652-1010 (05-005) Anemometer Instructions

Warranty and Parts:

We replace all defective or missing parts free of charge. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse, or normal wear and tear.

Materials Needed:

Electric fan, optional
Stopwatch

Description:

Anemometers measure wind speed and can measure air velocities of 5 - 20 mph accurately.

This anemometer is called the Robinson Cup type and is based on the fact that *moving air exerts more force on the open end of a hemisphere than upon the closed end.* It consists of 4 lightweight cups (3 one color, 1 another) at the end of spokes which are at right angles to one another.

Each open end faces the closed end of the following cup. The difference in air force between open and closed ends is enough to cause the anemometer to spin at a speed approximately **1/6** that of wind velocity.

(Full-size anemometers rotate at a speed 1/3 of wind velocity.)

This anemometer operates at wind speeds as slight as 2 mph.

Maintenance:

A drop of oil inside the bearing makes for easier turning. Light oil such as kerosene is recommended. Graphite will also work.

Calculating Wind Velocity from Your Data:

Anemometers usually carry a meter calibrated in units of speed activated by voltage generated by connecting the vanes to a small electric generator.

In this anemometer you calculate the wind velocity as follows:

1. Measure the distance from cup center to the center of the shaft. It is about 16 cm.
2. Count the number of rotations in one minute as the anemometer spins. Use a stopwatch to time the interval and count the number of times the contrast cup passes.
3. When a cup makes one full revolution, it covers a distance equal to the perimeter of a circle of radius 8 cm. It covers a distance equal to $2\pi r$, which would mean: 2 x 3.1416 x 8 cm, or 50.3 cm.
   - *Your anemometer cup therefore moves through 50.3 cm each time it revolves.*
4. Calculate the speed of your anemometer. *Example*: you counted 60 revolutions in one minute. *Your anemometer speed would be 60 RPM (revolutions per minute). It means a linear distance of 60 x 50.3 cm covered per minute.*
5. Convert this into km/hr using the following calculation:

$$\frac{60 \times 50.3\text{cm}}{1\text{ min}} \times \frac{60\text{min}}{1\text{ hr}} \times \frac{1\text{ km}}{100000\text{cm}}$$

$$= 60 \times 0.003 \text{ km/hr}$$

$$= 1.8 \text{ km/hr}$$

   - If you had counted 30 revolutions per minute instead of 60, your anemometer speed would have been 30 x 0.003 km/hr; or if the number of revolutions were 15, the anemometer speed would be 15 x 0.003 km/hr. You can use a "shortcut" method in calculating the anemometer speed. Multiply the rpm by 0.03 to obtain your anemometer speed in km/hr.
5. Once you know your anemometer speed, you can figure out the wind velocity that moved it.
   - Remembering that the anemometer moves only 1/6 as fast as the wind, multiply your speed by 6 to get wind speed: (6 x 1.8) or 10.8 km/hr
   - For anemometer speed of 60 rpm, wind velocity is 10.8 km/hr.

How to Teach with Anemometer

Concepts Taught: Wind; wind speed determination; weather

Curriculum Fit: Earth Science Sequence/The Planet Earth. *Unit: Atmospheric Processes.* **Grades 6-8.**

Concept Taught: Motion: Distance, Timer, Average trip speed, Direction of Motion.

Curriculum Fit: Physics Sequence/Motion & Force. *Unit: Descriptors of Motion.* **Grades 6-8.**

Concept Taught: Wind as source of Energy.

Curriculum Fit: Chemistry Sequence/Structure of Matter. *Unit: Energy Alternatives.* **Grades 6-8**.

Related Products:

The following products may be ordered from your distributor. If unavailable, from manufacturer **Science First®.**

612-1340 Ice Melting Set

Place two ice cubes on two identical-appearing bases. One cube melts much faster than the other. Why? With instructions.

611-1215 Ring and Disc

Simple materials - PVC ring and wood disc- with same mass but different distribution. Roll down an incline. Which is faster?

611-0350 Roman Arch

Grades 3-8. Set of 23 wood blocks in 6 unique shapes builds a working model of an architectural marvel. Full-size template, base, buttress, all hardware, instructions.

611-0355 Catenary Arch

Grades 3-8. Set of 13 wood blocks constructs a catenary arch, the shape of McDonald's golden arches. This arch has many interesting structural and mathematical properties. A hands-on investigation!

The table below provides wind velocities calculated for different speeds of this anemometer using the described method. It may or may not include your exact data. If not, follow the instructions or use the graph below, which has been plotted using the data of the table but made precise up to 2 decimal places. To find the wind velocity corresponding to the anemometer speed of **your** experiment, locate this speed on the **x-axis** and find the wind velocity on the **y-axis** by extrapolation. Follow the example shown for an anemometer speed of 60 RPM.

Wind Velocities for Different Anemometer Speeds

Speed (in RPM)	Calculation	Wind Velocity (in km/hr)	(in m/hr)
10	[10 x 0.03 km/hr] x 6	1.8	1.1
15	[15 x 0.03 km/hr] x 6	2.7	1.7
20	[20 x 0.03 km/hr] x 6	3.6	2.2
25	[25 x 0.03 km/hr] x 6	4.5	2.8
30	[30 x 0.03 km/hr] x 6	5.4	3.4
35	[35 x 0.03 km/hr] x 6	6.3	3.9
40	[40 x 0.03 km/hr] x 6	7.2	4.4
45	[45 x 0.03 km/hr] x 6	8.1	5.0
50	[50 x 0.03 km/hr] x 6	9.0	5.6
60	[60 x 0.03 km/hr] x 6	10.8	6.7
70	[70 x 0.03 km/hr] x 6	12.6	7.8
80	[80 x 0.03 km/hr] x 6	14.4	8.9
90	[90 x 0.03 km/hr] x 6	16.2	10.0
100	[100 x 0.03 km/hr] x 6	18.0	11.2

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