

Topic Page: [statistical mechanics](#)

Definition: **statistical mechanics** from *Collins English Dictionary*

n

1 (*functioning as singular*) the study of the properties of physical systems as predicted by the statistical behaviour of their constituent particles

Summary Article: **statistical mechanics**

From *The Columbia Encyclopedia*

quantitative study of systems consisting of a large number of interacting elements, such as the atoms or molecules of a solid, liquid, or gas, or the individual quanta of light (see photon) making up electromagnetic radiation. Although the nature of each individual element of a system and the interactions between any pair of elements may both be well understood, the large number of elements and possible interactions can present an almost overwhelming challenge to the investigator who seeks to understand the behavior of the system. Statistical mechanics provides a mathematical framework upon which such an understanding may be built. Since many systems in nature contain large number of elements, the applicability of statistical mechanics is broad. In contrast to thermodynamics, which approaches such systems from a macroscopic, or large-scale, point of view, statistical mechanics usually approaches systems from a microscopic, or atomic-scale, point of view. The foundations of statistical mechanics can be traced to the 19th-century work of Ludwig Boltzmann, and the theory was further developed in the early 20th cent. by J. W. Gibbs. In its modern form, statistical mechanics recognizes three broad types of systems: those that obey Maxwell-Boltzmann statistics, those that obey Bose-Einstein statistics, and those that obey Fermi-Dirac statistics. Maxwell-Boltzmann statistics apply to systems of classical particles, such as the atmosphere, in which considerations from the quantum theory are small enough that they may be ignored. The other two types of statistics concern quantum systems: systems in which quantum-mechanical properties cannot be ignored. Bose-Einstein statistics apply to systems of bosons (particles that have integral values of the quantum mechanical property called spin); an unlimited number of bosons can be placed in the same state. Photons, for instance, are bosons, and so the study of electromagnetic radiation, such as the radiation of a blackbody involves the use of Bose-Einstein statistics. Fermi-Dirac statistics apply to systems of fermions (particles that have half-integral values of spin); no two fermions can exist in the same state. Electrons are fermions, and so Fermi-Dirac statistics must be employed for a full understanding of the conduction of electrons in metals. Statistical mechanics has also yielded deep insights in the understanding of magnetism, phase transitions, and superconductivity.

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statistical mechanics. (2018). In P. Lagasse, & Columbia University, *The Columbia encyclopedia* (8th

ed.). New York, NY: Columbia University Press. Retrieved from
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statistical mechanics. (2018). In P. Lagasse & Columbia University, *The Columbia encyclopedia*. (8th ed.). [Online]. New York: Columbia University Press. Available from: https://search.credoreference.com/content/topic/statistical_mechanics [Accessed 14 October 2019].

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"statistical mechanics." *The Columbia Encyclopedia*, Paul Lagasse, and Columbia University, Columbia University Press, 8th edition, 2018. *Credo Reference*, https://search.credoreference.com/content/topic/statistical_mechanics. Accessed 14 Oct. 2019.