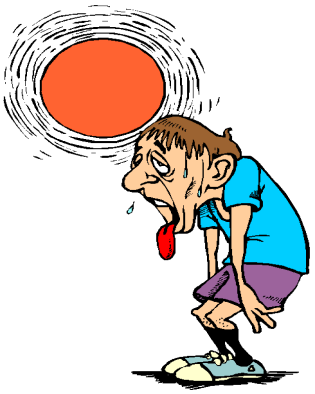
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Heat and Temperature

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Introduction to Heat and Temperature

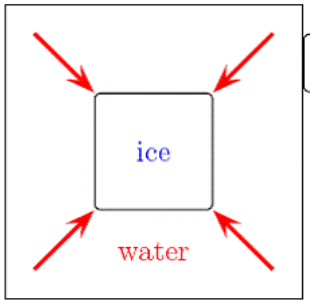
What is Heat?



Heat is the form of energy of an object that is due to the movement of its atoms and molecules. These are continuously moving around, hitting each other and other objects. When we addenergy to an object, its atoms and molecules move faster, which increases its energy of motion or heat. Even objects that are very cold have some heat energy because their atoms are still moving. `Cold' is not a physical thing. It does not move from place to place, it is just the word for a relative lack of heat, just as dark is the word for a relative absence of light.

What is Temperature?

Temperature is a measure of the average kinetic energy of the particles in a body. Or, you could also say, temperature is a measure of the average heat or thermal energy of the particles in a substance. Since temperature is an average measurement, it does not depend on the number of particles in an object. In that sense, it does not depend on the size of the object. For example, the temperature of a small cup of boiling water may be the same as the temperature of a large pot of boiling water, even though the large pot is much bigger than the cup and has millions and millions more water molecules.



We experience temperature every day. When it is very hot outside, when we have a fever and feel hot, and when it is snowing outside and we feel cold. When we boil water, we wait for the water temperature to increase, and when we make popsicles, we wait for the liquid to become very cold and freeze.

A heat flow diagram showing the heat flowing from the warmer water into the cooler ice cube.

It is heat that will increase or decrease the temperature. If we add heat, the temperature will become higher. If we remove heat, the temperature will become lower. Higher temperatures mean that themolecules are moving, vibrating, and rotating with more energy.

Detecting Heat

There are many ways to detect heat. The method chosen often depends on what heat source we are trying to measure. For example, the way we detect heat in the air is different from how we detect heat from a fire or heat from objects in deep space.

Heat is measured in quantities called joules (pronounced the same as jewels) in the metric system, and in British Thermal Units (BTU) in the English system. Heat can also be measured in calories.

Measuring Temperature

Many devices have been invented to accurately measure temperature, which all started with the establishment of a temperature scale. This scale transformed the measurement of temperature into meaningful numbers.

If we want to understand what temperature means on the molecular level, we should remember that temperature is the average energy of the molecules that compose a substance. The atoms and molecules in a substance do not always travel at the same speed. This means that there is a range of energy (the energy of motion) among the molecules. In a gas, for example, the molecules are traveling in random directions at a variety of speeds -- some are fast and some are slow. Sometimes these molecules collide with each other. When this happens the higher speed molecule transfers some of its energy to the slower molecule, which causes the slower molecule to speed up and the faster molecule to slow down. If more energy is put into the system, the average speed of the molecules will increase and more thermal energy or heat will be produced. So higher temperatures mean that a substance has higher average molecular motion.

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Reference links:

- http://www.en.wikipedia.org/wiki/temperature
- http://www.physics.about.com/od/energyworkpower/f/KineticEnergy.htm
- http://www.en.wikipedia.org/wiki/Molecule

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