Barometer: Air Pressure

Changes in air pressure are used to forecast weather. Generally, a change to higher pressure indicates fair weather, whereas lower air pressure indicates stormy weather. To make a barometer you will need a large balloon, a long plastic coffee stirrer (approximately 8 in., a bottle with an opening at least 2 in. wide, file folder, oak tag board (other stiff paper taller than the bottle and approximately 10 in. wide), rubber cement or glue, rubber band, and tape.

1. Cut open the balloon, from the opening to the top, to obtain a large piece of balloon material.
2. Stretch the balloon over the top of the bottle and secure tightly with a rubber band.
3. Lay the coffee stirrer across the balloon, with the end of the coffee stirrer in the middle of the bottle opening. Secure with glue.
4. Secure the tag board behind the barometer so that the end of the coffee stirrer is nearly touching. On the board, mark the end of the coffee stirrer. Because air pressure pushes on the balloon, the balloon will be pushed down with increased air pressure and the coffee stirrer will point higher on the board. Lower air pressure will result in less push on the balloon and the air inside the bottle with push the balloon up, causing the coffee stirrer to point high on the tag board chart.

Check the barometer morning and afternoon and again mark where the coffee stirrer points and record higher air pressure, the same air pressure, or lower air pressure.

Rain Gauge: Precipitation

Precipitation can be measured with a straight sided and fairly flat-bottomed can, such as a vegetable or tuna can, and a ruler with graduations that start at the end of the ruler. Place the can in an open area and surround it with rocks to hold it upright. Morning and afternoon, measure the precipitation by holding the ruler against the bottom of the can; the amount of precipitation is indicated by height of the mark on the ruler. Solid precipitation can be measured by bringing the can inside and allowing the ice or snow to melt. Because the opening of the can is the same diameter as the bottom of the can, the inches or fraction of inches indicated on the ruler is the amount of precipitation for the monitoring period.

Wind Vane: Wind Direction

Wind direction often indicates a change in weather. A wind vane can be constructed by cutting an arrow shape from a piece of heavy oak tag board (see Internet Resources for image).

1. Make the arrow head approximately 3 in. long and 2 in. high. Next cut the “feathers” or a backward arrow head, approximately 3 in. long and 2 in. high.
2. The arrow shaft is a plastic straw approximately 10 in. long. On each end, cut into the straw approximately three-eighths of an inch to create a slot to insert the arrow head on one end, feathers on the other.
3. Insert the arrow head and feathers into each end of the straw, use a hot glue to secure.

4. Find the balance point of the straw by balancing on your finger. Make a small hole at the balance point with a T pin. Make the hole large enough to allow the straw to easily rotate on the T pin.
5. Insert the T pin into the eraser of a tall pencil.
6. Place the wind vane in an open area, by inserting the pencil into the ground, or just hold the dowel at arm's length. The wind vane will move to point in the direction of the wind. Use a compass to determine the compass direction.

Protractor Anemometer: Wind Speed

An anemometer can be constructed with a protractor, a piece of string 11 in. long, Ping Pong ball, straw, and glue gun.

1. Begin by gluing the string to the center of the protractor.
2. Glue the ball to the string so that the string length from protractor to ball is 10 in.
3. Glue or tape a straw to the back of the protractor base.
4. Determine wind speed by holding the protractor level in line with the wind direction. The wind will blow the ball in the direction of the wind. Read the angle of the string on the protractor; use Figure 1 to find the wind speed.

Portion Cup Anemometer: Wind Speed

This anemometer design uses wind to turn a generator (1.5 V motor, cost is approximately $1; see Internet Resources). The generated electricity is measured in volts with a Volt Ohm Meter (cost is $3-$5; see Internet Resources). The greater the number of volts measured, the stronger the wind speed.

Building the anemometer:

1. Run two small diameter dowels through the middle of a dense foam cube. The dowels need to extend on each side of the foam cube approximately 2 in.
2. Mount a portion cup on each end of dowels. The anemometer is studier if the dowel end is stabbed from side to side through a portion cup.
3. Extend the dowel through the cup and hot glue in place.
4. Use the shaft on a 1.5 V motor to make a small indention in the center of the bottom of the foam cube holding the portion cup rotor.
5. Fill the indention with hot glue and quickly embed the motor shaft into the hold. Don't glue the motor bottom to the cube; the cube must be able to rotate and in turn, rotate the motor.
6. Next, connect the motor leads to the volt-ohm meter, set the meter on a volt setting. Rotate the cups by blowing across them, or hold in the wind. The meter will show a volt reading. Because portion cup size varies, this anemometer must be calibrated.
7. Calibrate your anemometer. The best way to calibrate requires a car, a driver, and an anemometer operator. On an empty street, hold the anemometer out the car window. Drive along at 1 or 2 mph and note the volts measured. Increase the car speed 2–3 mph and record the volts. Step by step, this will create a custom chart for the anemometer. The wind speed–volt chart will be accurate for anemometers made with the same size portion cups, dowels, and motors.

Hygrometer: Relative Humidity

A hygrometer measures the relative humidity, or the ratio of the amount of water, compared to the maximum amount of water that could be held at the same temperature (for image, see Internet Resources). A simple hygrometer can be constructed from a human hair. It works on the principle that as hair absorbs water, it is able to stretch. As hair dries, it becomes shorter.

To make the hair hygrometer, you will need a clean 1 quart milk carton. Cut a small slit—small enough to firmly hold a paper clip—at the top end of the milk carton center. Insert a paper clip into the slit so that only one-third of paper clip sticks out. Next, cut an H-shape into the side of the carton at the other end. The H tabs will hold the pointer axle. Bind the tab portions of the H tabs up. Mark the center of the tab and punch holes for the pointer axle. Cut a piece of index card and glue it to one side of the carton, below where the H tabs are located. Then make the axle for the pointer, insert a long needle through the holes in the H tab, with the sharp end above the index card. Force a 3-in. broom straw on the sharp end of the needle, and secure with glue. This will be the pointer. Find a friend willing to donate a 10- in. long hair. Tie one end of the hair to paper clip, run the hair the length of the carton and wrap it three or four times around the pointer axle. Allow the hair to hang about half way down the bottom end of the milk carton and use hot glue to attach a penny as a weight to the end of the hair. Calibrate the hygrometer by first dying the hair with a handheld dryer. Mark the pointer location on the index card; this is 0 % humidity. To find 100% on the index card scale, saturate the hair with water from a cotton ball and mark the pointer location. Next, mark graduations to indicate 25%, 50%, and 75%. Take relative humidity measurements by estimating the location of the pointer on the scale.

Harbor Freight

www.harborfreight.com

Homemade Hygrometers

www.salemclock.com/weather/hygrometers.htm

Kelvin

www.kelvin.com

Making a Wind Vane

www.ciese.org/curriculum/weatherproj/Introductory_Activity_Lessons/making_a_wind_vane.html

Figure 1. Chart.

Angle	Km/hr	**Angle**	Km/hr
90	0	66	21.0
88	5.9	64	21.9
86	7.2	62	22.9
84	10.2	60	23.8
82	11.8	55	26.2
80	13.2	50	28.8
78	14.5	45	31.4
76	15.7	40	34.2
74	16.8	35	37.4
72	17.9	30	41.3
70	18.9	25	45.9
68	20.0	20	52.0