

Heat Encyclopedia Article

Heat by Bill Buford

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Heat

The concept of heat has always been an important consideration in scientific thought. Some things are warmer than others. When warm objects are placed in contact with cold ones, the warmer object cools down as the colder one heats up. Apparently something causes an object to be warm and flows from warm objects to cold ones. This "something" is called heat.

The controversy over whether heat is a material substance or is due to the kinetic motion of particles continued into the early twentieth century. Isaac Newton (1642-1727), Christiaan Huygens (1629-1695), Robert Hooke (1635-1695), **Henry Cavendish**, **Humphry Davy**, and **Benjamin Thompson**, Count Rumford supported the kinetic interpretation. **Hermann Boerhaave**, **Antoine-Laurent Lavoisier** and Pierre-Simon Laplace (1749-1824) favored the material interpretation.

Joseph Black and Johann Wilcke (1732-1779) developed the concept of specific heat capacity, defined as the amount of heat which raises the **temperature** of a substance by 1 degree. The empirical definition of heat is based on this concept: the amount of heat involved in a process is equal to the product of the specific heat of the substance multiplied by the change in temperature which occurs when heat is added to or taken away from the substance. The unit given to the amount of heat is the calorie, defined as the amount of heat that raises the temperature of 1 gram of **water** by 1°Celsius.

James Joule showed that, unlike material substances, heat can be created and destroyed by changing it into work. One calorie of heat is equivalent to 4.2 joules of work. Subsequently, the kinetic theory proposed by A. K. Krönig (1822-1879) and Rudolf Clausius (1822-1888) explained heat as the result of translational, rotational, and vibrational motions of molecules: the faster they move, the higher the temperature. The work of **Albert Einstein** (1879-1955) finally clenched the argument in favor of the kinetic interpretation of heat.