Intensive Properties In Thermodynamics

The zeroth law of thermodynamics defines thermal equilibrium and forms a basis for the definition of temperature: if two systems are each in thermal equilibrium with a third system, then they are in thermal equilibrium with each other. f403ff3228 Examples include mass, volume and Gibbs energy. f403ff3228 == Regarding work and heat == f403ff3228

Non-equilibrium thermodynamics Non-equilibrium thermodynamics is concerned with transport processes and with the rates of chemical reactions. Non-equilibrium thermodynamics is a branch of thermodynamics that deals with physical systems that are not in thermodynamic equilibrium but can be described in terms Non-equilibrium thermodynamics is a branch of thermodynamics that deals with physical systems that are not in thermodynamic equilibrium but can be described in terms of macroscopic quantities (non-equilibrium state variables) that represent an extrapolation of the variables used to specify the system in thermodynamic equilibrium f403ff3228

The second law of thermodynamics establishes the concept of entropy as a physical property of a thermodynamic system. It predicts whether processes are forbidden despite obeying the requirement of conservation of energy as expressed in the first law of thermodynamics and provides necessary criteria for spontaneous processes. For example, the first law allows the process of a cup falling off a table and breaking on the floor, as well as allowing the reverse process of the cup fragments coming back together and 'jumping' back onto the table, while the second law allows the former and denies the latter. The second law may be formulated by the observation that the entropy of isolated systems left to spontaneous evolution cannot decrease... f403ff3228 == Introduction == f403ff3228 According to International Union of Pure and Applied Chemistry (IUPAC), an intensive property or intensive quantity is one whose magnitude (extent) is independent of the size of the system. f403ff3228 The terms "intensive and extensive quantities" were introduced into physics by German mathematician Georg Helm in 1898, and by American physicist and chemist Richard C. Tolman in 1917. f403ff3228 "Specific" properties are expressed on a per mass basis. If the units were changed from per mass to, for example, per mole, the property would remain as it was (i.e., intensive or extensive). f403ff3228

Laws of thermodynamics The laws also use various parameters for thermodynamic processes, such as thermodynamic work and heat, and establish relationships between them. The laws of thermodynamics are a set of scientific laws which define a group of physical quantities, such as temperature, energy, and entropy, that characterize The laws of thermodynamics are a set of scientific laws which define a group of physical quantities, such as temperature, energy, and entropy, that characterize thermodynamic systems in thermodynamic equilibrium. In addition to their use in thermodynamics, they are important fundamental laws of physics in general and are applicable in other natural sciences. They state empirical facts that form a basis of precluding the possibility of certain phenomena, such as perpetual motion f403ff3228

The zeroth law is important for the mathematical formulation of thermodynamics. It makes the relation of thermal equilibrium between systems an equivalence relation, which can represent equality of some quantity associated with each system. A quantity that is the same for two systems, if they can be placed in thermal equilibrium with each other, is a scale of temperature. The zeroth law is needed for the... f403ff3228 The first law of thermodynamics states that, when energy passes... f403ff3228

List of thermodynamic properties Some constants, such as the ideal gas constant, R, do not describe the state of a system, and so are not properties. In thermodynamics, a physical property is any property that is measurable, and whose value describes a state of a physical system. Thermodynamic properties are defined as characteristic features of a system, capable of specifying the system's state. Thermodynamic properties In thermodynamics, a physical property is any property that is measurable, and whose value describes a state of a physical system. On the other hand, some constants, such as Kf (the freezing point depression constant, or cryoscopic constant), depend on the identity of a substance, and so may be considered to describe the state of a system, and therefore may be considered physical properties f403ff3228

Almost all systems found in nature are not in thermodynamic equilibrium, for they are changing or can be triggered to change over time, and are continuously and discontinuously subject to flux of matter and energy to and from other systems and to chemical reactions. Many systems and processes can, however, be considered to be in equilibrium locally, thus allowing description by currently known equilibrium thermodynamics. Nevertheless, some natural systems and processes remain beyond the scope of equilibrium thermodynamic methods due to the existence of non variational dynamics, where the concept of free energy is lost. f403ff3228 Not all properties of matter fall into these two categories. For example, the square root of the volume is neither intensive nor extensive. If a system is doubled in size by juxtaposing a second identical system... f403ff3228 Work and heat are not thermodynamic properties, but rather process quantities: flows of energy across a system boundary. Systems do not contain work, but can perform work, and likewise, in formal thermodynamics, systems do not contain heat, but can transfer heat. Informally, however, a difference in the energy of a system that occurs solely because... f403ff3228 The zeroth law states that if two thermodynamic systems are both in thermal equilibrium with a third system, then the two systems are in thermal equilibrium with each other. f403ff3228 Traditionally, thermodynamics has recognized three fundamental laws, simply named by an ordinal identification, the first law, the second law, and the third law. A more fundamental statement was later labelled as the zeroth law after the first three laws had been established. f403ff3228

Zeroth law of thermodynamics The zeroth law of thermodynamics is one of the four principal laws of thermodynamics. It provides an independent definition of temperature without reference to entropy, which is defined in the second law. It provides an independent definition of temperature without reference The zeroth law of thermodynamics is one of the four principal laws of thermodynamics. The law was established by Ralph H. Fowler in the 1930s, long after the first, second, and third laws had been widely recognized f403ff3228

The thermodynamic study of non-equilibrium systems requires more general concepts than are dealt with by equilibrium thermodynamics... f403ff3228 The structure of chemical thermodynamics is based on the first two laws of thermodynamics. Starting from the first and second laws of thermodynamics, four equations called the "fundamental equations of Gibbs" can be derived. From these four, a multitude of equations, relating the thermodynamic properties of the thermodynamic system can be derived using relatively simple mathematics. This outlines the mathematical framework of chemical thermodynamics. f403ff3228

Thermodynamic equations Thermodynamics is based on a fundamental set of postulates, that became the laws of thermodynamics. thermodynamic quantities and physical properties measured in a laboratory or production process. Thermodynamics is based on a fundamental set of postulates Thermodynamics is expressed by a mathematical framework of thermodynamic equations which relate various thermodynamic quantities and physical properties measured in a laboratory or production process f403ff3228

An intensive property is not necessarily homogeneously distributed in space; it can vary from place to place in a body of matter and radiation. Examples of intensive properties include temperature, T; refractive index, n; density, ρ; and hardness, η. f403ff3228 One of the fundamental thermodynamic equations is the description of thermodynamic work in analogy to mechanical work, or weight lifted through an elevation against gravity, as defined in 1824 by French physicist Sadi Carnot. Carnot used the phrase motive power for work. In the footnotes to his famous On the Motive Power of Fire, he states: “We use here the expression motive power to express the useful effect that a motor is capable of producing. This effect can always be likened to the elevation of a weight to a certain height. It has, as we know, as a measure, the product of the weight multiplied by the height to which it is raised.” With the inclusion of a unit of time in Carnot's definition, one arrives at the modern definition for power: f403ff3228

Thermodynamics Thermodynamics is a branch of physics that deals with heat, work, and temperature, and their relation to energy, entropy, and the physical properties Thermodynamics is a branch of physics that deals with heat, work, and temperature, and their relation to energy, entropy, and the physical properties of matter and radiation. The behavior of these quantities is governed by the four laws of thermodynamics, which convey a quantitative description using measurable macroscopic physical quantities but may be explained in terms of microscopic constituents by statistical mechanics. Thermodynamics applies to various topics in science and engineering, especially physical chemistry, biochemistry, chemical engineering, and mechanical engineering, as well as other complex fields such as meteorology f403ff3228

Isothermal compressibility f403ff3228 == History == f403ff3228 Historically, thermodynamics developed out of a desire to increase the efficiency of early steam engines, particularly through the work of French physicist Sadi Carnot (1824). Scots-Irish physicist Lord Kelvin was the first to formulate a concise definition of thermodynamics in 1854 which stated, "Thermo-dynamics is the subject of the relation of heat to forces acting between contiguous parts of bodies, and the relation of heat to electrical agency." German physicist and mathematician Rudolf Clausius restated Carnot's principle known as the Carnot... f403ff3228

Another formulation by James Clerk Maxwell is "All heat is of the same kind". Another statement of the law is "All diathermal walls are equivalent". f403ff3228 By contrast, an extensive property or extensive quantity is one whose magnitude is additive for subsystems. f403ff3228

Intensive and extensive properties chemical properties of materials and systems can often be categorized as being either intensive or extensive, according to how the property changes when Physical or chemical properties of materials and systems can often be categorized as being either intensive or extensive, according to how the property changes when the size (or extent) of the system changes f403ff3228

Chemical thermodynamics of the laws of thermodynamics. Chemical thermodynamics involves not only laboratory measurements of various thermodynamic properties, but also the application Chemical thermodynamics is the study of the interrelation of heat and work with chemical reactions or with physical changes of state within the confines of the laws of thermodynamics. Chemical thermodynamics involves not only laboratory measurements of various thermodynamic properties, but also the application of mathematical methods to the study of chemical questions and the spontaneity of processes f403ff3228

Second law of thermodynamics A simple statement The second law of thermodynamics is a physical law based on universal empirical observation concerning heat and energy interconversions. " These are informal definitions, however; more formal definitions appear below. The second law of thermodynamics is a physical law based on universal empirical observation concerning heat and energy interconversions. Another statement is: "Not all heat can be converted into work in a cyclic process. A simple statement of the law is that heat always flows spontaneously from hotter to colder regions of matter (or 'downhill' in terms of the temperature gradient) f403ff3228

Material properties (thermodynamics) Each is directly related to a second order differential of a thermodynamic potential. Each is directly related to a The thermodynamic properties of materials are intensive thermodynamic parameters which are specific to a given material. The thermodynamic properties of materials are intensive thermodynamic parameters which are specific to a given material. Examples for a simple 1-component system are: f403ff3228

Two systems are said to be in thermal equilibrium if they are linked by a wall permeable only to heat, and they do not change over time. f403ff3228 Compressibility (or its inverse, the bulk modulus) f403ff3228

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