INSTRUMENTS

The amateur's weather station need not be elaborate or expensive; in fact, some of the instruments may be fashioned at home from materials readily at hand and others may be purchased at a nominal cost.

Some of the most common weather instruments include:

Barometer: While the barometer has been greatly overrated as a forecasting device, it is essential that the local observer should be equipped with some means by which to detect changes in atmospheric pressure. Pressure changes used in connection with the wind direction will give the best key to the local situation.

The barometer is—by far—the most expensive instrument the amateur meteorologist may have to purchase. Plans for the construction of "homemade" devices for measuring atmospheric pressure can be found in a number of books on weathercasting, but the skills needed to build them are often beyond the layperson and the instrument's accuracy may be somewhat suspect. In many areas, the telephone company provides recorded forecast and observational information which includes hourly barometer readings. This reading might be used where no other source is available. A serviceable aneroid barometer can be purchased for around $40.

The barometer should not be placed out-of-doors because such exposure may corrode its parts. Since air pressure is the same both indoors an outdoors the instrument can be located inside at some convenient spot. Keep it out of sunlight and away from drafts in a place where the temperature does not vary too much and readings will be reliable.

The barometer should be adjusted to sea level. Instructions for such adjustments will be included with the barometer. The current sea level pressure is available from local National Weather Service facilities.

Of the instruments combined in thermometer-barometer-humidity instrument sets, the barometer will be the only aid to the amateur meteorologist. Temperature and humidity readings taken indoors are valueless in forecast work and merely indicate atmospheric conditions within a particular room of the house.

Thermometer: The thermometer is another important weather instrument which can be built by the amateur; but a fairly accurate one can be bought for a few dollars.

If maximum and minimum temperature records are to be kept, a special thermometer (or set of thermometers) will be needed.

The National Weather Service uses a set of two thermometers to obtain maximum-minimum readings. The maximum thermometer has a special constriction near the bulb and the minimum thermometer has a floating index. This set costs around $45.

Less expensive is the longtime favorite of amateur forecasters called the Six's-type after its inventor. This U-shaped thermometer— one side reading maximum and one side reading minimum—can be bought for around $29.

A dial-type maximum-minimum thermometer is also available. This type has a coiled metal spring temperature element and two thin metal pointers that are pushed either up or down into position as the main pointer of the temperature element moves around the scale.

Thermometers, of course, should be located outdoors and in constant shade. A properly constructed and situated instrument shelter is ideal for thermometer exposure. Plans for such a shelter are discussed later.

Hygrometer: There are six basically different means of measuring the water vapor content of the atmosphere and hence an equal number of types of hygrometers. The psychrometer type described here is the simplest type of hygrometer and can be built at home without too much trouble.

The psychrometer consists of two matched thermometers—one, exposed to the free air, is the dry bulb and the other has its bulb covered by a water saturated wick, hence the wet bulb. The wet bulb measures the temperature at which water is evaporating from the wick. Since the rate of evaporation is controlled by the amount of moisture in the air and evaporation is a cooling process, the wet bulb will read lower than the dry bulb. This difference in temperature is known as the wet bulb "depression." When this depression figure is determined by subtracting the wet bulb temperature from the dry bulb temperature, the table in the "Weather Log" section may be consulted to find out the relative humidity.

A simple wet bulb thermometer can be made from a regular thermometer, a bootlace, and a small medicine bottle.

It is best to boil the bootlace before using it to get all the impurities and coloring matter out of it. Use about three inches of a tubular white cotton bootlace. Slip one end of it over the bulb of the thermometer—part of the thermometer's wooden or metal backing may have to be cut off. Arrange the thermometer so that the other end of the bootlace dips into a small bottle filled with water. The water will soak up into the bootlace and keep the bulb moist. The wet bulb thermometer may then be mounted on a suitable backing with another thermometer to form a psychrometer. (Make sure the temperature reading on the two thermometers is the same before they are purchased.)

A factory-built psychrometer, built to National Weather Service specifications, can be purchased for around $49.

Hygrometers should be kept out-of-doors in a properly ventilated shelter. In below-freezing temperatures, care should be taken to assure water for the wet bulb is not left outside between readings.

Rain gage: Any straight-sided container may be used for making an inexpensive rain gage. The rainfall for any given period of time is the depth of the rain falling on a horizontal surface during the period considered. If, therefore, the container has straight sides and the same area of cross section as the container opening and is exposed in a horizontal position, the depth of

catch measured in inches and tenths may be taken as the correct rainfall value for location.

A # 10 can (6-1/6 inches inside diameter, 7 inches tall) will do very well for an improvised rain gage. The can should be exposed in an unsheltered place, and a means provided to keep it level and protected from upsetting in the wind. It would be preferable to have the top edge of the can rolled to reinforce it so it will hold its circular shape.

The depth of water can then be measured by means of a wooden ruler marked in inches and tenths. If a more accurate measurement is desired, the water may be poured from the # 10 can into a # 303 can which happens to have an area of cross section about one-fourth that of the larger can. Thus the value obtained by measuring the precipitation when poured into the smaller can divided by four will be more accurate than if measured directly in the large can.

An exposure site should be chosen which is a few feet from the ground and well away from buildings and other obstructions. Care should be taken to see that the rain does not splash into the can from the support post or any other nearby object.

Wind vane: Wind direction can be determined from the flow of smoke, the behavior of a flag, or even the time-honored (if somewhat unscientific) wet-finger method. If a wind vane is in sight, so much the better.

A wind vane can easily be fashioned from wood, tin, or other material. Both ends should be balanced and it should swing freely on a central pivot. Ornamental wind vanes may be purchased at small cost adding a decorative value to their scientific usefulness.

The vane should be mounted where the wind is least affected by local influences (trees, buildings, windbreaks), and the direction indicators should be carefully lined up with cardinal compass points.

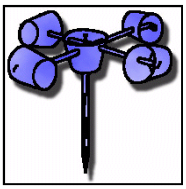
Anemometer: An anemometer to measure wind speed may be built at home by an amateur craftsman, but such instruments are seldom satisfactory as the gear box of a cup-type anemometer must be thoroughly weatherproofed and the whole instrument is difficult to calibrate in miles per hour.

A hand-held instrument shaped somewhat like a slingshot with a flap suspended between its arms which swings back along a scale as the wind strikes it can be built which will give the observer a fair idea of wind speed. This instrument is calibrated by holding it out of the window of a moving car and marking the point to which the flap is blown back along the scale at different speeds.

As with the wind vane, readings with this instrument should be made where the wind is least affected by local influences. The anemometer, of course, should be headed directly into the wind a reading is being made.

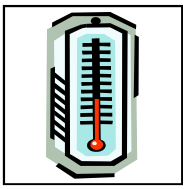
Instrument shelter: For the best results, the various thermometers listed here (maximum-minimum, psychrometer, and so on) should be kept outdoors, in a shelter. A thermometer really only takes its own temperature, and if this is to represent the air temperature the thermometer must be expected in such a way that it is subject to the same temperature as the air. This means keeping it out of the sun and keeping it where the air can move freely around it. The best way is to put it in a ventilated box or thermometer shelter.

A simple shelter can be built from a couple of window shutters, some wood or beaver board, and a supporting post or posts. The shutters form the sides of the shelter. The back, top, and bottom can be of ordinary wood. The top should be made from two layers of wood with a small air space in between. It can have a hinged door or an open side, but the opening should face north to keep the sun from shining in and affecting the thermometers when the door is open. The shelter should be painted white, inside and out.

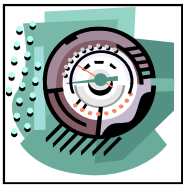


Anemometer: measures the velocity or speed of the wind.

Instrument shelter: protects temperature and relative humidity sensors and other instruments against errors and damage due to solar radiation, wind, and precipitation.



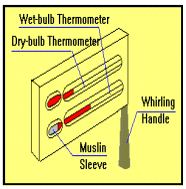
Thermometer: instrument for measuring temperature, usually by means of the expansion and contraction of mercury or alcohol in a capillary tube and bulb.



Barometer: instrument for measuring the pressure of the atmosphere, and thus determining the height above sea level, or probable changes in the weather.

Rain gage or Rain gauge: uses for measuring rainfall; an instrument is large or small container size.

Wind vane: device to show which way the wind is blowing.



Hygrometer or Psychrometer: devices for measuring the wet-bulb temperature of the air. The temperature reading is affected by air movement over the instrument. There are two types of measuring instrument, sling and screen hygrometer. The sling hygrometer is the more accurate one, therefore it is preferred by air conditioning engineers.

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