

## Activity 1: Measuring Recording Wind speed

In this lesson each student will learn:

How to calculate the average wind speed

How to present data on a graph.

Use an anemometer to predict whether a location is a good place to place a wind turbine.

### How do we measure wind speed?

We use an instrument called an anemometer to measure wind speed. The cup anemometer is the simplest type. It consists of four hemispherical cups mounted on the end of four horizontal arms (see picture). The speed at which the cups rotate is proportional to the speed of the wind. So, by counting the number of turns over a set time, we can work out the average wind speed.

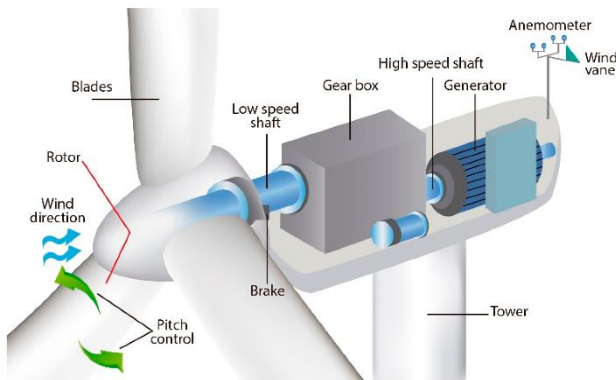


Figure 1: Anemometer and wind vane up close

In this activity, you will be using anemometers to find the average wind speed of your campus to determine the best location to site a new wind turbine.

## Part 1: background information on your school

Before you start collecting data, follow the first few steps to gather background information on your site.

1. Use an Internet mapping tool such as Google Earth to locate the school's location including city, state, latitude and longitude, and elevation. Record this information.

School location (city or region)

School latitude \_\_\_\_\_

School Longitude \_\_\_\_\_

School Elevation \_\_\_\_\_

2. Sketch a map of your campus below and label the geographical features of your campus. Hypothesize where you think wind speeds will be consistently strong based on the topography.

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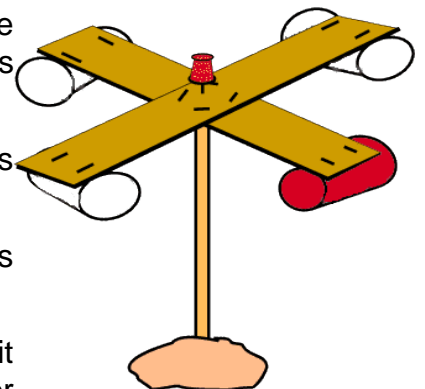
## Part 2: Build and use an anemometer to measure local windspeeds

### A. Materials needed

- Scissors
- 4 small paper cups (like drinking cups)
- A marking pen (any color)
- 2 strips of stiff cardboard (each the same length)
- Ruler
- Stapler
- Drawing pin/thumb tack
- Sharpened pencil with eraser on the end
- Modelling clay/putty (or bluetack)
- A stopwatch (or a watch that has a second hand)

### B. Procedure

1. Cut off the rolled edges of the paper cups to make them lighter.
2. Color the outside of one cup with the marking pen.
3. Cross the cardboard strips so they make a plus (+) sign. Staple them together.
4. Take the ruler and pencil and draw lines from the outside corners of where the cardboard strips come together to the opposite corners. Where the pencil lines cross will be the exact middle of the cross.
5. Staple the cups to the ends of the cardboard strips; make sure the cups all face the same direction.
6. Push the pin through the center of the cardboard (where the pencil lines cross) and attach the cardboard cross with the cups on it to the eraser point of the pencil.
7. Blow on the cups to make sure the cardboard spins around freely on the pin.
8. Place the modelling clay on a surface outside, such as a porch railing, wooden fence rail, a wall or a rock.
9. Stick the sharpened end of the pencil into the clay so it stands up straight. Your anemometer is now ready for use!



Video resource: [https://www.youtube.com/watch?v=l7BUZUrD5Kg&feature=emb\\_title](https://www.youtube.com/watch?v=l7BUZUrD5Kg&feature=emb_title)

### C. Record your data

1. In groups, bring your anemometers outside. Each group will rotate to three locations on campus and will test each location over three days.
2. Determine the wind direction each day and record it in the table provided.
3. Measure the wind speed by holding your anemometer away from your body (or by attaching it to a surface of some height)
4. Using the stopwatch, count the number of times the marked/coloured cup completes a full revolution. Repeat this measurement at least 3 times. Record your individual measurements in the table provided.
5. Rotate to the next two locations and repeat step 4 for each location.
6. Repeat steps 4 and 5 on two other days at different times of the day (if possible) to record the average wind speed of each location on your campus.
7. Put the days along the horizontal axis and the wind speeds (turns per minute) along the vertical axis.
8. Draw a graph using the graph to represent this data

### D. Analyse your results

Calculate the average (mean) wind speed for each location over the number of days and time.

1. After testing the three locations, discuss your results with your group.
2. Which location had the highest wind speed?
3. Why did that location have different results than the others?
4. If one location had a similar wind speed to another, why do you think that occurred?
5. Based on your knowledge of how wind is generated, try to explain why there might be variations?
6. Where would you place the new wind turbine?
7. How could you improve the design of your anemometer to make it more reliable?

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Fill in:			Measure:					Calculate: <i>You will need a calculator</i>	
Location	Day	Time of day	Direction of (wind)	Speed 1 (kmph)	Speed 2 (kmph)	Speed 3 (kmph)	Speed 4 (kmph)	Average speed per day (kmph)	Average speed per location (kmph)
1 _____ _____ _____	1								
	2								
	3								
2 _____ _____ _____	1								
	2								
	3								
3 _____ _____ _____	1								
	2								
	3								
4 _____ _____	1								

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<hr/> <hr/>	2								
	3								

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**Graph your calculated average wind speed for each day. Different locations can be represented by drawing separate colour graphs**







