

Build a Simple Anemometer

Helpful website:

<http://www.fi.edu/tfi/units/energy/dixie.html>

Introduction to the Teacher:

Determining just how fast the wind is blowing is no easy task. We can all tell if the wind is moving or still, or if the wind is blowing gently or with gale forces. Putting an actual measure of velocity in miles per hour takes a specialized tool.



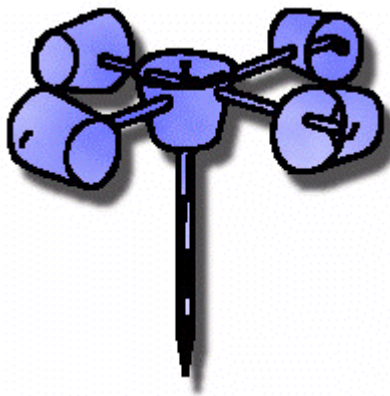
Here is a hand-held anemometer that costs almost \$300.

Students will use both the science lab and math skills for this project.

For this activity, students will need to build an anemometer, count the revolutions per minute of their wind instrument and then they will use the circumference formula to find the wind velocity. It is an example of what is called a Vertical-axis wind collector. As an additional assignment, student can investigate vertical axis wind collectors on the Internet.

Learning Objectives: Students will be able to:

- Build an Anemometer
- Use the circumference formula
- Determine approximate wind velocity



Materials: each student will need:

- 5 - 2 or 3 ounce paper Dixie cups
- 2 straight plastic soda straws
- 1 straight pin
- scissors
- paper punch
- small stapler
- a sharp pencil/with eraser

Procedure: Demonstrating the procedure recommended

1. Take 4 Dixie cups. Using the paper punch, punch 1 hole into each of the 4 cups about 1/2 inch below the rim.
2. Take the 5th cup and punch 4 EQUALLY spaced holes about 1/4 inch below the rim. Now punch a hole in the center of the bottom cup.
3. Take 1 of the 4 cups and push a soda straw through the hole. Fold the end of the straw and staple it to the side of the cup across from the hole. Repeat this process from another one-hole cup and the 2nd straw!
4. Now, slide 1 cup and straw assembly through 2 opposite holes in the cup with 4 holes. Push another 1 hole cup onto the end of the straw just pushed through the 4 hole cup.
Bend the straw and staple it to the one hole cup, and make sure that the cup face in the opposite direction from the first cup.
Repeat this process using the other cup and straw and the remaining 1 hole cup.
5. Align the 4 cups so that their open ends face the same direction (clockwise), around the center cup. Push the pin through the 2 straws where they intersect. Push the eraser end of the pencil through the bottom hole in the center cup. Push the pin into the end of the pencil eraser as far as it will go.
6. Put a large bright mark on the one of the cups so that it will be easier to count revolutions per minute.

Tasks:

Now that your simple anemometer is built, you are ready to use it to calculate the velocity of the wind. To find out how fast the wind is blowing you need to do 2 tasks:

- a) Count the number of revolutions per minute (RPM) the anemometer is spinning at.
- b) Determine the circumference of the circle made by the rotating cups.
- c) Calculate the approximate wind velocity.

a) Counting the revolutions

This can be done in more than one way. One method would be to have a small fan in the classroom. Set the fan on a low setting so that anemometer doesn't spin too fast. One student must have a timer to count 60 seconds. The other student will count the number of times the cups spins in 60 seconds. Have student record revolution per minute on the worksheet.

One student worked with his parents to get an estimate of the wind speed. These people went for a very slow ride in the car. They held their anemometer out the window and counted the number of revolutions their instrument made at 10 miles per hour. They determined that when the car was traveling at 10mph, they had 100 revolution per minute.

b) Finding the circumference

Not every anemometer is exactly the same size. Larger circles spin differently than smaller circles. To determine the circumference of the circle your anemometer creates when it spins, first measure the diameter of the circle using a ruler or yard stick. **Use feet as your unit of measure.** Write down the measurement. Next, use the circumference formula.

Circumference = diameter x 3.14

c) Calculating the Wind Velocity

To see how fast your wind is blowing in feet per minute, multiply the RPM x circumference. The answer your students will now have is the approximate wind velocity in **feet per minute.**

To convert feet per minute to miles per hour:

Take the FPM figure and multiply by 60 (minutes per hour)

Take the new number (feet per hour) and divide by 5280 (feet per mile)

The new answer is in MPH

Student Activity and Record Sheet

Student information:

Today, you will be building a tool that will allow you to make an approximate measurement of the speed of some wind. For wind, we will be using a small fan. If it is a nice day, we will go outside to get our wind. Our goal is to try to figure out what speed the wind is blowing at in miles per hour.

Tasks:

- Get your materials and follow the directions for making your anemometer
- With your partner, count the revolutions per minute your instrument spins when it is in the wind. You are using a stop watch to count the seconds for you. **Record your answer below.**
- Measure the diameter the diameter of your wind instruments and use the circumference formula $C = 3.14 \times \text{diameter}$ to find the size of the circle your anemometer uses when it spins. **Record your answer below.**
- Find the approximate wind speed by multiplying the RPM you recorded times the circumference. The answer you get will be the wind velocity in feet per minute. **Record your answer below.**
- Convert your answer in feet per minute (FPM) to miles per hour (MPH) by:
 - a) Multiplying your FPM times 60 (minutes per hour) to get feet per hour
 - b) then divide feet per hour by 5280 (feet in a mile) to get Miles per hour.

Record your answers:

1. Revolution per minute: _____

2. Diameter of circle: _____

3. Circumference of circle: _____

4. Wind velocity in feet per minute (FPM): _____

5. Wind velocity in miles per hour (MPH): _____