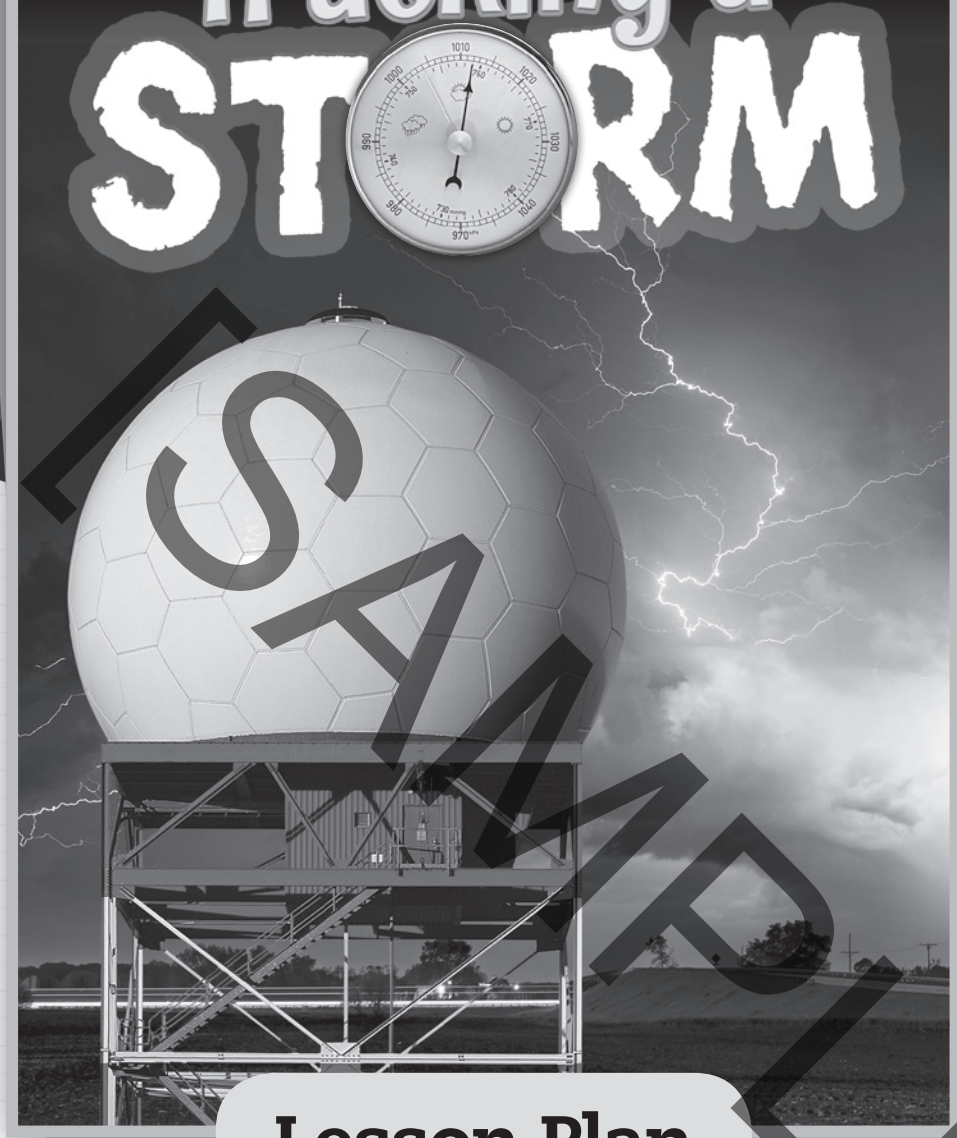
Tracking a STORM



Unit 5
The Natural World

Lesson Plan

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Smithsonian STEAM Readers
Science ■ Technology ■ Engineering ■ Arts ■ Mathematics

Teacher Created Materials PUBLISHING
5301 Oceanus Drive
Huntington Beach, CA 92649-1030
www.tcmpub.com
TCM 29027 (i21044)
ISBN 978-1-4938-6812-4
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ISBN-13: 978-1-4938-6812-4
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Answer Key: *Tracking a Storm*

page 10—Features and Functions

Responses will vary. Example:

1. It has a rod with cups attached to it; The cups spin when they catch the wind; It finds the speed of the wind by counting the number of times the cups spin.
2. A change in wind direction warns that the weather will soon change; It has a rod, arrow, and directional markings for north, south, east, and west; The arrow rotates to point in the direction the wind is coming from.

page 11—Meteorologist for a Day

Responses will vary. Example:

Introduction: Good morning everyone! My name is _____ , and I'll be giving your weather report today.

Temperature—29° C (85° F), The air feels warm; People should wear light clothing and stay hydrated.

Wind Speed/Direction—5 mph, northeast, There are light winds; People might want a light sweater.

Cloud Cover—clear skies and sunny; People should wear their sunglasses and a hat.

Later today, cloudy skies are expected and the temperature will drop. People should bring jackets with them if they will be out all day.

page 17—*Tracking a Storm* Quiz

1. B
2. D
3. A
4. C
5. Responses will vary. Example: Modern weather tools give people accurate information about weather. This information helps people prepare for major storms before they hit.

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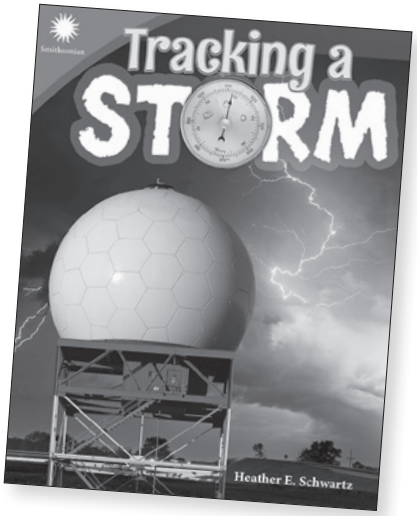
Tracking a Storm

Materials



- *Tracking a Storm* books
- copies of student activity sheets (pages 9–19)
- index cards
- pocket chart (*optional*)
- chart paper
- **STEAM Challenge materials include but are not limited to the following:**
  - ✓ cardboard pieces
  - ✓ construction paper
  - ✓ fan with adjustable speeds
  - ✓ masking tape
  - ✓ paper cups, various sizes
  - ✓ paper hole punch
  - ✓ pencils with erasers
  - ✓ pins
  - ✓ plastic bottles
  - ✓ stapler
  - ✓ straws
  - ✓ string or twine
  - ✓ timer
  - ✓ tissue paper

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Learning Objectives

- **Reading:** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- **Writing:** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- **Speaking and Listening:** Engage effectively in a range of collaborative discussions with diverse partners on grade-appropriate topics and texts, building on and expressing ideas clearly.
- **Engineering:** Define an engineering problem, design and evaluate solutions, and optimize a design based on test results.

Phenomena

Weather often occurs in observable patterns.

Lesson Timeline

Day 1	Day 2	Day 3	Day 4	Day 5–10
Introductory and **Before Reading Activities** (page 4)	**During Reading Activities** (page 5)		**After Reading Activities** (page 5)	**STEAM Challenge** and **Assessments** (pages 6–8)
Define the STEAM Challenge, and practice identifying details in the text.	Research weather tools, identify and record details about the features and functions of weather tools, and brainstorm design solutions.		Write a weather report using information from weather tools.	Design, build, test, improve, reflect on, and share a tool that measures wind strength and direction. Complete the assessments.

Tracking a Storm (cont.)

STEAM Vocabulary

forecast humidity meteorologists
precipitation radio waves

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Introductory Activity

Define the Problem

1. Display the image of the anemometer on page 8 of the *Tracking a Storm* book. Tell students that the image is a tool scientists use to gather data about wind strength and direction. Ask students to look closely at the tool and invite them to share what they notice about the design. Have them make predictions about how the tool works.
2. Distribute the *Tracking a Storm* books to students. Reveal the STEAM Challenge by reading aloud pages 28 and 29 of the book. As you read, explain each step of the engineering design process.
   - Display the Interactiv-eBook for a more digitally enhanced introduction to the challenge.
3. Distribute *Make a Plan* (page 9) to students. Have them summarize the challenge. Summaries should include constraints and criteria. Provide the following sentence frame to help students summarize: *Make a _____ that can _____ , is no more than _____ , and represents _____.*

   Note: You may wish to distribute all student activity sheets as one packet. They will be used throughout the STEAM Challenge.

Before Reading

1. Write the vocabulary words on index cards and discuss the meaning of each word. Create a word wall in a pocket chart or on chart paper.
2. Have students help you sort the words in a way that makes sense. Try several variations. Accept any arrangements as long as students can justify them. Continue to change and add to the word wall throughout the lesson.
3. Tell students that nonfiction texts often include technical information that explains how something works or is used, such as a tool. Explain to students that readers can look for details in both the text and images to support their understanding.
4. Explain to students that previewing texts and making predictions helps prepare and focus readers and aids in comprehension. Have students preview the text and predict how and why different tools are used to understand and forecast the weather.
   - Provide **English language learners** with the following weather descriptions and have them find examples of them as they preview the text: *stormy, clear, cloudy, snowy, sunny, foggy, windy,* and *rainy.* Have them describe local weather with the following sentence frame: *It is a _____ day.*

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Tracking a Storm (cont.)

During Reading

Research and Brainstorm

1. Distribute the *Tracking a Storm* books to students. Read pages 4–7 together. Pause periodically to identify technical information about how something works or is used. For example, on page 8, point out how the image and text provide information about the parts of an anemometer and how it works.
   - Display the Interactiv-eBook for a more digitally enhanced reading experience. You may wish to have students annotate the PDFs as you read.
   - Play the audio recording as students follow along to model fluent reading. This may be done in small groups or at a listening station. The recording will help **below-level learners** practice fluency and aid in comprehension.
2. Distribute *Features and Function* (page 10) to students. Have students read the books in pairs. Ask them to identify and record details from the text to help explain weather tools.
3. Have students record their ideas for designs on their *Make a Plan* activity sheets.

After Reading

1. Write the vocabulary words on the board and review their definitions. Then, have students write riddles for one of the words. For example, a riddle for the word *temperature* might be: *I am a measurement of how cold or hot something is. Scientists use a thermometer to measure me. What am I?*
2. Have students take turns saying their riddles and guessing the correct answers. Ask students to walk around and exchange riddles with five other people before sitting down.
3. Remind students that scientists and engineers use various types of tools and instruments to obtain data, and they use that data in different ways. Review with students the types of tools that meteorologists use to collect data about the weather and make forecasts.
4. Distribute *Meteorologist for a Day* (page 11) to students. Tell students they will write a script for a weather report, as a meteorologist would, that includes data for different weather factors. Have students use tools, make observations, or conduct research to find current weather data. Give the following examples to help students with their charts: measurement—*32°C (90°F)*, description—*hot*, *tip—Wear short sleeve shirts and drink a lot of water.* Have them work in pairs to plan their weather reports.
5. Have students write their scripts for weather reports on index cards or separate sheets of paper. Allow time for students to present their reports in small groups or in front of the class.
   - You may choose to show students examples of weather reports as models.

EXAMPLE

Tracking a Storm (cont.)

Prep

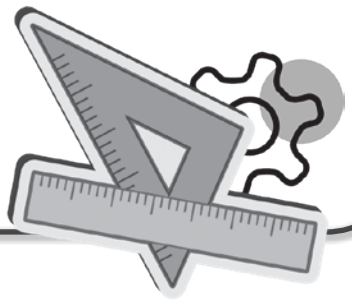
- Review all designs prior to building.
- Prepare all materials for the STEAM Challenge.

[SAMPLE]

STEAM Challenge

Design and Build

1. Discuss the following questions as a class to connect the reading to the STEAM Challenge:
   - *What tools do meteorologists use to measure wind strength and direction?* Have students recall that meteorologists use anemometers and wind socks to measure wind strength and direction.
   - *How do weather vanes tell wind direction?* Have students discuss how weather vanes include directional markings and that rotating arrows point in the direction the wind is coming.
2. Distribute previously completed activity sheets. Review the STEAM Challenge on pages 28 and 29. List materials on the board and show students how the fan will be used to create different wind strengths.
3. Ask students to independently sketch and label two designs on their *Make a Plan* activity sheets.
4. Organize students into teams. Distribute one copy of *Collaborative Design* (page 12) to each team. Ask teams to have members share their designs. Then, have groups choose, sketch, and label a team design. (Team designs must be submitted for approval before building.)
   - Challenge **above-level learners** by adding constraints or criteria (e.g., only four materials may be used to build the tool).
5. Explain to students that when they build their models, they must follow their design plans. Reassure them they will have an opportunity to change and improve their designs after they present them. Review classroom expectations for working with materials. Give teams time to build models.
   - You may choose to digitally record students' processes to share at a later date with students and parents.
6. Distribute *Think about It* (page 13) to students. Explain that reflection is an important part of the engineering design process. Read aloud questions 1 and 2 on the activity sheets and have students write their responses. Ask volunteers to share.



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Tracking a Storm (cont.)

Prep

- Review all designs prior to building.
- Prepare all materials for the STEAM Challenge.

SAMPLE

STEAM Challenge

Test and Improve

1. Discuss the following questions as a class to connect the reading to the STEAM Challenge:
   - *How does advance warning about weather help people?* Have students discuss how advance warning about severe weather gives people time to prepare by stocking up food and water, boarding up buildings, or evacuating.
   - *How have weather tools improved over time?* Point out that modern weather tools and instruments help scientists collect more accurate data.
2. Gather teams for testing. Invite teams to bring their tools to an open area with the fan set up for testing. Explain that teams will offer feedback after each test. Use *Friendly Feedback* (page 14) to review best practices for giving feedback.
3. Distribute *Wind Tool Test Results* (page 15) to students and ask them to record results for each team.
4. Allow time for each team to test. Ask a student from each team to demonstrate how the tool can be used to measure wind strength and direction using the multispeed fan. Then, have another student from the team explain how it represents the school. Successful models will measure wind strength and direction; will not be made of recycled materials; and will represent the school with colors, artwork, and/or symbols.
5. Allow time for teams to brainstorm ways to improve their designs based on test results and feedback. Refer students back to their *Collaborative Design* activity sheets. Ask them to sketch their improved designs and explain any changes. Have students submit improved designs for approval before building.
   - Challenge **above-level learners** and/or successful teams with additional constraints or criteria for the second design (e.g., the tool must stand on its own, identify a way to collect data about wind speed).
6. Have teams gather materials to improve their designs. Then, have them retest their tools.
7. Have students answer questions 3 and 4 on their *Think about It* activity sheets.

Tracking a Storm (cont.)

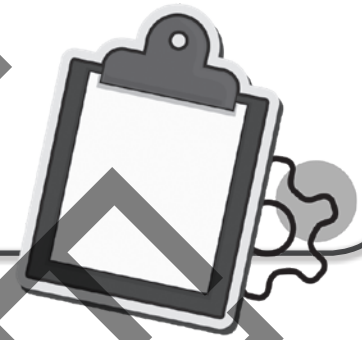
STEAM Challenge

Reflect and Share

1. Challenge teams to design thermometers that represent "degrees" of collaboration, or teamwork, during the STEAM Challenge. Have teams sketch large thermometers on chart paper and ask them to label various levels from the bulb to the top of the thermometer. Tell students that their thermometers should indicate how well they worked together as a team during the challenge. Invite groups to share their designs with the class.
2. Have students answer question 5 on their *Think about It* activity sheets.
3. Distribute *Engineering Design Process* (page 16) and review how students used the steps to complete the challenge. Have them annotate the infographics with details specific to this challenge.
4. Read "Career Advice" on page 32 of the book. Ask students to brainstorm other tips for a career studying weather patterns.

Assessment Activities

1. Have students complete the short posttest, *Tracking a Storm Quiz* (page 17), to assess the lesson's objectives.
2. Students may complete the Interactiv-eBook activities in the Digital Resources for assessment purposes.
3. Have students complete *Teamwork Rubric* (page 18) and *Engineering Design Process Checklist* (page 19) to reflect on and evaluate their work and collaboration skills.
4. Have students complete the Read and Respond questions from the book. Possible answers to the questions can be found in the Digital Resources (storm_reproducibles.pdf).



[SAMPLE]

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Name: _____ Date: _____

Make a Plan

Directions: Summarize the challenge. Brainstorm ideas and sketch two designs. Circle your favorite.

Challenge: _____

_____

_____

[SAMPLE]

Brainstorm

Design 1

Design 2

Name: _____ Date: _____

Features and Functions

Directions: Write details from the text that explain weather tool features and how the tools work.

1. An anemometer measures wind speed.

Detail	Detail	Detail

2. A wind vane measures wind direction.

Detail	Detail	Detail

SAMPLE

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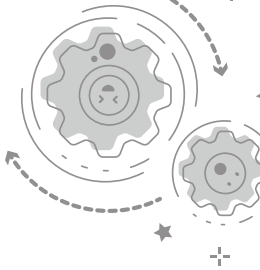
Name: _____ Date: _____



Meteorologist for a Day

Directions: Plan a weather report. Introduce yourself and record current data for at least three weather factors. Write tips to help people dress and plan their days. Then, write what weather is expected later in the day.

Introduction: _____

_____

_____

[SAMPLE]

Weather Factor	Measurement/Description	Tips
Temperature		
Wind Speed/ Direction		
Cloud Cover		

Later today…

_____

_____

_____

Team Members: _____

Date: _____

Collaborative Design

Directions: Sketch your team's design in the first box. Sketch your team's improved design in the second box. Label each design with materials needed and the purpose of each part.

Design 1

Design 2

[SAMPLE]

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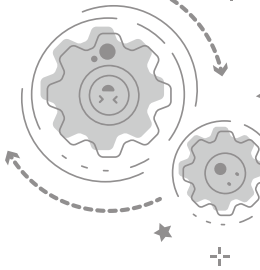

Think about It

1. What did your team struggle with? How did you deal with it? _____

_____

_____

_____

2. How did you contribute to your team? _____

_____

_____

_____

3. How did you use science, technology, engineering, the arts, and/or math in your designs? _____

_____

_____

_____

4. What was successful about your first design? How did you improve it? _____

_____

_____

_____

5. What is the most important thing you learned? What questions do you still have?

_____

_____

_____

_____

[SAMPLE]

Name: _____ Date: _____

Friendly Feedback

Directions: Feedback can help people improve their work. Use these sentence stems to give feedback to your peers.

Clarify

Can you explain _____ ?

Why did you choose to _____ ?

How did you _____ ?

Warm Feedback

I like _____ because _____ .

It is interesting that _____ .

_____ is a good idea because _____ .

Cool Feedback

Have you thought about _____ ?

I wonder if _____ .

You might want to try _____ .

[SAMPLE]

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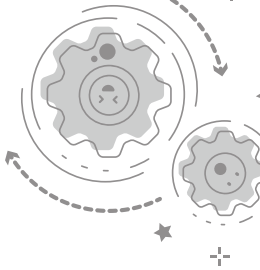

Wind Tool Test Results

Directions: Write how each team's tool represents the school. Check boxes to record each team's test results. Then, answer the question.

Team	How does it represent the school?	Test Result
		☐ measures wind direction ☐ measures wind strength
		☐ measures wind direction ☐ measures wind strength
		☐ measures wind direction ☐ measures wind strength
		☐ measures wind direction ☐ measures wind strength
		☐ measures wind direction ☐ measures wind strength
		☐ measures wind direction ☐ measures wind strength

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Which team's design can be used to measure wind strength most accurately?

_____

_____

_____

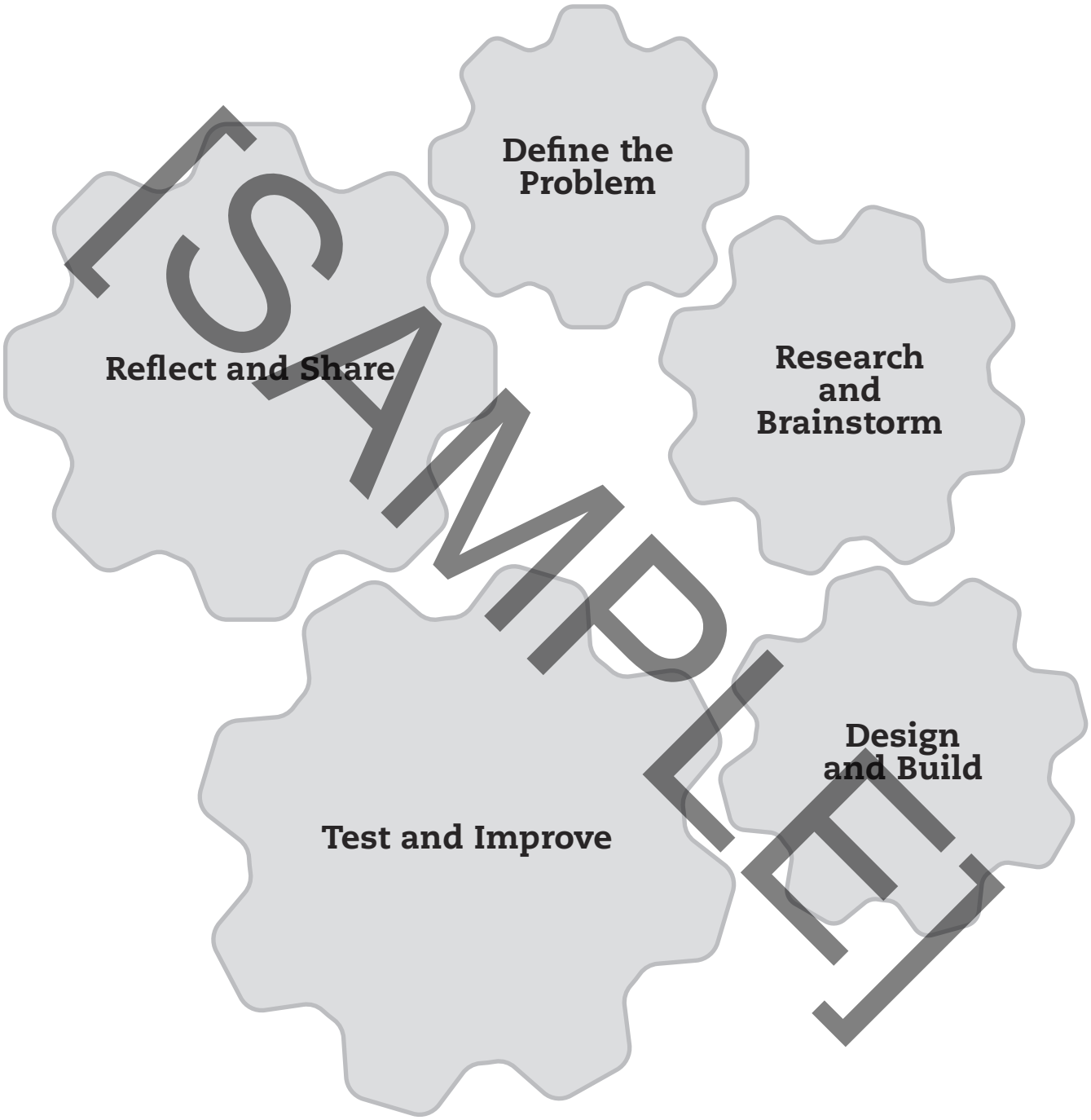
_____

_____

_____

Name: _____ Date: _____

Engineering Design Process



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Name: _____ Date: _____

Tracking a Storm Quiz

Directions: Read each question. Choose the best answer. Fill in the bubble for the answer you have chosen. Answer the last question in complete sentences.

1. Which sentence describes an anemometer?

- (A) It measures the pressure of the atmosphere.
- (B) It is made of a rod with cups attached to it.
- (C) Markings on the tube show how much rain has fallen.
- (D) Scientists use it to find temperature.

2. Scientists use all of the following tools to collect data about weather *except*:

- (A) weather vanes
- (B) anemometers
- (C) rain gauges
- (D) precipitation

3. Which sentence gives details about how weather satellites work?

- (A) They take pictures and record videos of the atmosphere.
- (B) Scientists use images of the atmosphere to track severe weather.
- (C) The system sends radio waves.
- (D) Scientists use weather satellites to warn people about major storms.

4. The _____ stated that snow would start falling in the afternoon.

- (A) geolocation
- (B) humidity
- (C) forecast
- (D) temperature

5. How do modern weather tools help people?

_____

_____

_____

_____

SAMPLE

Name: _____ Date: _____

Teamwork Rubric

Directions: Think about how you worked in your team. Score each item on a scale of 1 to 4.

4 = Always 3 = Often 2 = Sometimes 1 = Never

I listened to people on my team.	4	3	2	1
I helped people on my team.	4	3	2	1
I shared ideas with people on my team.	4	3	2	1
We made choices as a team.	4	3	2	1
Total				

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Comments: _____

_____

_____

_____

_____

_____

_____

_____

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Name: _____ Date: _____

Engineering Design Process Checklist

Directions: Check the boxes to show that you completed each step.

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Define the Problem

- ❑ I understood and explained the problem in my own words.

Research and Brainstorm

- ❑ I used research to help me brainstorm solutions.

Design and Build

- ❑ I planned and made a model.
- ❑ I thought like a mathematician.

Test and Improve

- ❑ I used criteria to evaluate designs.
- ❑ I improved designs based on test results.
- ❑ I thought like a mathematician.

Reflect and Share

- ❑ I shared my results and reflected on my work.

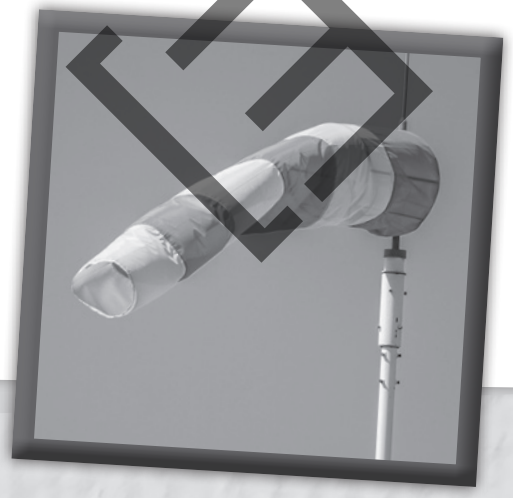
STEAM CHALLENGE

Define the Problem

Imagine your class is creating and installing a set of weather tools to be used at school. Your group has been challenged to design a tool that represents the school and measures wind strength and direction.

Constraints: Your tool must be made out of recycled materials.

Criteria: Your tool must have colors, artwork, and/or symbols that represent the school and clearly show wind speed and direction.



1 Research and Brainstorm

How is wind strength measured? How does your tool work? Where will it be placed? What materials are used to make your tool? What colors, symbols, or themes represent your school?

2 Design and Build

Sketch a design for your tool, including any artwork. Build your tool.

3 Test and Improve

Use a multispeed fan to create different wind strengths. Does your tool clearly show the strength and direction of the wind? Ask teachers and students at your school about how well your artwork represents the school. Modify your design and try again.

4 Reflect and Share

Does placement of your tool matter? How will your tool be useful to students at your school? Would your tool survive all weather conditions?

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