## Glossary

**adiabatic process** a process in which no heat transfer takes place

**Carnot cycle** a cyclical process that uses only reversible processes, the adiabatic and isothermal processes

**Carnot efficiency** the maximum theoretical efficiency for a heat engine

**Carnot engine** a heat engine that uses a Carnot cycle

**change in entropy** the ratio of heat transfer to temperature $Q/T$

**coefficient of performance** for a heat pump, it is the ratio of heat transfer at the output (the hot reservoir) to the work supplied; for a refrigerator or air conditioner, it is the ratio of heat transfer from the cold reservoir to the work supplied

**cyclical process** a process in which the path returns to its original state at the end of every cycle

**entropy** a measurement of a system's disorder and its inability to do work in a system

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

**heat engine** a machine that uses heat transfer to do work

**heat pump** a machine that generates heat transfer from cold to hot

**human metabolism** conversion of food into heat transfer, work, and stored fat

**internal energy** the sum of the kinetic and potential energies of a system's atoms and molecules

**irreversible process** any process that depends on path direction

**isobaric process** constant-pressure process in which a gas does work

**isochoric process** a constant-volume process

**isothermal process** a constant-temperature process

**macrostate** an overall property of a system

**microstate** each sequence within a larger macrostate

**Otto cycle** a thermodynamic cycle, consisting of a pair of adiabatic processes and a pair of isochoric processes, that converts heat into work, e.g., the four-stroke engine cycle of intake, compression, ignition, and exhaust

**reversible process** a process in which both the heat engine system and the external environment theoretically can be returned to their original states

**second law of thermodynamics** heat transfer flows from a hotter to a cooler object, never the reverse, and some heat energy in any process is lost to available work in a cyclical process

**second law of thermodynamics stated in terms of entropy** the total entropy of a system either increases or remains constant; it never decreases

**statistical analysis** using statistics to examine data, such as counting microstates and macrostates