Lesson 11: Measuring the Wind (Making an Anemometer)

Adopted/ Revised From
N/A

Grade Level
6- 8

Objectives
- Construct an anemometer to measure wind speed
- Examine the wind resource at your school

Overview
Students build a simple anemometer and translate rotations-per-minute into miles per hour, then use wind speed to make conclusions about electricity generation.

Materials (per group)
- Pencil with full eraser
- Push pin
- 5 small paper drinking cups, ~ 3 oz.
- 2 straws
- Scissors
- Tape
- Permanent marker
- Hole punch
- Stopwatch

Estimated Cost of Materials
$35 per group

Computer Required?
No

Duration
1 class period

Primer References
3.2 Wind

Engagement
1. How can you measure wind?
2. What are the different ways to measure wind?
3. Why would you want to measure wind?

Investigation

Now we're going to measure the wind speed outside our classroom to draw conclusions about the relationship between wind speed and electricity generation:

1. Divide the class into small groups and hand out listed materials.
2. Using a hole puncher, punch one hole in 4 small drinking cups, about ½ inch (1.5 cm) below the rim. (Note, you may choose to trim the rim off the drinking cups if you wish to lighten the weight of the cups).
3. Draw a large **X** on the bottom of one of the 4 small drinking cups and, if possible, color the cup to make it clearly different from the other cups.
4. Take the fifth drinking cup and punch two holes in it, directly opposite from each other, about ½ inch below the rim. Then punch two more holes in the cup, each ¼ inch below the rim that are equally-spaced between the first two holes to form a cross pattern.
5. Make a hole in the center of the bottom of the cup with four holes in it using the push pin and scissors. This is where the pencil will fit through.
6. Slide a straw through the hole in one of the cups that has only one hole in it. Bend the end of the straw that is inside the cup about ½ inch and tape it to the inside of the cup.
7. Place the other end of the straw through two of the holes in the fifth cup and then through the hole in one of the other cups. Tape the end of the straw to the inside of the cup. Make sure that the openings of the two cups face in the same direction perpendicular to the middle cup.
8. Repeat steps 4 and 5 with the remaining two cups. Make sure that the opening of each cup faces the bottom of the cup in front of it.
9. Insert the pencil with the eraser facing up through the bottom of the fifth cup. Push the pin through the two straws and into the eraser on the pencil making sure that the cups move freely.
10. You now have a working anemometer! You can use it to measure wind speed. Each time the marked cup spins around that is a full revolution.
11. Have each group assign a timekeeper, 1 or more counters to measure revolutions per minute (rpms), and a holder of the anemometer.
12. Students should take the anemometer outside to fill in the Activity Sheet for up to 10 trials for this lesson.
13. Groups can experiment by measuring wind speeds at different locations outside school (i.e. the north side of the building, the south side of the building, in an open field, etc.)

Class Review

1. Ask the class to share the results of their wind speed experiments in order to see how variable different sites were and different groups' results were at the same site.

Elaboration

Now that we have seen how to measure wind speed:

1. Have students read the Primer References for this lesson.
2. Were any sites suitable for electricity generation (Class 2 or above)?
3. Project the overhead of the Wind resource map from Appendix B or from this website (or provide handouts). Do class results match what is found on the map? Why or why not?

Instructor Notes

- Students can watch for full minutes to determine rpms or for shorter periods and just multiply accordingly.
- You may want to assign 5-10 different locations for the groups to measure their wind speeds.

Extensions and Variations

- You can calibrate the anemometer for mph a variety of ways. If you use raw calculations in the classroom, remember to note forces such as drag and friction. What components on the anemometer cause drag and friction? How can you improve the design?

References/For More Information

Wind Meters and Wind Measurement
http://www.anemometertypes.com/

American Wind Association Wind Resource Map:
http://www.windpoweringamerica.gov/maps_template.asp?stateab=co

Measuring the Wind

	Location	Height (from ground)	Time Interval (seconds)	Number of Revolutions	rpm	Wind speed in mph
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Assumptions
100 rpm = 10 mph

Questions

1. How can we calibrate our anemometer so we can measure wind speed?

2. Use the table below to identify what class of wind you measured when the wind blew at its top speed:

Class	MPH*
1	0-12.5
2	12.5-14.3
3	14.3-15.7
4	15.7-16.8
5	16.8-17.9
6	17.9-19.7
7	>19.7

*Listed wind speeds are typically at 50m

3. What location did the wind blow at its top speed? Why?