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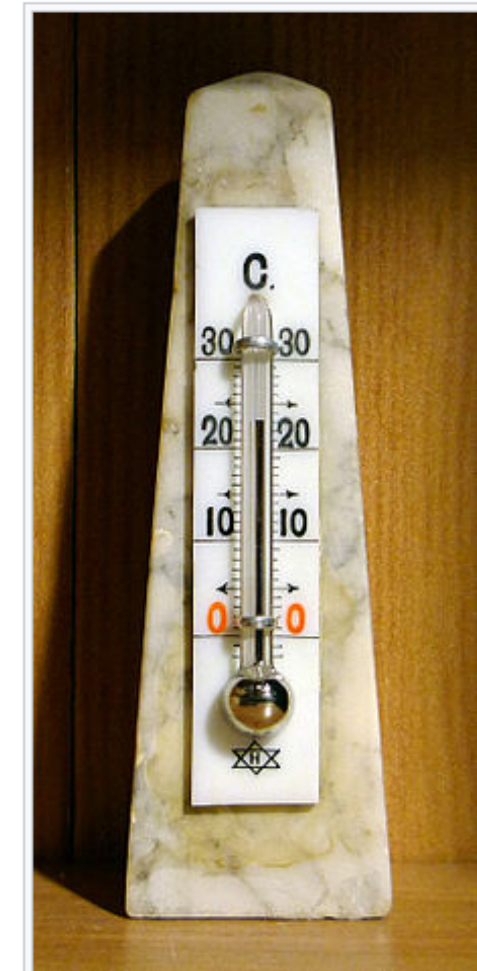


## How a thermometer works

How cold is the air outside today? How high is my fever when I'm sick? When we need to know how hot or how cold something is, we use a thermometer to measure the object's temperature. "Thermo" means heat, and "meter" means measuring device. A thermometer measures the amount of heat, or thermal energy, transferred from the object to the thermometer.

How thermometers work can be explained using KMT, which stands for Kinetic Molecular Transitions. KMT explains how particles in matter behave. According to KMT, all objects are made of particles that are spinning at fixed positions. There are also spaces between particles. In solids, particles are packed loosely and spin slowly. For liquids, particles are further apart and spin more quickly. And, for gases, particles are torn apart and no spin exists. To change state, energy is added or removed. In other words, to change from solid to liquid to gas, energy is added (and vice versa). Thus, the more energy the particles have, the faster they spin and the farther apart they can get.

In a thermometer, a sealed glass tube is partly filled with a liquid like mercury or alcohol. If the thermometer's bulb is placed in an object that is hotter than the mercury, the mercury will absorb more energy, the space between mercury particles will shrink, and the mercury will drop in the glass tube. If the thermometer is placed in an object that is colder than the mercury, the mercury will lose energy, the space between mercury particles will expand, and the mercury will rise.



Mercury thermometer (mercury-in-glass thermometer) for measurement of room temperature. Daniel Fahrenheit's application of mercury and a standardized temperature scale for liquid-in-glass thermometers ushered in a new era of accuracy and precision in thermometry.<sup>[1]</sup> From the early 1710s until the introduction of electronic devices in the 1960s, mercury-in-glass thermometers were the world's most reliable and accurate thermometers, accounting for their widespread use.<sup>[2]</sup>