

## A TEMPERATURE IN THE NATURE AND TECHNIQUE

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Temperature is one of those aspects of the everyday world that seems rather abstract when viewed from the standpoint of physics. In scientific terms, it is not simply a measure of hot and cold, but an indicator of molecular motion and energy flow. Thermometers measure temperature by a number of means, including the expansion that takes place in a medium such as mercury or alcohol. These measuring devices are gauged in several different ways, with scales based on the freezing and boiling points of water—as well as, in the case of the absolute temperature scale, the point at which all molecular motion virtually ceases.

Energy appears in many forms, including thermal energy, or the energy associated with heat. Heat is internal thermal energy that flows from one body of matter to another—or, more specifically, from a system at a higher temperature to one at a lower temperature.

Two systems at the same temperature are said to be in a state of thermal equilibrium. When this occurs, there is no exchange of heat. Though people ordinarily speak of "heat" as an expression of relative warmth or coldness, in physical terms, heat only exists in transfer between two systems. It is never something inherently part of a system; thus, unless there is a transfer of internal energy, there is no heat, scientifically speaking.

Thus, heat cannot be said to exist unless there is one system in contact with another system of differing temperature. This can be illustrated by way of the old philosophical question: "If a tree falls in the woods when there is no one to hear it, does it make a sound?" From a physicist's point of view, of course, sound waves are emitted whether or not there is an ear to receive their vibrations; but, consider this same scenario in terms of heat. First, replace the falling tree with a hypothetical object possessing a certain amount of internal energy; then replace sound waves with heat. In this case, if this object is not in contact with something else that has a different temperature, it "does not make a sound"—in other words, it transfers no internal energy, and, thus, there is no heat from the standpoint of physics.