Exploring Wind
Materials List

1 Pinwheel

1 anemometer

1 laminated data table

1 wet erase marker

2 books
Curious George Flies a Kite
Catch The Wind

Exploring Wind Energy

Ages: Kindergarten & up

Wind is a form of energy!

Wind energy is a renewable energy source. Wind energy can make things move. Energy from the wind can vary throughout the day, change from day-to-day and differ by location.

Extension activities included: Find the wind using a pinwheel, measure the speed of the wind using an anemometer, and build a kite or windsock.

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JAMES MADISON UNIVERSITY

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How Does a Wind Turbine Work?

https://www.youtube.com/watch?v=gHUJqTT3THU

KidWind Renewable Energy Challenge

https://www.youtube.com/watch?v=n9rR9NH8l1Y

Contact Information

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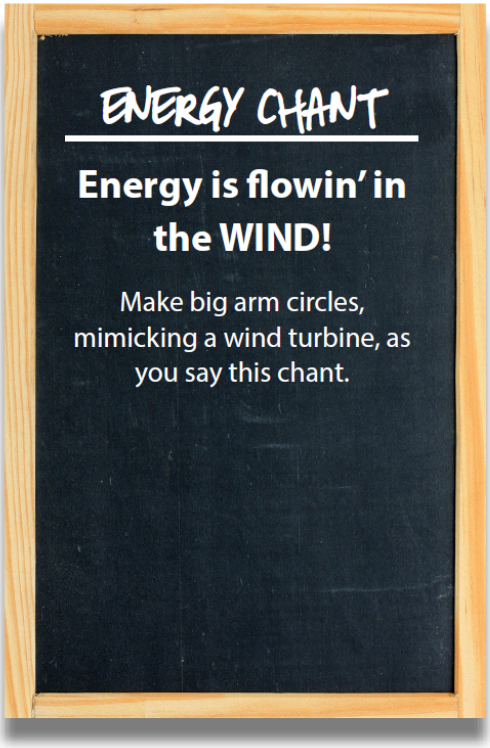
Wind Energy

TEACHER

Wind is moving air. We can use the energy in wind to do work. Early Egyptians used the wind to sail ships on the Nile River. People still use wind to move them in sailboats. In the Netherlands, people used windmills to grind wheat. The Pilgrims used windmills to grind corn, pump water, and run sawmills. Today, we use wind to make electricity.



The energy in wind comes from the sun. When the sun shines, it heats the Earth. Some parts of the Earth get hotter than others. An area where land and water meets is a good example. Land usually absorbs and releases energy more quickly than water. The air over the land gets hotter than the air over the water. The warm air rises and cooler air rushes in to take its place. The moving air is wind.

As long as the sun shines, there will be winds on the Earth. We will never run out of wind energy. It is a **renewable** energy source. It is also free, since no one can own the sun or the air.

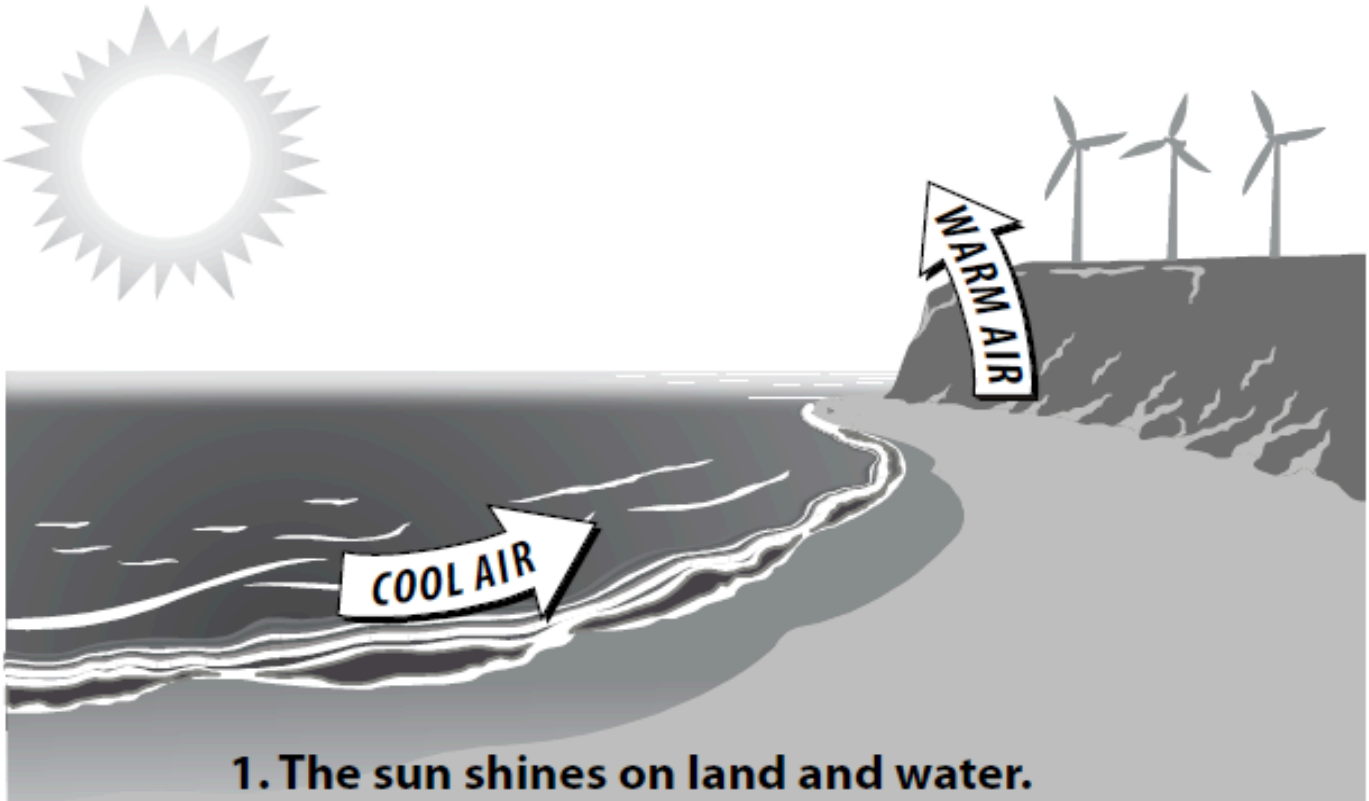
Some places have more wind than others. Areas near the water usually have a lot of wind. Flat land and mountain passes are good places for the wind, too. Today, we use big **wind turbines** to catch the wind. Sometimes, there are hundreds of wind turbines in one place. This is called a **wind farm**. Not all wind farms are on land; some countries have wind farms on the water. These are called **offshore wind farms**. The first offshore wind farm in the United States was built off the coast of Block Island, Rhode Island. The five-turbine wind farm began generating electricity for Block Island in 2016. Two new turbines were built in 2020 off of the coast of Virginia, with a large wind farm planned for 2024 in the same area. More wind farms will also be built on the Atlantic Ocean.

Many of the wind turbines on wind farms are very tall so they can catch the most wind. Some wind turbines are taller than a 20-story building or the Statue of Liberty! Not all wind turbines are that big, though. Some wind turbines might be only 30 feet tall. People can put these small turbines up in their backyards to generate electricity to use at home. Schools can put small wind turbines on their property to make electricity, too. Small wind turbines can even be put on sailboats so people have electricity when they are sailing on the water.

When the wind blows, it pushes against the blades of the wind turbines. The blades spin around. They turn a **generator** to make electricity. The wind turbines do not run all the time, though. Sometimes the wind does not blow at all. Sometimes the wind blows too hard. Most wind turbines operate 65 to 90 percent of the time.

Today, wind energy makes 9 percent of the electricity we use. Most of the big wind farms are in Texas, Oklahoma, Iowa, Kansas, and Illinois. More wind turbines and wind farms are popping up all over the country.

How Wind Is Formed Where Water Meets Land



1. The sun shines on land and water.
2. Land heats up faster than water.
3. Warm air over the land rises.
4. Cool air over the water moves in.

PINWHEEL INVESTIGATION IDEAS

First check to see if the pinwheel spins when you blow on it.

Blow from the front, back and each side. Does it spin? Which way does it spin?

Blow above and below the blades, how does the pinwheel spin now?

If there's no wind outside, you could use a fan or hairdryer (use a cool setting and ask an adult to help).

If it is a windy day, take the pinwheel outside. Hold the pinwheel facing the wind, sideways to the wind, and away from the wind.

What position makes the pinwheel spin faster?

Measuring Wind
Anemometer Activity

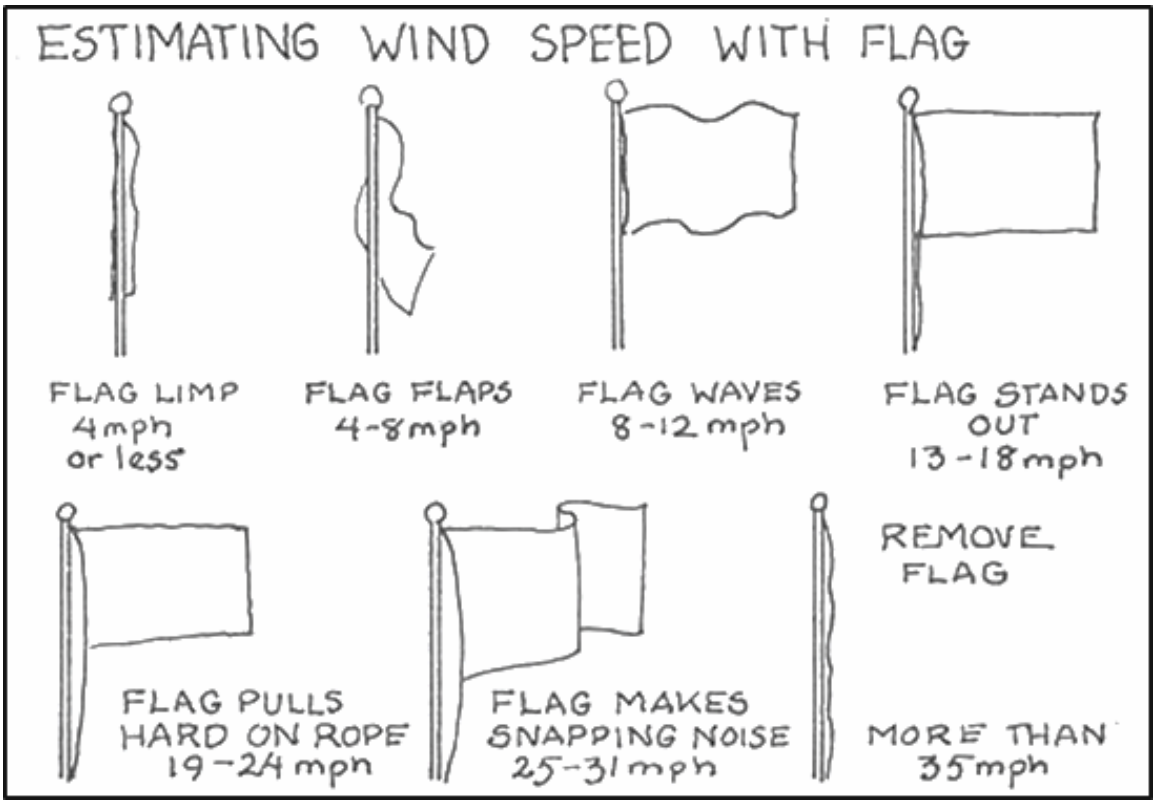
Laminated activity sheet and wet-erase marker included.

Will the wind move at the same speed in different locations?

Directions:

1. Take the anemometer outside and choose a location where the anemometer rotates consistently.
2. Estimate the wind speed using the flag diagram.
3. Count the number of revolutions the anemometer makes in 10 seconds.
   Record the number of revolutions on the laminated data table.
4. Use the chart to determine the wind speed (miles per hour).
   Record the wind speed on the laminated data table.
5. Find a new location and find the wind speed in the new location.

Conclusion: Where is the wind speed the fastest? Slowest?



Build an Anemometer

Question

How accurate are various tools for measuring wind speed?

Materials

- 1 Pencil
- 5 Snow cone paper cups
- 2 Long straws
- Tape
- Hole punch
- Scissors
- 1 Straight pin
- Marker
- Watch with second hand
- Ruler

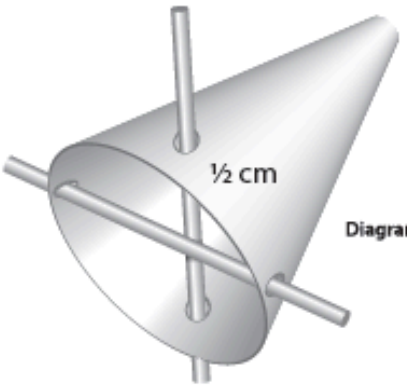


Diagram 1

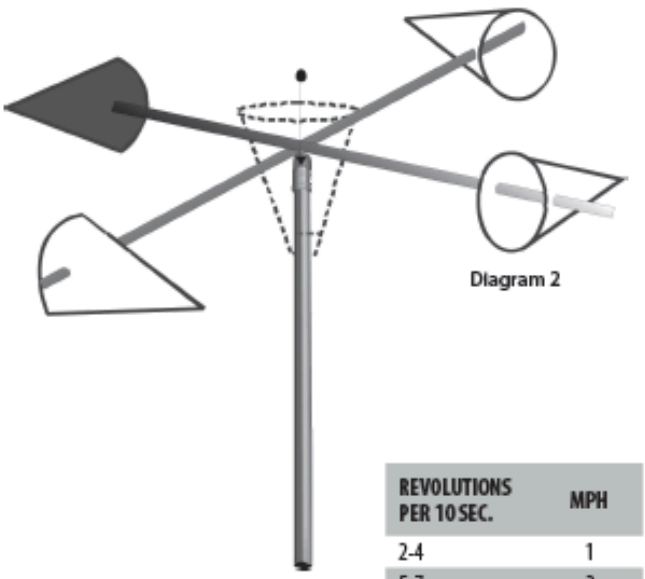


Diagram 2

Procedure

1. Cut the end off one cup to make a hole big enough for the pencil to fit in. Use the hole punch to make four holes in the top of the cup: two holes opposite each other very near the rim and two holes on opposite sides about a half-centimeter below the first holes, as shown in Diagram 1.
2. Slide the straws through the holes in the cup, as shown in Diagram 1.
3. Color or mark one cup so that you can count the revolutions of the anemometer.
4. Use the hole punch to make two opposite holes in the other cups about 1 centimeter from the rim. Slide one cup onto the end of each straw, making sure the cups face in the same direction. Tape the cups to the straws.
5. Center the straws in the base cup. Slide the base cup over the pencil as shown in Diagram 2 and push the pin through the middle of both straws and into the pencil eraser as far as you can to anchor the apparatus. Lift the straws slightly away from the eraser on the pin so that the apparatus spins easily. You might need to stretch the pin holes in the straws by pulling gently on the straws while holding the pin in place.
6. Take your anemometer outside and measure the speed of the wind in several areas around the school by counting the number of revolutions in 10 seconds and using the chart to determine miles per hour (mph). Compare your results with those of other students in the class.

REVOLUTIONS PER 10 SEC.	MPH
2-4	1
5-7	2
8-9	3
10-12	4
13-15	5
16-18	6
19-21	7
22-23	8
24-26	9
27-29	10
30-32	11
33-35	12
36-37	13
38-40	14
41-43	15
44-46	16
47-49	17
50-51	18
52-54	19
55-57	20

Conclusions

1. How did your data compare to that of your class?
2. How could you change the design of your anemometer to make it more reliable?

Make a Wind Sock

You can use a wind sock to find out what direction the wind is coming from. This is very important to know when designing an offshore wind farm.

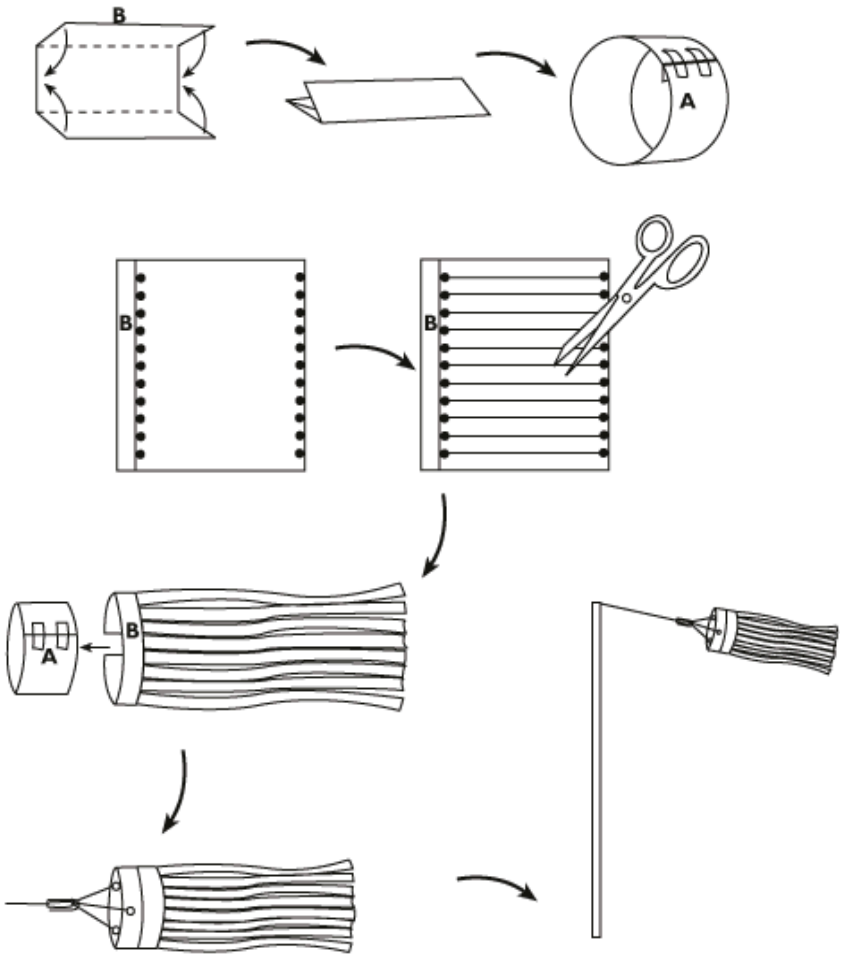
Toolbox:

1 sheet of printer paper (8.5x11)
1 plastic grocery bag
Tape
Scissors
Paper puncher (single hole)
1 paper clip
Fishing line
Magnetic compass

Procedure:

Make the wind sock by following the instructions and referring to the drawing:

1. Fold the printer paper in thirds the long way
2. Roll into a tube and tape
3. Cut handles off the plastic bag
4. Cut long shreds starting at the open end and stopping about 1-2 inches from the bottom of the bag (only need half the bag)
5. Tape shredded bag to paper tube from step 2
6. Using the hole punch, punch 3 equidistant holes in the paper tube
7. Tie fishing line to each of the 3 holes and then tie all to the paper clip
8. Tie fishing line to other end of paper clip – this will attach to the pole you mount the wind sock on (later)
9. When you mount the wind sock also mount the compass (using glue) so that you can tell the direction of the wind



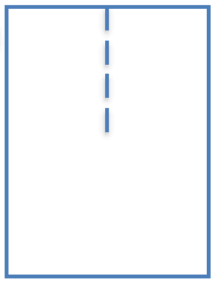
Source: Aeronautics - An Educator's Guide with Activities in Science, Mathematics, and Technology Education, NASA, 1998- http://www.windpower.org/en/kids/choose/nacelle/windsock.htm

Create a Kite!

Materials:

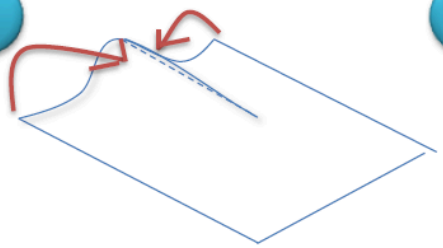
1 piece of computer paper	tape
1 long piece of String	strips of paper

1



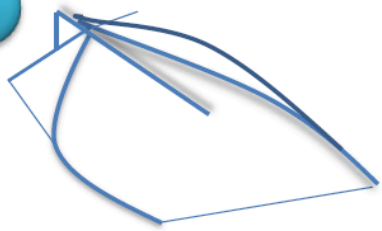
Fold half way along the middle of the paper

2



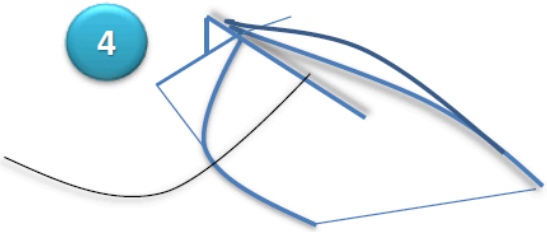
Take the two corners and make them meet on the fold about an inch away from the top of the paper

3



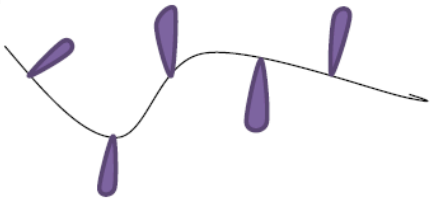
Staple the corners to the fold

4



Staple the string about 3 inches below first staple

5



Tape the paper strips along the string

Take your kite out into an open area on a windy day to fly it.
As the kite is flying, notice the flags along the string of the kite.

How are they moving differently?

Does the height of the flag play a role in how fast the flags move?

What do you think this says about wind at different heights?

Kits available from

CENTER for the ADVANCEMENT of SUSTAINABLE ENERGY
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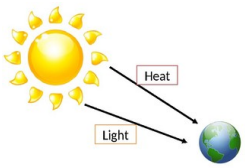
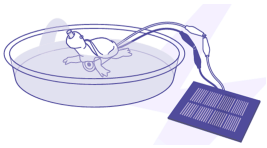
Exploring Wind Energy

Exploring Solar Energy



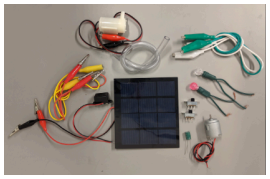
Wind Powered Light (Firefly)

Solar Powered Water Fountain



Educator Kit: Wind Energy

Educator Kit: Solar Energy

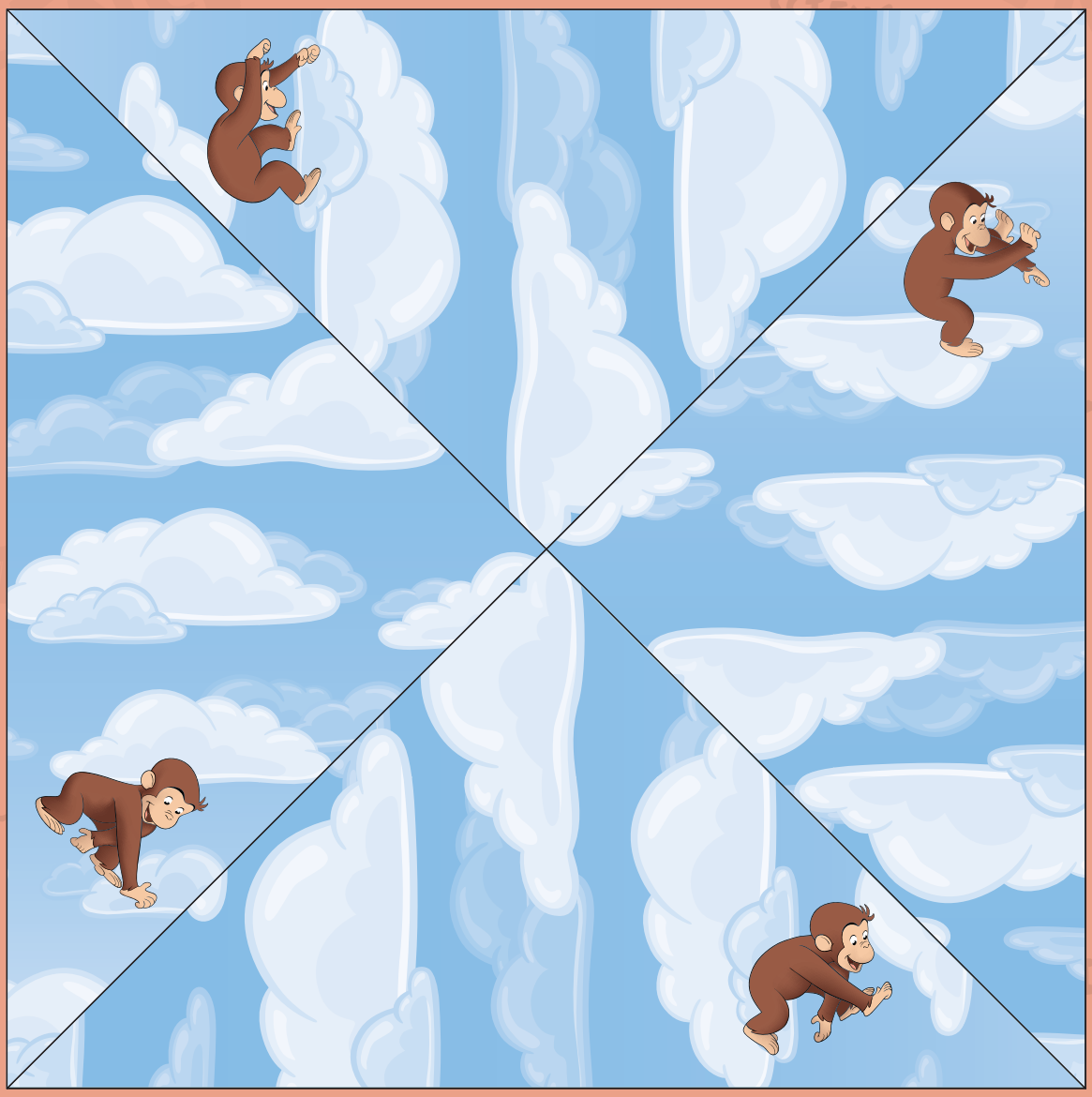


Explore the Wind with Curious George

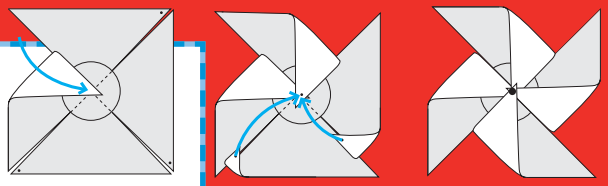
In the *Curious George Flies a Kite* episode, George has an exciting adventure while learning about things that move in the wind. You and your young scientist can also explore the wind and make interesting discoveries.

Go outside together. Stand so the wind blows in your face, then turn so it blows on your back. Look for things that are moving in the wind. Listen to the wind and imitate the sounds you hear. Ask: *What is the wind blowing that makes that sound?*

Make a pinwheel. (See next page.) Let your child explore how wind can make the pinwheel turn.

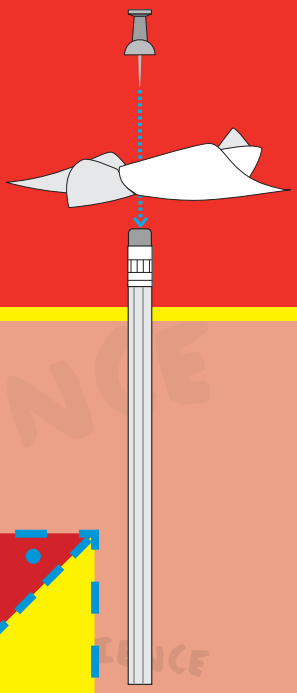


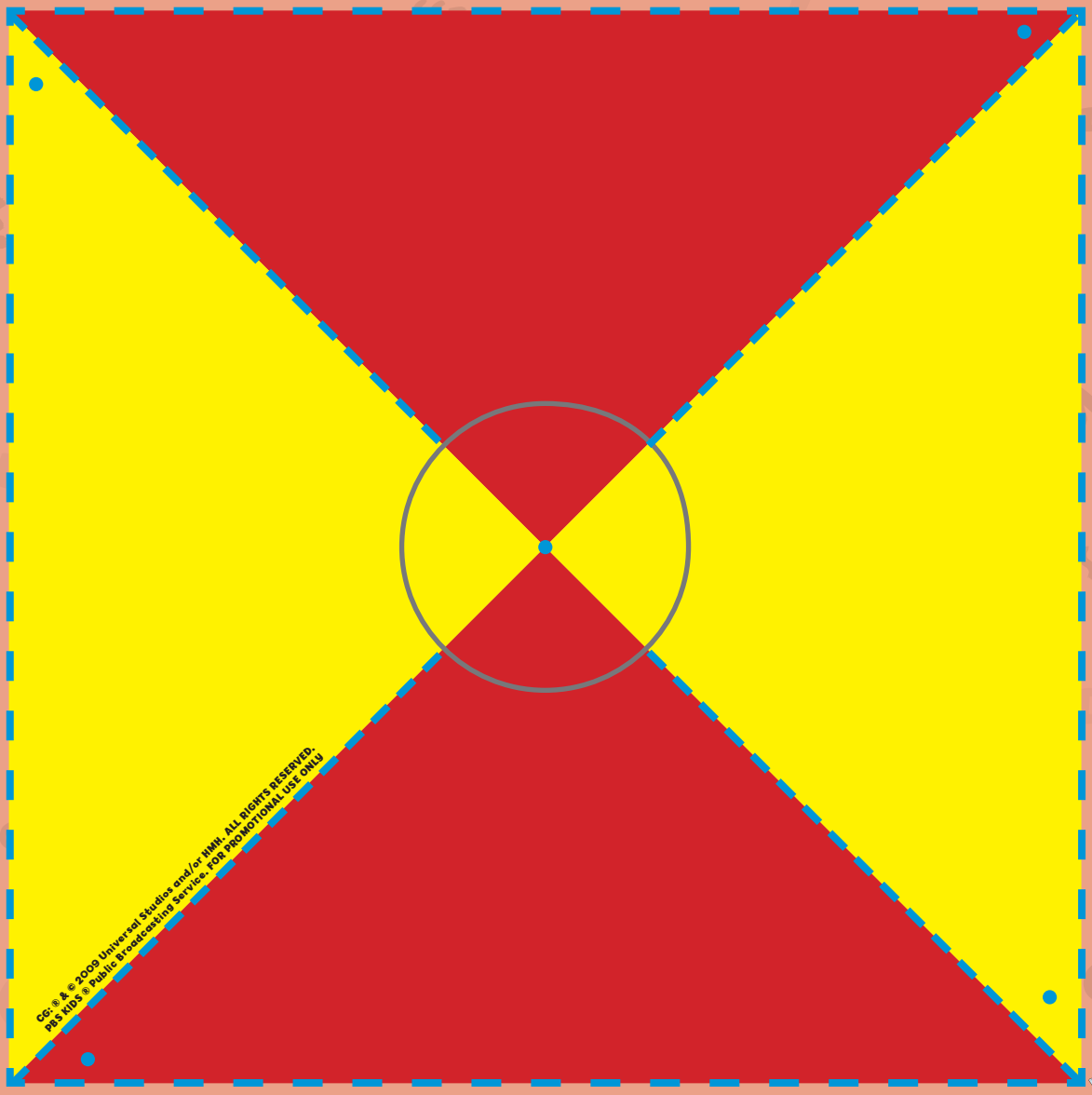
Make a Pinwheel



You need:  , a  and a

1. Help your child cut out the pinwheel below.
2. Cut along the blue dashed lines.
3. Use the pushpin to poke holes in the center of the pinwheel and in the four corners. Twist the pin to make the holes smooth. This will help your pinwheel more easily.
4. Stick the pushpin through each of the corner holes, through the center hole, then into the top of the pencil eraser. (See diagram.)
5. Blow your pinwheel. Watch it spin! Ask: *What do you notice? What is making the pinwheel spin? How else can you make it spin?*





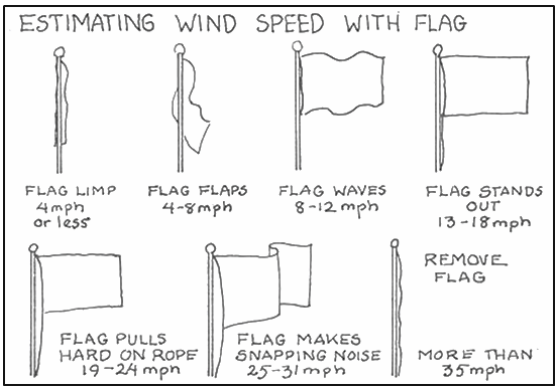
Cut on dashed lines.

Visit pbskids.org/curiousgeorge for more great science, math, and engineering activities.

Measuring Wind
Anemometer Activity

Will the wind move at the same speed in different locations?

Directions:



1. Take the anemometer outside and choose a location where the anemometer rotates consistently.
2. Estimate the wind speed using the flag diagram.
3. Count the number of revolutions the anemometer makes in 10 seconds.
   Use the wet-erase marker to record the number of revolutions on the laminated data table.
4. Use the chart to determine the wind speed (miles per hour).
   Use the wet-erase marker to record the wind speed on the laminated data table.
5. Go to a new location and find the wind speed in the new location.

Location	Number of revolutions in 10 seconds	Wind speed (mph)

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Conclusion: Where is the wind speed the fastest? Slowest?