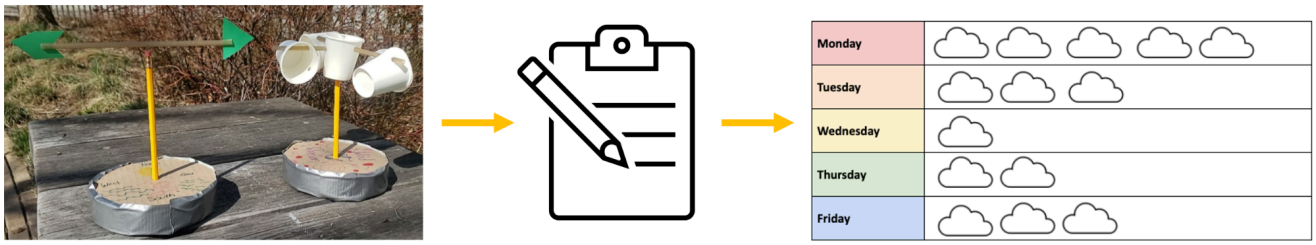
Where the Wind Blows

An investigation into wind speed and direction for elementary students

Where the Wind Blows Activity Overview

The *Where the Wind Blows* activity is designed to give students the opportunity to create weather instruments to observe and record weather patterns. Once students have made observations, they will represent their data by creating a picture graph.



Build a weathervane and anemometer | Record data | Graph results

Table of Contents (Jump to specific parts of the teacher guide by clicking on the links below.)

Grade Level and Time to Complete

The *Where the Wind Blows* activity is designed for elementary school students. While the lesson is specifically aligned with third grade standards, it can be adapted by teachers and used for grades three through five.

The *Where the Wind Blows* activity will take ~145 instructional minutes to complete. While much of the lesson can be done in one day, students will make observations and record data over a span of several days. Time required may vary depending on your students' prior knowledge and instructional needs. The chart below lists suggested timing for the various parts of the activity.

Facilitation Guide		
Activity	**Time**	**Suggested Sequence**
Introduction to weather	15 minutes	This task can be completed in one session.
Anemometer and weathervane construction	40-45 minutes	This task can be completed in one session or split among several days.
Observations & Data Collection	40-50 minutes	Students should observe their weather instruments in action over the course of 5 days. Daily observation should take >10 minutes.
Graphing	20 minutes	This task can be completed in one session.
Reflection Questions	15 minutes	This task can be completed in one session.

Materials and Supplies

When completing the request form, you will be asked to indicate the total number of students that you plan to do the lesson with. The TU Center for STEM Excellence will provide enough materials for each student to build either a weathervane OR an anemometer. For example, if your class has 30 students, you will be sent enough materials to build 15 weathervanes and 15 anemometers. If you plan to do the lesson with a total of 50 students, you will be sent enough materials to build 25 weathervanes and 25 anemometers.

We suggest having students work in partners, where one student builds the weathervane and the other the anemometer. If you think your students will work better in larger groups instead of partners, you are free to keep the extra materials or you can mail them back with your return shipment.

Materials listed in **red** are to be provided by the teacher.

Item	Amount	Comments	Return Instructions
Student Handout	1 per student	MDLL provides the template, teachers must make their own copies.	N/A
Weathervane Picture Steps	16	Step by step instructions for building a weathervane.	Return
Anemometer Picture Steps	16	Step by step instructions for building an anemometer.	Return
Weathervane Materials Bag	½ TOTAL # students	One bag contains all materials needed to build 1 weathervane.	Return unused bags
Anemometer Materials Bag	½ TOTAL # students	One bag contains all materials needed to build 1 anemometer.	Return unused bags
Compasses	16	Used to orient weathervane and assess wind direction.	Return
Markers	16 bags	Students can decorate the cups on the anemometer. One cup should be different from the remaining three so they can easily count rotations.	Return
Duct tape	1 roll	Two cardboard rounds are placed on either side of a Styrofoam round and sealed with duct tape around the perimeter.	Return
Sand Timers	16	Students use 60-second sand timers to count rotations per minute on the anemometer.	Return
Fan	16	Students can use a fan to make the anemometer spin if there is no measurable wind outside.	Return

Teacher Background Information

What is an anemometer?
An anemometer is an instrument that measures wind speed. In *Where the Wind Blows* students will create an anemometer that is a spinning wheel. The stronger the wind blows, the faster the

wheel rotates. Anemometers are a common weather station instrument that meteorologists use to describe wind speeds and make predictions about weather.

What is a weathervane?

A weathervane is an instrument that measures the cardinal direction (north, south, east, west) that the wind is blowing. Weathervanes are typically mounted on the top of buildings and can be seen on places like barns. Weathervanes are a common weather station instrument that meteorologists use to describe wind direction and make predictions about weather.

Why measure wind speed and direction?
Measuring wind speed and direction are essential for monitoring and predicting weather patterns. Wind turbines can be a source of renewable energy, so if an area receives enough wind, it can also be a power source. Sailors need to know how windy it is before they go out on the water, as the wind can affect the efficiency of their travel and create stronger currents. An increase in wind for meteorologists can tell the story of an approaching storm.

How will students measure wind speed?
Students will use the anemometer they create to measure wind speed by counting rotations per minute. One cup on the anemometer will be different from the remaining three. One student will be the counter and one the timer. The student who is the 'timer' will use the 60-second sand timer, while the student who is the 'counter' will count how many times the unique cup goes around the anemometer in one minute. For example, if the counter counts the unique cup 16 times during the 60-second sand time, the measurement would be 16 rotations per minute.

How will students measure wind direction?
Students will label the base of their weathervane with the four cardinal directions (north, south, east, west). Students will use the compass to orient their weathervane, ensuring that the cardinal directions on their weathervane match that of the compass. One side of the straw will have an arrow (from the weathervane cut-out). When the weathervane is placed outside, the direction that the arrow points indicates the direction that the wind is blowing.

Student Activities

In the Where the Wind Blows activity, students will have the opportunity to create their own anemometers and weathervanes. They will use these instruments to measure wind speed and direction over several days, and ultimately analyze and interpret their data by creating a pictograph and a bar graph.

Introduction to Weather
Linked below are slides that can be used to introduce the topic of weather with your students. The slides go over important terms like meteorologist, weathervane, anemometer, cardinal directions, and rotations per minute. These slides (which can be modified to suit individual needs) encourage students to consider the role that weather plays in their everyday lives.

Where the Wind Blows Lesson Introduction Slides (google slides)

Building an Anemometer
Listed below are step-by-step instructions for building an anemometer. The steps listed below are meant to provide teachers with a detailed overview of how to create an anemometer. Students are provided with laminated picture steps, or can use the google slides linked below:

Anemometer Picture Steps (google slides version)

Anemometer Instructions	
Step Number	**Directions**
1	Use the point of your pencil to poke a hole in the center of the bottom of your cup. HINT: Be sure to use the cup with 4 holes in it.
2	Put the pencil, eraser side first, through the bottom of your cup.
3	*Slide a straw through two holes across from each other in the cup.*
4	Slide another straw through the other two holes so they make a '+' in the center.
5	Use a pin to poke through both straws and into the eraser.
6	Choose **one** of the cups with two holes to decorate. Put an 'X' on the bottom.
7	Slide the end of the straws through the two holes in your cups including the one you decorated.
8	Make an "ice cream sandwich" with the two cardboard circles and the Styrofoam round.
9	Use the tip of the pencil to poke through the first layer of cardboard and the Styrofoam round.
10	Wrap your "ice cream sandwich" in a layer of duct tape. HINT: flatten the tape on the top and bottom of the cardboard round.
11	Decorate your anemometer. Your anemometer is complete!

12	Test your anemometer with the fan: •Hold your fan 6 inches from your anemometer. •Angle your fan so that some air is blowing into the opening of the cup, and some is blowing outside the cup.

Building a Weathervane
Listed below are step-by-step instructions for building weathervane. The steps listed below are meant to provide teachers with a detailed overview of how to create a weathervane. Students are provided with laminated picture steps, or can use the google slides linked below:

Weathervane Picture Steps (google slides version)

Weathervane Instructions	
Step Number	**Directions**
1	Carefully push a pin into the center of your straw.
2	Push the pin through the eraser of your pencil. **HINT:** Be sure to leave space between the eraser and the straw.
3	Cut out your shapes. Slide the shapes into the slits on the end of the straw. **HINT:** The straw should spin. If it doesn't, rotate it a few times to loosen it.
4	Make an "ice cream sandwich" with the two cardboard circles and the Styrofoam round.
5	Use the tip of the pencil to poke through the first layer of cardboard and the Styrofoam round. **HINT:** Don't poke the hole through the second cardboard round.
6	Wrap your "ice cream sandwich" in a layer of duct tape.

	HINT: Flatten the tape on the top and bottom of the cardboard round.
7	Write the four cardinal directions on the top cardboard round. **HINT:** The four cardinal directions are north, south, east, and west.
8	Decorate your weathervane! Your weathervane is complete! **HINT:** Be sure not to cover the cardinal directions.
9	Use your fan to test your weathervane: 1. Line up your cardinal directions with your compass. 2. Hold your fan 6 inches in front of your weathervane. 3. Turn the fan on to the lowest setting. The weathervane will spin at first, but eventually stop. **HINT:** The red arrow on your compass should line up with the 'N' for North.

Observations, Data Collection, and Graphing

After students have built their anemometer and weathervane, they will use these instruments to collect data on wind speed and direction. Using the handout linked below, students will collect data over the course of five days.

After they have collected their data, students will analyze and interpret their data using a picture graph and a bar graph. This worksheet can be adapted for individual needs.

Suggested modification: students create scaled picture and bar graphs, where each picture or square represents a certain number of anemometer rotations. For example, one cloud on the picture graph could represent five anemometer rotations. Teachers can also incorporate the concept of rounding.

Where the Wind Blows Student Sheet (google doc)

Reflection

Linked below are slides that can be used to reflect on the entire lesson. The slides have students revisit the concept of using weather to decide what to wear and what a meteorologist is that they thought about in the lesson introduction. Then, students are prompted to think about the data they collected throughout the lesson, and what it means. These slides (which can be

modified to suit individual needs) encourage students to think about what they have learned, and what they would like to learn about next in regards to weather.

Where the Wind Blows Reflection Slides (google slides)

Connections to Maryland Standards

Performance Expectation: Students' ability to complete the following performance expectation(s) will be supported by participation in this activity. **3-ESS2-1:** Represent data in tables and graphical displays to describe weather conditions expected during a particular season.		
Dimension	**Code or citation**	**Matching student task**
Disciplinary Core Idea	● ESS2.D: Weather and Climate: o Scientists record patterns of weather across different times and areas so that they can make predictions about what kind of weather might happen next.	Students will record data from their weathervane and anemometer on wind direction and speed. Students will make predictions on weather patterns based on the data they collect.
Science and Engineering Practice	Analyzing and Interpreting Data ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.	Students will represent the data they collected on wind speed in both a pictograph and a bar graph.
Crosscutting Concept	Patterns ● Patterns of change can be used to make predictions.	Students will make a prediction about wind speed and direction based on the data they have collected.

Grade 3: Measurement & Data	
Standard	**Matching student task**
CCSS.MATH.CONTENT.3.MD.B.3: Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.	Students will record data from their weathervane and anemometer on wind direction and speed. Students will represent the data they collected on wind speed in both a pictograph and a bar graph.

This activity was developed by Quináe West as part of the Chesapeake Conservations Corps (funded by the Chesapeake Bay Trust) and the Towson University Center for STEM Excellence.