

THERMODYNAMICS

Thermodynamics is the study of the relationships between heat, work, and energy. Though rooted in physics, it has a clear application to chemistry, biology, and other sciences: in a sense, physical life itself can be described as a continual thermodynamic cycle of transformations between heat and energy. But these transformations are never perfectly efficient, as the second law of thermodynamics shows. Nor is it possible to get "something for nothing," as the first law of thermodynamics demonstrates: the work output of a system can never be greater than the net energy input. These laws disappointed hopeful industrialists of the early nineteenth century, many of whom believed it might be possible to create a perpetual motion machine. Yet the laws of thermodynamics did make possible such highly useful creations as the internal combustion engine and the refrigerator.

Any physical system will spontaneously approach an equilibrium that can be described by specifying its properties, such as pressure, temperature, or chemical composition. If external constraints are allowed to change, these properties generally change. The three laws of thermodynamics describe these changes and predict the equilibrium state of the system.