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the second law of thermodynamics is one of the cornerstones of classical statistical mechanics. its statement is of fundamental significance in statistical mechanics and thermodynamics and has been the subject of considerable study since the work of boltzmann, gibbs, and einstein in the 19th century. a. einstein wrote the paper "on the movement of small particles suspended in stationary liquids which are at thermal equilibrium with the liquid" and published the paper "on the theory of brownian motion" in 1905. in 1905, he also calculated the scattering cross section for the interaction of a brownian particle with the wall of a capillary. brownian motion is a random, time-dependent motion of particles suspended in a fluid which are caused by the random thermal agitation of the fluid molecules. the study of brownian motion led to the formulation of the second law of thermodynamics, and also to the formulation of the famous einstein relation between the diffusion constant of a particle, d, and the particle's relaxation time, t, for particles that are in thermal equilibrium with the surrounding fluid. einstein's formula is: d=kt/6m, where k is the boltzmann constant, t is the absolute temperature, and m is the particle mass. the second law states that all macroscopic processes are irreversibly directed towards states of increasing entropy. the entropy is defined as the logarithm of the number of microscopic states available to a system in a given macrostate. in a macrostate, the system is in a well-defined state, and it is not possible to predict what its state will be in the future. the system can, however, be reversibly transformed into any other macrostate. the second law therefore states that macroscopic systems, in thermal equilibrium, evolve towards the maximum entropy macrostate. this is an important statement in thermodynamics and statistical mechanics since it is the basis for all the work done in these fields. it was first expressed as a thermodynamic principle by clausius in 1865 in the form: ds=dq/t. this is the first law of thermodynamics. in the 20th century, the second law was redefined in terms of the entropy of the system, s, and the entropy change of the system, s. the second law then becomes: ds>0. the second law has two components. the first is that the entropy of the universe is increasing. the second is that the entropy of a system can never decrease, although it can fluctuate. the second law is not a fundamental statement about the universe, but is a statement about a system. 5ec8ef588b

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