the form of a weather "forecast."

Lesson 4: Let's Vacation in an Exciting Climate! *

Day 1 (9): Students learn the difference between weather and climate. They also learn that different regions of the globe have different climates.

Day 2 (10): Students conduct research into particular climates of the world, and create a brochure to try and entice their teacher to go to a particular region on vacation.

*** This portion of the unit (with research and brochure creation) may actually take 5-6 class periods to complete fully.**

Lesson 5: Building a City

Days 1-4 (11-14): Students will use the *EIE* model for engineering to create a model of a city along a waterway with a barrier to prevent the city from flooding in an extreme weather event, then test their solution with water and make revisions based on their evaluations and observations.

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Introductory Lesson	Constructing Lesson	Practice Lesson	Assessment Lesson
Lesson that introduces the content. More teacher directed	Lessons that engage students in building and linking together understanding. Guided/collaborative. Student/teacher or partners/small group	Lessons or activities that students can complete relatively independently	Formative: Check-ins along the way to see if students "get it" Summative: Students showing what they know, when you feel they are ready

Stage 3 Learning Plan

Summary of Key Learning Events and Instruction

Lesson Name	**Type** (Introductory, Constructing, Practice, and Assessment)	Content Addressed	**Standards Included** (by number)
Introduction to Weather	Introductory	Basic weather vocabulary, students' prior knowledge.	SL.3.1
Track Weather Like a Meteorologist	Practice	Data specific to weather: temperature, precipitation, wind direction, sky conditions, air pressure, and wind speed.	3-ESS2-1
Time for a Forecast	Constructing, Assessment	Data specific to weather: temperature, precipitation, wind direction and speed, and sky conditions.	3-ESS2-1
Let's Vacation in an Exciting Climate!	Constructing, Assessment	Students knowledge about weather is transferred into learning about climate.	3-ESS2-1 3-ESS2-2
Building a City	Constructing, Assessment	Student learning culminates with the students putting together their knowledge of weather, climate and design solutions to construct their own design solution.	3-ESS2-1 3-ESS2-2 3-ESS3-1

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Lesson 1: Introduction to Weather

Overview of the Lesson: The students will be brainstorming a definition of weather, collecting weather words while listening to a humorous "weather" story, completing a KWL about weather, and beginning a weather journal.

Time (minutes): 120 minutes (2 days)

Standard(s): What standards (s) will be the focus of the lesson?

- **SL.3.1** Engage effectively in a range of collaborative discussions with diverse partners on grade 3 topics and texts building on other's ideas and expressing their own clearly.

Essential Question(s): What essential questions will be addressed in this lesson?

- What is weather?
- How does weather affect our lives?

Science Objectives

- Students will brainstorm a list of questions and weather words, based on prior knowledge, to be amended through the unit.
- Students will infer how people's lives are affected by changing weather conditions.
- Students will identify some weather-related things in their environment.

Language Objectives and/or Targeted Academic Language

- Students will use content-specific language in their discussion (weather, snow, sleet, hail, rain, wind).
- Students will engage in cooperative discussions about weather.

Anticipated Student Preconceptions/Misconceptions (optional)

- Weather is caused by luck or chance.
- The main fact in weather is temperature.

Instructional Materials/Resources/Tools

Day 1:

- *Cloudy with a Chance of Meatballs* (Judi Barret)
- 12 x 18" construction paper (or manila folders)
- chart paper and sticky notes

Day 2:

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- clipboard for each group
- Scavenger Hunt Clue Sheet
- pencils
- collection bags

Assessment: How will you know that the students got it?
Students' understanding of the objectives will be assessed through participation in the class discussion, turn-and-talks, and entries in their weather folders.

Science and Engineering Practices included (in bold):

1. Asking questions (for science) and defining problems (for engineering)
8. Obtaining, evaluating, and communicating information

Notes about Science and Engineering Practices included:

- Students will brainstorm to answer the question "what is weather?"
- Students will obtain information from the story and their peers about what weather actually is, and communicate their thinking with one another.

Lesson Details, including but not limited to:

Day 1:

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Students are asked to think about the question "What is weather?"
2. Have students make folders to store weather related papers in during the unit. The front cover should have a title about weather and an appropriate picture. The inside of the front cover should be labeled: What I KNOW, and students should brainstorm what they know (or think they know about weather).
3. Students choose one thing they know about weather and write it on a sticky note for classroom chart.
4. Teacher will share the responses orally.
5. Students should label the inside back cover: What I WANT to know, and the back cover: What I LEARNED.

During the Lesson

1. Explain to students that they should be listening for weather words and terms as the story is being read.

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2. Read aloud *Cloudy With a Chance of Meatballs* (interactively).
3. Allow students time to fill in the categories on their folder independently.

Lesson Closing

1. Working as a class, share some of the information, and the teacher can begin a classroom KWL chart.
2. Students can add to their folders as they listen to the questions and comments that other students have.
3. As this is going on, the teacher can also add weather related words on a chart paper (to be added to as the unit progresses).
4. Finally, end with an oral reading of the poem:

WEATHER

Whether the weather be fine
Or whether the weather be not,
Whether the weather be cold
Or whether the weather be hot,
We'll weather the weather
Whatever the weather,
Whether we like it or not.

Anonymous

Day 2:

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Introduce the Scavenger Hunt Clue Sheet and directions for the assignment.
2. This activity will give the students another opportunity to reflect on weather, how it changes, and the effects it has on people and things. They will go outside and collect, list, or sketch things that are weather related. Students should work in teams. This activity is best done on a sunny day. Some clues can be collected in bags; most can be drawn or described on paper. Allow approximately one half hour for the hunt and one half hour for groups to share their findings.

During the Lesson

1. Divide students into groups of three or four and give each group a Scavenger Hunt Clue Sheet. One student in each group should have a clipboard or a notebook and serve as the recorder.
2. After the students have completed the activity, the groups should report on their findings, explain the item found for

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each clue, and tell why they chose that item.

3. As an alternative, the students may take home the scavenger hunt, complete it with their family, and then bring in the completed sheet to discuss with classmates in small groups. Click here to view a scavenger hunt that was completed at home by a kindergartner and a second grader.

Lesson Closing

1. After the students have completed the activity, the group should report on their findings, explain the item found for each clue, and why they chose that item (partners working with different groups).
2. Have students independently add to their KWL one fact they learned. Weather words can be independently added to chart.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?

- Plan necessary support in collaboration with ELL or Special Education teachers.
- Have students collect pictures of various types of weather.
- Have students responsible for assembling and keeping track of a weather-type of bulletin board.
- Teacher puts together a classroom library of weather books: fiction and nonfiction and encourages student input.
- Designate a space for weather related items: library, weather station, data collection charts, etc.

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Lesson 2: Track Weather Like a Meteorologist

Overview of the Lesson: Students will explore a different concept each day (temperature, precipitation, air pressure, and wind speed and directions) to determine the factors that make up weather.

Time (minutes): 225 minutes (5 days)

Standard(s): What standards (s) will be the focus of the lesson?

- **3-ESS2-1.** Use graphs and tables of local weather data to describe and predict typical weather during a particular season in an area.

Essential Question(s): What essential questions will be addressed in this lesson?

- What is weather?
- How does weather affect our lives?

Science Objectives

- Students will explain how temperature, precipitation, air pressure, and wind speed and direction make up the weather in a particular place and time.
- Students will identify the three states of water in the water cycle.
- Students will distinguish among the various forms of precipitation (rain, snow, sleet, and hail), and make connections to this as being what makes up the weather in a particular place and time.

Language Objectives and/or Targeted Academic Language

- Students will participate in small and group discussions.
- Students will use charts to keep track of the weather for a week.

Anticipated Student Preconceptions/Misconceptions (optional)

Instructional Materials/Resources/Tools

Day 1:

- Daily Weather Chart
- thermometers
- clipboards

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- pencils

Day 2:
- Daily Weather Chart
- clean, empty 2-liter soda bottle with cap (for each group of students)
- round balloons (8-12 inches)
- hair dryer
- Eno board/projector

Day 3:
- Daily weather chart
- Roll of crepe paper cut into 3ft strips for each student
- Compass for teacher
- Pre made large size compass rose for outside use

Day 4:
- Daily Weather Chart
- clear 2-liter soda bottle (for each group of students)
- sharp scissors
- ruler
- wet sponge
- chalkboard or desk top
- glass of ice water
- "Water-Cycle Bottle" lab sheet
- 1 cup of warm water
- tape
- sunny windowsill

Day 5:

For demonstration:
- quart jar with lid
- very warm water

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- one piece of black paper
- match

For students:

- oak tag or cardboard
- cotton balls
- glue
- piece of string (to hang cloud)

Other:

- The Cloud Book by Tomie DePaola
- Hole punch

Assessment: How will you know that the students got it?

Science and Engineering Practices included (in bold):

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Notes about Science and Engineering Practices included:

Lesson Details, including but not limited to:

DAY 1:

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Lesson Opening (Engagement Strategy/Pre Assessment)

1. Discuss "What is a meteorologist?" (And meteorology).
2. Introduce the Daily Weather Chart to the students, and explain that we will be collecting data by charting the daily weather each day for the week. We will use our data to make predictions about future weather in our area.
3. https://docs.google.com/document/d/1cHhNSvYj-inOZbFDi38NEnA1J8xWo4eJtXekSsVhyZo
4. Explain that our focus today is to read thermometers to measure temperature.
5. Introduce thermometers, and practice reading them at various places in the room.

During the Lesson

1. Take the students outside, and have them make predictions about what they think the temperature outside is, while their thermometers sit in a location.
2. While the thermometers rest, discuss the different categories on the chart, and add what we can so far...wind direction, wind speed, precipitation, and sky conditions (in basic terms).
3. After 5-10 minutes, have students read their thermometers.
4. Discuss the differences in their findings (sunny vs. shady, length of time outside, etc.). Add to the chart.

Lesson Closing

1. Log on to The Weather Underground website.
2. Examine their information about the temperature, air pressure, wind direction, wind speed, precipitation and and sky conditions in your area.

Extension Activity for Day 1:

Students will take the temperature outside their house at the same time on a given day:

1. Obtain a map of your town showing the streets where the students live.
2. Choose one day on which the students will record the temperature outside their houses at the same time. One suggestion is to take the reading in the morning before they leave for school, probably between 7:00AM and 8:00AM. The Teacher will record the temperature at the school.
3. Students plot the temperature for their house on the town map. Examine the map for trends and discuss possible reasons for them.

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Build a thermometer: http://www.energyquest.ca.gov/projects/thermometer.html

DAY 2:

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Have students take out and review the Daily Weather Charts.
2. Ask them some focus questions such as:
    a. How can we tell from which direction the wind is blowing?
    b. How can we tell how fast the wind is blowing?
    c. What causes the wind to blow?

During the Lesson

1. Explain that wind is really the result of unequal and unequal heating and cooling of air. When the sun shines on Earth, it heats up the surface, which in turn heats the air above it. When air gets hot, it expands.
2. DEMONSTRATION:
    a. Place the balloon over the neck of the bottle and call on a student volunteer. Have the student turn on the hair dryer and direct the flow toward the bottom of the bottle. Encourage the class to observe the balloon. Ask: What happens to the balloon as the air in the bottle gets hot? (*The balloon slowly starts to inflate.*)
    b. Explain that the balloon is inflating, not because the hair dryer is adding air to the bottle, but because the air in the bottle is getting hot. When air gets hot, it expands.
    c. Ask: What will happen to the balloon as the air starts to cool? (*It will slowly deflate.*)
3. Discuss again: What causes wind?
4. Discuss air pressure (*the weight of air pushing down on a planet's surface*).
5. Use any of these three videos to support student understanding:
    a. 5 minute Bill Nye video: https://www.youtube.com/watch?v=QeAp3CuGjk8
    b. 4 minute video: https://www.youtube.com/watch?v=o9lwghOHL5E
    c. 4 minute video: https://www.youtube.com/watch?v=jmQ8FWnM0fA
6. Discuss the connection between temperature, wind and air pressure.

Lesson Closing

1. Fill out the Daily Weather Charts for today (outside, 10 minutes).

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2. Compare with information from The Weather Underground website.

DAY 3:

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Have students take out and review the Daily Weather Charts.
2. Ask them some focus questions
    a. Why do we need to know about wind speed and direction?
    b. How can it affect our daily lives?

During the Lesson

1. Show a teacher created compass rose and discuss cardinal directions. Ask students "How can we determine wind direction?"
2. Give each student 3 feet crepe paper streamers and take outside to a clear area, along with compass rose.(wind direction is opposite of the direction the streamers are pointing. Be sure to clarify to students.)Students are thinking about the direction the wind is coming from and predicting wind speed.
3. Come together to discuss finding. Introduce Beaufort Wind Scale.www.spc.noaa.gov/faq/tornado/beaufort.html Ask students if they would like to revise their predictions.

Lesson Closing

1. Fill out the Daily Weather Charts for today (outside, 10 minutes).
2. Compare with information from The Weather Underground website.
   Add to KWL. Journals.

E**xtension:** make an anemometer http://www.ciese.org/curriculum/weatherproj/Introductory_Activity_Lessons/making_an_anemomete make a wind vane http://www.ciese.org/curriculum/weatherproj/Introductory_Activity_Lessons/making_a_wind_vane/

DAY 4: The Water Cycle

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Show Brainpop Video on "The Water Cycle"

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Extension: Teacher-created Google slides on Water Cycle
https://docs.google.com/presentation/d/1qaj3n3r8rX6oetRwseiMoeTWyB199C4WGHujOxWdA-M/edit#slide=id.p

2. Discuss: all the water on our planet has been recycled millions of times. The water cycle begins with evaporation (*energy from the sun causes liquid water to to change to gas (water vapor), which rises in the atmosphere*). As water vapor rises, it *cools and condenses back to liquid water or freezes into solid ice crystals* called condensation. When the *ice or water droplets get heavy enough, they fall back to earth* as precipitation (water that falls back to Earth as rain, snow, sleet or hail).
3. DEMONSTRATION:
    a. Rub a wet sponge on the chalkboard, or stick a wet paper towel to the window. Add heat, and observe. Ask: What is happening? (The water is disappearing.) Explain evaporation.
    b. Hold up the glass of ice water and invite students to touch it. How does it feel? Explain what is happening--condensation.
    c. Watch water droplets run down the glass. What is happening? Explain precipitation.

During the Lesson

1. Give each pair of students 2 liter soda bottle and have them follow these steps:
    a. Cut the top off about 20 cm from the bottom.
    b. Put 1 cup of warm water into the bottom of the bottle, and screw the top on the soda bottle.
    c. Turn bottle top upside down, and put into the soda bottle cylinder.
    d. Tape the two parts together, and fill the top with ice.
    e. Put in the sunlight.
2. Have the students make a prediction about what will happen in the bottle.
3. While the water cycle bottles are sitting in the sunlight, take the students outside to fill out the Daily Weather Charts for today.
4. Compare Weather Charts with information from The Weather Underground website.

Lesson Closing

1. Return to the Water Cycle Bottles.
2. Discuss:
    a. What do we notice?

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b. What stages of the water cycle do we see taking place?

3. Have students illustrate what has taken place in their water cycle bottles and label the different processes.
4. One final discussion about how this involves weather.

Day 4 Extension Activities (Water Cycle):

- https://www3.epa.gov/safewater/kids/kids_k-3.html
- http://clearintotheclassroom.com/wp-content/uploads/2013/12/CITC_LessonsTheWaterCycle.pdf
- Questions to go with Water Cycle Bottle: https://drive.google.com/open?id=0B1Q7hadb6KPDV2djQ2daaEFfY0U
- Read-Around Water Cycle Report: https://drive.google.com/open?id=0B1Q7hadb6KPDQXdtVWdvaVhNdEU

DAY 5: Cloudy Weather

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Ask students to draw a picture of a cloud in their journal. Ask, "Have you ever seen an object or animal in the clouds?" Read *The Cloud Book* by Tomie de Paola
2. Tell students that today we will be making a cloud in a jar. Remind students about the previous lesson on water cycle and ask if they know what clouds are made from. Tell them that when they felt the water on the outside of the glass with ice in it, that was condensation. The cold from the ice made the water vapor from the air in the room condense onto the glass. This is how clouds are formed.

During the Lesson

Ask students to predict whether clean or smoky air would be better for cloud formation (smokey is better because it gives something for water vapor to condense on.)

1. Place a quart jar on black paper. Fill one third of the jar with very warm water. (If the jar steams up, swirl the water around to clear the glass) {lace a small bag of ice on top of the top of the jar. Observe the inside of the jar against the black paper background. (The kids will not see much but this is the point.)

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2. Do the same thing again, but first light a match and hold it over the jar opening. After a few seconds, drop the match in the jar and then cover the top of the jar with the bag of ice. observe the inside of the jar against the black paper background. (This time students should see a "cloud" form inside the jar.)
3. Refer back to The Cloud Book (or any other cloud resources) and show pictures of different types of clouds. You may want to give these clues to help them remember the types; CIRRUS feathery, CUMULUS piled up, STRATUS like a sheet, CUMULONIMBUS thundercloud NIMBOSTRATUS dark rain sheets
4. Hand out pieces of cardboard or oak tag, and cotton balls for each student. Have them cut the cardboard and glue cotton balls to create their own clouds. Punch a hole in the "cloud" and tie on a length of string. Have students label the back with their name and type of cloud they made. Hang clouds around the room.

Lesson Closing

Assessment: Answer in your journal: Would clouds form more quickly in pure clear air or air that contains smoke and dust? Explain your answer and back it up with evidence.

1. Fill out the Daily Weather Charts for today (outside, 10 minutes).
2. Compare with information from The Weather Underground website.
3. Add to KWL. Journals.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?

Extension Activities for Building Weather Instruments:

Anemometer

Wind Vane

Rain Gauge

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Lesson 3: Time for a Forecast

Overview of the Lesson: The students will use the information gathered on their Weather Charts from the previous lesson, in order to make a "weather forecast" or prediction about upcoming weather.

Time (minutes): 60 minutes

Standard(s): What standards (s) will be the focus of the lesson?

- **SL.3.1** Engage effectively in a range of collaborative discussions with diverse partners on grade 3 topics and texts building on other's ideas and expressing their own clearly.

Essential Question(s): What essential questions will be addressed in this lesson?

- What is weather?
- How does weather affect our lives?

Science Objectives

- Students will analyze their weather chart to try and notice similarities in the week's weather trends.
- Students will make predictions about upcoming weather based on information observed.

Language Objectives and/or Targeted Academic Language

- Students will use content-specific language in their discussion (weather, snow, sleet, hail, rain, wind).
- Students will engage in cooperative discussions about weather.
- Students will present a "forecast" to the class.

Anticipated Student Preconceptions/Misconceptions (optional)

- Weather is caused by luck or chance.
- The main factor in weather is temperature.

Instructional Materials/Resources/Tools

- Student-created Weather Data Charts
- construction paper
- crayons, markers or colored pencils (if desired)

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Assessment: How will you know that the students got it?
Students' understanding of the objectives will be assessed through completed forecasts, which make sense based on their previous observations.

Science and Engineering Practices included (in bold):

1. Asking questions (for science)
4. Analyzing and interpreting data
6. Constructing explanations (for science)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Notes about Science and Engineering Practices included:

- Students will work cooperatively with a partner to analyze weekly weather data.

Lesson Details, including but not limited to:

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Students will watch a forecast from Antarctica, a decidedly different climate than our own: http://www.accuweather.com/en/aq/vostok-station/2273742/weather-forecast/2273742
2. Discuss the differences in the weather in Antarctica, as compared to the weather they have had over the past week.

During the Lesson

1. Explain to the students that they will be creating their own forecast based on their Weather Data Charts. They must make reasonable predictions and cover all of the areas they learned about: temperature, wind, precipitation, and cloud cover.
2. Students should choose one of these components and make a bar or pictograph of one category to show to data for the week, and support their prediction during their forecast.
3. Students may draw an illustration to accompany their forecast, if they would like.

Lesson Closing

1. Students share their forecasts in front of the class.

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Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?

- Plan necessary support in collaboration with ELL or Special Education teachers.
- Struggling learners may be best paired with a high-level learner.
- Teacher puts together a classroom library of weather books: fiction and nonfiction and encourages student input.
- Designate a space for weather related items: library, weather station, data collection charts, etc.

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Lesson 4: Let's Vacation in an Enticing Climate!

Overview of the Lesson: Creating a travel brochure highlighting the climate of a chosen region

Time (minutes): 120 minutes (2 days)

Standard(s): What standards (s) will be the focus of the lesson?

- 3-ESS2-2: Obtain and summarize information about the climate of different regions of the world to illustrate that typical weather conditions over a year vary by region.

Essential Question(s): What essential questions will be addressed in this lesson?

- What is climate?
- How do we research and learn about a topic?

Science Objectives

- Students will explain that different parts of the world have different climates based on evidence.
- Students will summarize the changes in the climate of a region over a course of a year.

Language Objectives and/or Targeted Academic Language

- RL.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for answers.
- RL3.2 Determine the main idea of a text;recount the key details and explain how they support the main idea.
- RL3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 3 topic or subject area.*

Anticipated Student Preconceptions/Misconceptions (optional)

Climate is the same everywhere.

Instructional Materials/Resources/Tools

- computers/ipads
- text resources:atlases
- research graph
- map with climate regions
- poster boards, construction paper, (alternative presentation)

Assessment: How will you know that the students got it?

Students will be able to accurately describe or illustrate a region's climate over the course of a year.

Science and Engineering Practices included (in bold):

1. Asking questions (for science)
3. Planning and carrying out investigations
4. Analyzing and interpreting data

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6. Constructing explanations (for science)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Lesson Details, including but not limited to:

Day 1

Lesson Opening (Engagement Strategy/Pre Assessment)

1. Students are asked to think about the question"What is Climate?" and record their thinking in their KWL folder. Share out whole
2. class. Show Climate video; stopping and discussing during the video. https://www.youtube.com/watch?v=YbAWny7FV3w
3. Discuss what students learned from the video. Guide discussion to include the difference between weather and climate.
4. Have students enter what they learned in their KWL folder

During the Lesson

1. Teacher opens with: "Teachers work hard, and when it's time to take a vacation, we want to make it count! How do we decide where to go? After all, we may not get another vacation for...well, who knows, at least another year!" "The climate of the location will be the main deciding factor that I will use when considering my ideal destination. I need your help collecting data for the average, monthly temperature (highs and lows) during the year. I will be deciding where and when to take my vacation based on your recommendation."
2. Let students know that they will be working in groups to conduct their research and create their presentation. Discuss the idea of a vacation and the criteria needed in their research.

Lesson Closing

1. Students will begin think about the different region choices and record ideas on sticky notes and teacher begins to think about groupings based on student choices and student dynamics. Provide a list of recommended regions for students to choose from as well as, suggestions from students. Refer students to atlases, globes, and other resources in the classroom to help with their choices.

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Day 2

Lesson Opening (Engagement Strategy/Pre Assessment)

2. Discuss group norms, criteria for research, and research materials. (classroom library, approved websites..etc.)
3. Display, provide and discuss research template with clear criteria for organizing and collecting information.https://docs.google.com/document/d/1WxoF19D4juqg-4lv-uQOwPvG5hcDhT2Gp7brWfYvh0I/edit
4. Share and record on chart paper student choices and groups based on student choices and student dynamics.

During the Lesson

1. Provide a mini lesson on the three main climate zones: polar, temperate or tropical.
2. http://www.webquest.hawaii.edu/kahihi/sciencedictionary/C/climatezone.php
3. Students begin working in their groups referring to the research template while they gather information about their region based on the criteria.

***(could take 3 to 4 class periods to complete)**

Lesson Closing

1. Students present their "travel brochures" using decided upon media. (slides, videos, paper brochure, posters, etc..)

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?

- Plan necessary support in collaboration with ELL or Special Education teachers.
- Struggling learners may be best paired with a high-level learner.

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Lesson 5: Protect Your City!

Overview of the Lesson: Students will use the *EIE* model for engineering to create a model of a city along a waterway with a barrier to prevent the city from flooding in an extreme weather event, then test their solution and make revisions based on their evaluations and observations.

Time (minutes): 3-4 class periods

Standard(s): What standards (s) will be the focus of the lesson?

- 3-ESS3-1 Evaluate the merit of a design solution that reduces the damage caused by weather.
- 3.3-5ETS1-1 Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.
- 3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.
- 3.3-5-ETS1-4(MA). Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution.

Essential Question(s): What essential questions will be addressed in this lesson?

- How can people help protect themselves from weather-related hazards?

Science Objectives

- Students will understand an engineering design process
- Students will investigate impacts of an extreme weather event (flooding) using a model

Language Objectives and/or Targeted Academic Language

- Students will engage in discussion throughout the engineering process
- Students will actively listen to peers as they describe their solutions and evaluations
- students will become familiar with engineering design process terminology; ask, imagine,

Anticipated Student Pre-conceptions/Misconceptions (optional)

Students may think the stiffer and stronger materials will hold back the water best.

Instructional Materials/Resources/Tools

- paint roller trays for each group
- beakers to hold 500 mL of water
- Suggestions for models: sand, pebbles, grass, straw, cardboard, modeling clay, tape, glue, foam peanuts, sponges, foil, soil
- a poster or projection of the EIE engineering design process *http://www.eie.org/overview/engineering-design-process*

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Assessment:
Students will create plans on paper before beginning their models. They will present solutions to other groups orally and make revisions based on their investigations and discussions.

Science and Engineering Practices included (in bold):

1. **Asking questions (for science) and defining problems (for engineering)**
2. **Developing and using models**
3. **Planning and carrying out investigations**
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. **Constructing explanations (for science) and designing solutions (for engineering)**
7. **Engaging in argument from evidence**
8. Obtaining, evaluating, and communicating information

Lesson Details, including but not limited to:

Lesson Opening (Engagement Strategy/Preassessment)

1. Students will be introduced to the design challenge and shown the poster/projection of the EIE model. If this is the first engineering project for the students they will need to be introduced to what engineering is (the action of working artfully to bring something about; creating a solution to solve a problem) and walked through the process of engineering.
2. Arrange students into groups of about 4.
3. Read the Problem: *In 2005 Hurricane Katrina devastated the Gulf Coast (show on a map). Some areas in Mississippi and Louisiana had up to 13 feet of water, causing destruction in homes and other buildings. Flooding from hurricanes and other storms can cause property damage and loss of life. We don't have ways to keep these storms from happening so we need to find ways to protect ourselves from these and other weather related events.* Your task is to design a solution for a city similar to New Orleans (show on the map http://www.nola.com/katrina/pdf/041206_flood_zones.pdf) that borders a river and construct a way to prevent it from flooding in an extreme rain event.

During the Lesson

1. Explain that they will begin with the "ask" step and they need to know about the problem and the constraints (time and

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materials). What kinds of information do they need to know in order to solve the problem? After they have discussed and shared, tell them these criteria and constraints:

- The prototype must be built in a paint tray.
- When the paint tray is leveled, 400-500 mL of water must be contained for one minute in its original location (cannot pass the barrier prototype).

2. Next they will "imagine" by brainstorming some ideas. Emphasize that most engineers work in groups so that they can get many ideas before selecting one to test. Be sure you have a plan for each student to give input.
3. For the "Plan" phase they should select two or three of their best ideas and make a diagram of them on paper. They will then choose one to test and make a list of materials they will need for their prototype (*An option for a math connection is to assign a price to each material that is available and have students calculate the cost of building their barriers)*.
4. Prompt students to list the steps of their plan and design.
5. The next step is to "create". Decide how much time you will allot for each group to create their "city" and their flood barrier. Monitor student groups to ensure that they are remaining within their design parameters. During this stage, when they are ready, they will test their solutions by pouring 500mL water down the "ramp" of the paint liner. They will need one member of the group to time one minute during the test.
6. The next phase is "improve". Students will discuss what worked and what didn't work during this phase and have a chance to improve or rebuild their prototypes. (Some groups may have time to do this more than once). Each prototype should be tested.

Lesson Closing

1. Students present their prototypes as a possible solution for protection from rising water, including how it meets the criteria and constraints. Encourage students to ask and answer questions about each other's' prototypes. Sample student questions for discussion:
    - Why did you build your barrier using that design?
    - Why did you choose those materials?
    - What did you change about your first design and why?

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?

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You may want to use sentence frames to help with argument and reasoning skills such as:
I agree because _____
I disagree because _____
I like how you _____
In my opinion, I think _____

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Grade 3 MA Science and Technology/Engineering Standards: Grouped into Units

Unit 1: Earth's Systems, Human Activity, and Engineering

3-ESS2-1. Use graphs and tables of local weather data to describe and predict typical weather during a particular season in an area.
3-ESS2-2. Obtain and summarize information about the climate of different regions of the world to illustrate that typical weather conditions over a year vary by region.

3-ESS3-1. Evaluate the merit of a design solution that reduces the damage caused by weather.*

3.3-5-ETS1-1. Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.*

3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.*

3.3-5-ETS1-4 (MA). Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution.*

Unit 2: Motion and Stability: Forces and Interactions

3-PS2-1. Provide evidence to explain the effect of multiple forces, including friction, on an object. Include balanced forces that do not change the motion of the object and unbalanced forces that do change the motion of the object.

3-PS2-3. Conduct an investigation to determine the nature of the forces between two magnets based on their orientations and distance relative to each other.

3-PS2-4. Define a simple design problem that can be solved by using interactions between magnets.*

3-5-ETS1-1. Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.*

3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.*

3.3-5-ETS1-4 (MA). Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution.*

Unit 3a: Biological Evolution

3-LS4-1. Use fossils to describe types of organisms and their environments that existed long ago and compare those to living organisms and their environments. Recognize that most kinds of plants and animals that once lived on Earth are no longer found anywhere.

3-LS4-3. Construct an argument with evidence that in a particular environment some organisms can survive well, some survive less well, and some cannot survive.

3-LS4-4. Analyze and interpret given data about changes in a habitat and describe how the changes may affect the ability of organisms that live in that habitat to survive and reproduce.

Unit 3b: Biological Evolution

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals within the same species may provide advantages to these individuals in their survival and reproduction.

3-LS4-5 (MA). Provide evidence to support a claim that the survival of a population is dependent upon reproduction.

Unit 4: Organisms, their Characteristics, and Life Cycles

3-LS1-1. Use simple graphical representations to show that different types of organisms have unique and diverse life cycles. Describe that all organisms have birth, growth, reproduction, and death in common but there are a variety of ways in which these happen.

3-LS3-1. Provide evidence, including through the analysis of data, that plants and animals have traits inherited from parents and that variation of these traits exist in a group of similar organisms.

3-LS3-2. Distinguish between inherited characteristics and those characteristics that result from a direct interaction with the environment. Give examples of characteristics of living organisms that are influenced by both inheritance and the environment.

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