HOW THINGS WORK

How Does the Thermometer Work?

A thermometer is a device that measures the temperature of things. The name is made up of two smaller words: "Thermo" means heat and "meter" means to measure. You can use a thermometer to tell the temperature outside or inside your house, inside your oven, even the temperature of your body if you're sick.

Galileo Thermometer
Photo courtesy:
Wind & Weather

One of the earliest inventors of a thermometer was probably Galileo. We know him more for his studies about the solar system and his "revolutionary" theory (back then) that the earth and planets rotated around the sun. Galileo is said to have used a device called a "thermoscope" around 1600 - that's 400 years ago!!

The thermometers we use today are different than the ones Galileo may have used. There is usually a bulb at the base of the thermometer with a long glass tube stretching out the top. Early thermometers used water, but because water freezes there was no way to measure temperatures less than the freezing point of water. So, alcohol, which freezes at temperature below the point where water freezes, was used.

The red colored or silver line in the middle of the thermometer moves up and down depending on the temperature. The thermometer measures temperatures in Fahrenheit, Celsius and another scale called Kelvin. Fahrenheit is used mostly in the United States, and most of the rest of the world uses Celsius. Kelvin is used by scientists.

Fahrenheit is named after the German physicist Gabriel D. Fahrenheit who developed his scale in 1724. Ice freezes at 32 degrees Fahrenheit (F for short), and water boils at 212 degrees F. He arbitrarily decided that the difference between the freezing point and boiling point of water should be 180 degrees.

The Celsius scale is named after Anders Celsius. The Celsius scale used to be called the "centigrade" scale. Centigrade means "divided into 100 degrees." Anders Celsius developed his scale in 1742. He started with the freezing point of water and said that was 0 degrees Celsius (C for short). At the point where water boils, he marked that at 100 degrees C. This scale is much more scientific because the measurement is broken down into an even 100 degrees. This is similar to the scientific system of measuring distance and weight called the metric system.

Kelvin is named after Lord Kelvin, whose full name is Sir William Thomson, Baron Kelvin of Largs, Lord Kelvin of Scotland. His scale starts at 0 degrees Kelvin, which is called absolute temperature.

Lord Kelvin took the idea of temperature one step further with his invention of the Kelvin Scale in 1848. The Kelvin Scale measures the coldest temperature there can be. He said there was no upper limit of how hot things can get, but he

said there was a limit as to how cold things can get. Kelvin developed the idea of Absolute Zero. This is at minus 273.15 degrees Celsius (or -523.67 F)! At this temperature, absolute zero is the lowest possible temperature, occurring when no heat energy remains in a substance. Absolute zero is the point at which molecules do not move (relative to the rest of the body).

As far as scientists know, nothing in the universe can get that cold!

How A Thermometer Works

When you look at a regular outside bulb thermometer, you'll see a thin red or silver line that grows longer when it is hotter. The line goes down in cold weather.

This liquid is sometimes colored alcohol but can also be a metallic liquid called mercury. Both mercury and alcohol grow bigger when heated and smaller when cooled. Inside the glass tube of a thermometer, the liquid has no place to go but up when the temperature is hot and down when the temperature is cold.

Numbers are placed alongside the glass tube that mark the temperature when the line is at that point.

Bulb Thermometer
Note reservoir at bottom.
Photo courtesy:
Wind & Weather

Spring Thermometer
Photo Courtesy:
Wind & Weather

The other type of common thermometer is a "spring" thermometer. A coiled piece of metal that is sensitive to heat is used. One end of the spring is attached to the pointer. As the air heats, the metal expands and the pointer moves higher. As the air cools, the metal contracts and the pointer moves lower. Typically, these type of thermometers are less accurate than bulb or digital thermometers.

To convert Fahrenheit to Celsius or Celsius to Fahrenheit

Go to Our On-Line Calculator

Other Places to Visit:

- About Inventors page on Thermometers (http://inventors.about.com/library/inventors/blthermometer.htm)
- How Stuff Works - Thermometer (www.howstuffworks.com/therm1.htm)
- Galileo and Thermometer (http://es.rice.edu/ES/humsoc/Galileo/Things/thermometer.html)
- Thermometer and Weather Instruments (http://botw.org/top/Kids_and_Teens/School_Time/Science/The_Earth/The_Atmosphere/Weather/Instruments/)

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Page updated: April 22, 2002