Key Terms

Boltzmann constant constant with the value $k = 1.38\times10^{-23}$ J/K, which is used in the ideal gas law

cyclical process process in which a system is brought back to its original state at the end of every cycle

entropy measurement of a system's disorder and how much energy is not available to do work in a system

first law of thermodynamics states that the change in internal energy of a system equals the net energy transfer by heat *into* the system minus the net work done *by* the system

heat engine machine that uses energy transfer by heat to do work

heat pump machine that generates the heat transfer of energy from cold to hot

ideal gas law physical law that relates the pressure and volume of a gas to the number of gas molecules or atoms, or number of moles of gas, and the absolute temperature of the gas

internal energy sum of the kinetic and potential energies of a system's constituent particles (atoms or molecules)

pressure force per unit area perpendicular to the force, over which the force acts

second law of thermodynamics states that the total entropy of a system either increases or remains constant in any spontaneous process; it never decreases

thermal efficiency ratio of useful energy output to the energy input

thermal equilibrium condition in which heat no longer transfers energy between two objects that are in contact; the two objects have the same temperature

zeroth law of thermodynamics states that if two objects are in thermal equilibrium, and a third object is in thermal equilibrium with one of those objects, it is also in thermal equilibrium with the other object